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Regulatory Impact Analysis of the Phase III Land Disposal Restrictions Final Rule and Addendum: Revised Risk Assessment for Spent Aluminum Potliners

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REGULATORY IMPACT ANALYSIS OF THE PHASE III LAND DISPOSAL RESTRICTION FINAL RULE

U.S. Environmental Protection Agency
Office of Solid Waste

February 15, 1996

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EXECUTIVE SUMMARY

This Regulatory Impact Analysis (RIA) estimates the costs, economic impacts, and benefits of the Phase III Land Disposal Restriction (LDR) rule. In the Phase III LDR rule, EPA has proposed concentration-based treatment standards for:

- Underlying hazardous constituents in characteristic wastes managed in land-based units (e.g., surface impoundments, underground injection control wells). Prior to final discharge or disposal in a well, underlying hazardous constituents in these wastes must meet universal treatment standards (UTS) or Clean Water Act best available treatment (BAT) standards.

- The following newly-listed wastes: carbamates (K158 through K161) and spent aluminum potliners (K088). Hazardous constituents in these wastes will also be required to meet UTS levels before disposal in a land-based unit.

EPA proposed Phase III LDRs in February 1995 and expects to promulgate a final Phase III rule by early 1996.

BACKGROUND

Characteristic Wastes Affected

As part of its series of regulations governing hazardous waste land disposal, EPA promulgated the "Third Thirds" rule on May 8, 1990. This rule established treatment standards for waste demonstrating the characteristics of ignitability, corrosivity, and reactivity. The Third Third rule required that these wastes be decharacterized or deactivated to below characteristic levels prior to disposal in a land-based unit. Generators could apply a number of treatment technologies, including dilution, to decharacterize the waste.

The litigants in *Chemical Waste Management (CWM) v. EPA* challenged this treatment standard, arguing that, because decharacterization would not necessarily remove or destroy the underlying hazardous constituents in this waste, the standard was incompatible with RCRA

treatment requirements.[1] On September 25, 1992, the U.S. Court of Appeals for the District of Columbia Circuit determined that RCRA Section 3004(m) requires that short- and long-term risks from hazardous waste be minimized either by treating or removing the hazardous constituents in waste, or disposing of the waste in a no-migration unit. The court also ruled that Section 3004(m) grants EPA the authority to require treatment methods more stringent than decharacterization for characteristic waste.[2] Under this ruling, dilution, decharacterization, and subsequent management of characteristic waste in land-based units is only permissible if EPA can demonstrate that hazardous constituents in this waste are destroyed or treated to the same extent they would be under otherwise applicable RCRA standards.

Based on its interpretation of the *CWM vs. EPA* decision, the Agency has determined that the Phase III LDR rule must establish treatment standards for the underlying hazardous constituents found in ignitable, corrosive, reactive, and toxicity characteristic (ICRT) wastewaters that are managed in land-based units. The majority of this waste is treated in CWA surface impoundments, and is already subject to treatment and monitoring requirements specified by the Clean Water Act. Therefore, these wastes are potentially subject to two sets of regulatory requirements -- those specified under the CWA and those specified under RCRA. In developing Phase III LDRs, EPA sought to minimize the burden and potential redundancy that dual treatment and monitoring could cause. It therefore has proposed four compliance options. The first three apply to direct dischargers.

- **Treat to UTS** -- Under this option, generators would treat underlying hazardous constituents in characteristic waste to the UTS standard. Waste would be required to meet this standard prior to final discharge, and facilities would have to comply with RCRA monitoring and reporting requirements.[3] Enforcement would occur solely under RCRA.

- **Modify NPDES permit to include CWA BAT standard** -- EPA has determined that BAT standards developed under CWA may be equivalent to UTS (i.e., BDAT) standards developed under RCRA. Therefore, generators have the option of asking CWA to specify BAT levels in their permits, in lieu of treating to UTS levels. Under this option, control authorities would have to determine whether treatment taking place in CWA units adequately reduces or removes the constituent in question. The

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[1] *Chemical Waste Management Inc. v. U.S. EPA,* 976 F.2d 2 (D.C. Cir 1992)

[2] *Ibid*

[3] Also under consideration by EPA is the incorporation of Hazardous Waste Identification Rule (HWIR) risk-based exit levels as additional or replacement treatment standards. HWIR exit levels could be incorporated into the Phase III LDR rule in one of three ways. First, HWIR exit levels could act as a cap on UTS levels at the point of disposal (i.e., the less stringent standard would apply). Second, HWIR levels could replace UTS values as the point of disposal criteria for RCRA equivalency. Or, third, HWIR exit levels could be applied only at the point of generation, most likely in conjunction with additional point of disposal requirements. See Appendix U for an analysis of the possible effects of incorporating HWIR exit levels into the rule.

modified permit limits would be CWA requirements enforceable solely under that statute.

- **Seek a RCRA treatability variance** -- Under this option, generators could apply for a RCRA treatability variance if they have implemented a treatment recognized as BAT by the CWA, and are treating UTS constituents of concern but not achieving UTS levels.

In addition to the options cited above, indirect dischargers have a fourth compliance option. As written in the rule, indirect dischargers also may be exempt from treating underlying hazardous constituents to UTS or BAT levels if they can demonstrate that the POTW to which they are sending their waste is treating these constituents to UTS or BAT levels.

EPA has proposed to grant a two year capacity variance before enforcing this rule in order that facilities may open and modify their NPDES permits or install the treatment technology necessary to comply with RCRA UTS levels.

Newly Listed Wastes

The Phase III LDR rule also included treatment standards for two newly listed wastes: carbamates and spent aluminum potliners.

Carbamates

Carbamates are the active ingredient in many pesticide products (e.g., insecticides, fungicides and herbicides). EPA proposed listing six carbamate wastes (K156 - K161) in March 1994, and as part of the Phase III rule includes LDRs for waste codes associated with their production. These wastes frequently contain toxic solvents at concentrations that could present human health risks. EPA has proposed that the underlying constituents of concern in these wastes meet UTS levels.

Spent Aluminum Potliners

Potliners are large blocks of solid carbon that line the electrolytic cells used in primary aluminum reduction processes. Spent potliners (K088 waste) often contain higher concentrations of fluoride and cyanide, as well as a lesser amount of polynuclear aromatic hydrocarbons and other organics. K088 wastes were originally listed as hazardous waste in 1980[4]; however, the Bevill amendment deferred this listing.[5] A reinterpretation of the Bevill amendment in 1988 reinstated the initial listing.

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[4] 45 CFR 261.32 July 16, 1980

[5] The Bevill Amendment (RCRA Section 3001(b)(3)(A)(ii)) exempts from Subtitle C regulation all "solid wastes from the extraction, beneficiation, and processing of ores and minerals."

For K088 waste, EPA has identified several options for treatment, recycling, reclamation and reuse. Although the Agency prefers those technologies that recycle or reclaim spent material, it recognizes that limited data are available on the effectiveness of these technologies. The Agency has therefore proposed numerical standards for this waste, and any technology that meets these standards is acceptable.

CHARACTERIZATION OF AFFECTED WASTES

Affected Characteristic Waste

Based on our analysis, we categorized industries into four groups:

- Industries that could be significantly affected by the rule;
- Industries expected to experience minor effects;
- Industries that will not be affected; and
- Industries for which we did not have sufficient data to determine effects.

In Exhibit ES-1, we present the industries in each of these categories, along with estimates of the waste quantities affected. Appendices A through O describe in more detail the methods and results of the screening that estimated analyses of the number of facilities and quantity of waste that may be affected by the rule for each industry.

Exhibit ES-1 ESTIMATED QUANTITIES AFFECTED ICRT WASTE		
Industries with Major Impacts	**Estimated Quantity Affected (million tons)**	**Number of Facilities Affected**
Organic Chemicals (OCPSF)	24 to 95	28 to 73
Petroleum Refining	11 to 86	8 to 30
Industries with Minor Impacts		
Pesticides	≈ 4	≤ 1 percent of all facilities
Inorganic Chemicals	≤ 5	≤ 1 percent of all facilities
Iron and Steel	≈ 3	≤ 1 percent of all facilities
Steam Electric Power Generation	≤ 1	≤ 1 percent of all facilities
Electrical and Electronic Components	≤ 3	≤ 1 percent of all facilities
Food	≤ 10	≤ 1 percent of all facilities
Industries with No Impacts		
Metal Parts and Machinery	0	0
Electroplating and Metal Finishing	0	0
Pulp and Paper	0	0
Pharmaceuticals	0	0
Industrial Laundries	0	0
Leather Treating	0	0
Industries with Inadequate Data		
Federal Facilities	NA	NA
Transportation Equipment Cleaning	NA	NA

Industries with Significant Effects

We expect to see significant impacts (e.g., large quantities and a significant number of facilities affected) in only two industry sectors -- organic chemicals production and petroleum refining.

Organic Chemicals

The Organic Chemical, Plastics and Synthetic Fibers (OCPSF) industry is potentially a very large generator of wastewaters that might be affected by the Phase III rule.[6] Although no detailed single source of concentration and quantity data exists for determining this industry's affected wastewaters, we were able to identify potentially affected facilities through an analysis of the TRI data and information on the percentage of facilities using surface impoundments. Our analysis suggests that between 28 and 73 organic chemical manufacturing facilities could be affected by the Phase III LDR rule.[7] These facilities are estimated to generate between 24 and 95 million tons of wastewaters that may exceed UTS standards. For this industry as well as others relying on analysis of the TRI data, the resulting estimates may understate the impacts of the rule because the TRI analysis does not consider 53 of the 101 non-priority UTS pollutants of concern. The impacts of the rule would be higher if decharacterized ICRT wastewaters managed in land-based units contain any of these 53 pollutants at concentrations exceeding UTS. Unfortunately, no data were available the effects of the rule due to these pollutants and additional data and comments from industry on the presence of these pollutants in wastestreams would be useful.

Petroleum Refining

To analyze the impacts of the Phase III rule on the petroleum industry, we reviewed information on quantities of potentially affected wastewaters and on the concentrations of non-priority pollutants in these wastes. In general, we found no single source of data that provides a good indicator of the impacts of the Phase III rule on refiners. Instead, we ultimately were forced to infer impacts based on analyses of the TRI data. Based on this analysis, we estimated that between eight and 30 facilities may be discharging wastewaters containing non-priority pollutants at above UTS levels. These facilities, which represent between four and eleven percent of the approximately 202 direct and indirect dischargers in the industry, generate between 11 and 86 million tons per year of potentially affected wastes.

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[6] The OCPSF industry includes SIC codes 2821 to 2824 and 2865 to 2869.

[7] The Chemical Manufacturers Association (CMA) submitted effluent concentration data from 14 member companies listing end-of-pipe wastewater concentrations for constituents found at greater than UTS at the point of generation. Our analysis of this data found that 7.1 percent of these facilities would be affected (1 out of 14), whereas our analysis found that 9.7 to 17.9 percent of the facilities would be affected (113 to 233 out of 1305). Considering the small sample size of the CMA data, however, results from these two data sets appear to be consistent. A comparison of the non-priority constituents found in each data set shows that all but one of the constituents listed in the CMA sample, are also found in the TRI data. The single constituent found only in the CMA sample, vanadium, is not included in the Toxic Release Inventory.

Industries with Minor Effects

Relying largely on TRI data and following the approach described above, we found minor impacts in six industry sectors. We categorized these sectors as minor impact industries because fewer than approximately one percent of all facilities in the industry are expected to discharge wastewaters that exceed UTS concentration levels. In these industries, we estimate that relatively small quantities of waste might be affected. These industries include the following: pesticides, inorganic chemicals, iron and steel, electric power generation, electrical and electronic components (EEC), and food production. EPA found that the other industries analyzed should experience no impacts, or that data are inadequate at this time to assess impacts.

Limitations of Characteristic Waste Analysis

In general our analysis of potentially affected industries is limited by poor and incomplete data. In most instances, data characterizing wastestreams are not available. We therefore had to piece together information from a variety of sources in order to determine constituent concentrations in wastestreams and whether these wastes are managed in surface impoundments. Although this analysis represents our best estimates, we cannot be certain that we have accurately captured all wastestreams likely to be affected. Particularly important uncertainties requiring more or better data to resolve include:

- **Limited constituent information in TRI data** -- Of the 101 non-priority UTS constituents that we consider in this analysis, only 48 are reported in TRI. Also, only those facilities generating more than 10,000 pounds annually of TRI constituents are required to report. Both of these limitations may cause us to underestimate the quantities of affected wastes.

- **Lack of data in TRI on ICRT waste and use of surface impoundments** -- As we described above, much of the constituent concentration data that we developed are based on TRI reporting. A significant limitation of these data is that they do not include information on management in land-based units or whether wastewaters are decharacterized ICRT wastes. This limitation likely serves to overestimate the quantity of waste that could be affected by the rule.

- **Poor testing for non-priority pollutants** -- Much of the Office of Water's testing data collected during previous effluent guideline development efforts was of little use in this analysis because it focused on priority pollutants. Only in recent years have testing efforts expanded to incorporate a wider range of contaminants. Therefore, few data exist on concentrations of non-priority pollutants, which are the focus of this analysis. This limitation also may cause us to underestimate the quantity of waste affected.

Newly Listed Wastes

EPA conducted a number of analyses at the time that carbamates and spent aluminum potliners were proposed for listing to determine the quantity of waste that would affected by new treatment standards. These analyses, as well as studies conducted by industry, are the basis of the estimates in this RIA.

Carbamates

In an effort to gather data in support of the carbamate listing, EPA conducted a survey in 1991 of carbamate facilities. Data collected through this survey, as well as information obtained through other industry sampling efforts, were summarized in the capacity assessment that EPA produced for the carbamate industry.[8] This analysis served as the basis for waste quantity estimates provided in the carbamate listing.

Based on these sources, the EPA estimates that approximately 440,000 tons of newly listed carbamate K156 - K161 wastes are generated each year. An estimated 4,500 tons of this waste will require additional treatment to meet UTS levels included in the Phase III LDR rule. In Exhibit ES-2 we present the quantities associated with each waste code.

Exhibit ES-2

QUANTITY OF CARBAMATE WASTE AFFECTED

Wastecode	Quantity (tons)
K156	0
K157	0
K158	10
K159	0
K160	740
K161	3,700
TOTAL	4,500

In addition, small quantities of U and P commercial chemical product waste included in the carbamate listing could be affected. EPA estimates that 13 tons of carbamate P waste and 28 tons of carbamate U waste will require additional treatment.

Spent Aluminum Potliners

EPA and industry have conducted a number of studies to characterize aluminum production processes and estimate the quantity of spent aluminum potliners generated annually. This analysis draws primarily on the survey that EPA conducted in 1991, which investigated most of the 23 facilities generating this waste, and a survey of the primary aluminum production industry conducted by the Reynolds Metal Company in 1992.[9] Based on these surveys and current market conditions,

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[8] *Draft Non-CBI Capacity Assessment for the Carbamate Industry* (in support of preliminary LDR capacity assessments), U.S. Environmental Protection Agency, Capacity Programs Branch, June 13, 1994.

[9] *Summary of Generation, Disposal and Treatment Practices for Spent Aluminum Potliners from the Primary Reduction of Aluminum*, U.S. EPA Risk Reduction Engineering Lab, March 12, 1990.

EPA estimates that 118,000 tons of K088 waste are produced annually. All of this waste will require alternative treatment to meet UTS levels. The Capacity Analysis Branch estimates that some of this waste currently may be thermally treated. Because we are uncertain as to the quantity of waste undergoing treatment, we estimate the impact of LDR standards on the total generated quantity.

COSTS OF LAND DISPOSAL RESTRICTIONS FOR PHASE III WASTES

Our analysis of Phase III rule costs considers compliance costs and economic impacts for both the characteristic and newly listed wastes affected by the rule. These costs are summarized in Exhibit ES-3.

In general, we expect facilities will seek permit modifications, treatability variances, or certification of adequate POTW treatment because these compliance options can be implemented at much lower cost than the option requiring treatment to UTS levels. We estimate the total annualized costs of the rule for these wastes will range from approximately $197,000 to $598,000, with the majority of the costs incurred by the organic chemicals industry. These are the costs of sampling, analysis, and administrative processing of applications to modify Clean Water Act permits and additional on-going monitoring of wastestreams to comply with the permits.

Exhibit ES-3

ESTIMATED INCREMENTAL COSTS OF THE PHASE III LDR RULE

Waste Type	Annualized Costs
Characteristic Wastes	
Organic Chemical Industry	$154,000 to $425,000
Petroleum Refining Industry	$43,000 to $173,000
Total Characteristic Wastes	$197,000 to $598,000
Newly Listed Wastes	
Carbamates	$5.5 million
Spent Aluminum Potliners	$6.3 to $41.7 million
Total Newly Listed Wastes	$11.8 to $47.2 million
TOTAL Phase III Incremental Costs	$12.0 to $47.8 million

Note: These estimated costs represent the incremental costs of the rule based on a comparison of the costs of treating and disposing of the wastes with and without the rule. Annualization is based on a period of 20 years and an interest rate of 7.0 percent.

The costs of treating the newly listed wastes to LDR standards are substantially higher and are expected to occur each year. These costs range from approximately $11.8 million to $47.2 million per year, and are attributable primarily to thermal treatment of aluminum potliner wastes (K088). These costs represent a substantial increase in the average expenditures on pollution control in the aluminum industry (approximately 40 percent), but are not expected to have as significant an impact on the total cost of producing aluminum.

Overall, the estimates presented in Exhibit ES-3 provide an accurate assessment of the impacts of the Phase III rule, as long as generators of characteristic wastes can obtain CWA permit modifications indicating that BAT treatment occurs for those constituents exceeding UTS levels at the end-of-pipe. However, if this is not possible, costs of the Phase III rule could increase significantly. We estimate that average per facility costs of treating all constituents to UTS levels in the organic chemical industry could be as high as $1 million per year. In a sensitivity analysis, we considered the costs of the rule under two scenarios: (1) assuming that 80 percent of the facilities comply with the rule by obtaining permit modifications and 20 percent comply by treating their wastes and (2) assuming that 60 percent comply by obtaining permit modifications and 40 percent comply by treating their wastes. Based on the first scenario, the estimated annualized costs of the rule would range from $6.6 million to $18.2 million. Based on the second scenario, the estimate annualized costs are expected to be between $12.9 million and $35.7 million. While these costs do not represent a major increase in annual pollution control expenditures for large chemical or petroleum refining plants, they are substantially higher than the costs of all facilities obtaining CWA permit modifications.

ECONOMIC IMPACTS OF PHASE III LAND DISPOSAL RESTRICTIONS

We measure the economic impacts of the Phase III Rule by comparing the estimated costs of regulatory compliance with the historic costs in the industry activity. Based on the results of our cost analysis, we consider the potential economic impacts on:

- The aluminum industry's compliance with LDR standards for spent potliners.
- The organic chemical and petroleum refinery industry's compliance with LDR standards for characteristic waste; and

Characteristic Wastes

For characteristic wastes, our analysis shows that the impact on organic chemical producers and petroleum refiners will be quite minimal. Compliance costs represent less than one percent of historic pollution control and operating costs for both of these industries. However, for those facilities that must treat to UTS in order to comply, costs would be more significant. Here again we emphasize that few facilities are likely to comply by treating to UTS, and that as many facilities as possible will try to comply by modifying their permits. In Exhibit ES-4, we detail the costs and economic impacts of this compliance option.

Exhibit ES-4 ECONOMIC IMPACTS OF PHASE III RULE COMPLIANCE				
	Historic Pollution Control Costs (per facility)	Historic Operating Costs (per facility)	Compliance Costs (per facility)[10]	Economic Impact
Option 1: Modify Permit				
Organic Chemical	$3 million	$76 million	$61,000	≤ 1 percent
Petroleum Refining	$11 million	$471 million	$61,000	≤ 1 percent

Newly Listed Wastes

The estimated incremental compliance costs for treating the newly-listed spent aluminum potliners represents the majority of the costs for treating all newly listed wastes affected by the rule. As shown in Exhibit ES-5, the incremental costs of treating spent aluminum potliners represents an estimated 40 percent of historic pollution control operating costs for aluminum producers.[11] Treatment costs represent only one percent of total historic operating costs. The difference between the economic impact figures suggests that, while the compliance costs of the rule may pose significant additional pollution control costs, these costs are less significant when compared to the total operating costs, suggesting the rule has only small impacts on the price of aluminum.

Exhibit ES-5 HISTORIC OPERATING COSTS FOR SPENT ALUMINUM POTLINERS			
Per Facility Costs	Historic Cost (per facility)	Compliance Costs (per facility)	Economic Impact
Pollution Control Operating Costs	$2.6 million	$1.0 million	40 percent
Total Operating and Management Costs	$135.6 million	$1.0 million	1 percent

[10] The present value of the annualized compliance cost for permit modification is used. A period of 20 years and an interest rate of 7.0 percent is used. In addition, the value represents an average for costs to direct and indirect dischargers.

[11] We did not consider the impact on capital costs, as the assumed compliance option (off-site treatment) will not incur capital expenditures. It is worth noting that the majority of the 31 aluminum reduction facilities included in our historic cost estimates are large facilities (i.e., greater than 500 employees). Therefore, historic costs for aluminum producers are not skewed towards those of small facilities, as might be the case for organic chemical historic costs.

To analyze the effect of the Phase III rule on the domestic aluminum industry, we compared the estimated compliance costs with average aluminum costs and prices. Based on estimated compliance costs of $6.3 to $41.7 million, and historic annual production rates of approximately 8.1 million pounds per year, the Phase III compliance costs correspond to an incremental cost of $0.001 to $0.005 per pound.[12] In relation to present average western production costs ($0.564 per pound[13]), this would account for an additional 0.2 to 0.8 percent. Though these increases are not insignificant, present aluminum profits are approximately 30.4 cents per pound (85 minus 54.6 cents), which is 60 to 304 times greater than the incremental cost caused by the Phase III rule. Industry analysts also estimate that prices will increase by 35 percent during the next two years. These price increases are driven by an international market where supplies are struggling to meet demands. This rising market suggest that competitiveness of domestic primary aluminum producers should not be significantly harmed by the incremental costs of the Phase III rule.

BENEFITS ASSESSMENT

EPA assessed the benefits of the Phase III LDR rule for both ICRT wastes and newly listed wastes. For ICRT wastes, the magnitude of benefits depends on the compliance option implemented by the affected facilities. Generators of affected wastewaters will have a number of compliance options under the rule. For direct dischargers, facilities may: (1) treat their waste to meet UTS standards; (2) seek modifications to their CWA permits to include BAT standards for UTS constituents; or (3) seek a treatability variance under RCRA for UTS constituents. For indirect dischargers, a fourth option includes demonstrating that the POTW treating their wastewater provides adequate treatment of affected pollutants.

We estimate the loadings and risk reductions likely to occur if facilities comply with the rule under the first option (i.e., that treatment occurs). If facilities can comply under the second, third or fourth options, loadings reductions and risk reductions may be lower or zero, depending on whether any facilities must treat their wastes.

We evaluated the pollutant loadings reductions and risk reductions only for those industries estimated to have major impacts, organic chemicals and petroleum refining. In addition, this benefits assessment considered only those wastestreams expected to require treatment under the rule (i.e., those with contaminant concentrations that exceed UTS levels). In the assessment, we used the wastestream quantity and loadings data developed for the affected waste analysis.

Based on the results of this analysis, 20 of the 48 constituents considered were identified as pollutants of concern (i.e., a wastestream contained this constituent at a concentration level exceeding UTS). We were able to evaluate the risks associated with 15 of these 20 constituents; health based criteria were not available for the other five constituents. The loadings reductions evaluation considered all 20 constituents.

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[12] Estimated annual production rates are based on the average of 1982 to 1991 annual production rates, as reported in *Annual Survey of Manufactures: Statistics for Industry Groups and Industries*.

[13] "Aluminum Market Facing 'Hangover'," **American Metal Market**, February 1, 199, p. 4.

For newly listed wastes, we assessed the potential benefits of the rule by estimating the incremental reduction in human health risks resulting from implementation of the rule. First, we quantified the baseline risks associated with current waste management practices, which typically consist of disposal in Subtitle C landfills. We used data on the concentration of regulated constituents, fate and transport processes, and various exposure scenarios to calculate cancer and noncancer risks to human health. We then compared these baseline risks to the post-regulatory risks assuming treatment to UTS levels before disposal of spent aluminum potliners. The incremental risk reduction is used as in indicator of the rule's benefits.

Characteristic Wastes

The results of this assessment indicate that the benefits of the rule range between very small and zero, depending on whether facilities comply with the rule by treating their affected wastestreams (option one) or comply by either revising their CWA permit, obtaining a treatability variance under RCRA, or demonstrating that the POTW treating their wastestream provides adequate treatment of affected pollutants (options two, three, or four).

Even at the high-end (i.e., under option one), the estimated benefits are very small.

- High-end loadings reductions range between 36 and 269 tons per year for direct dischargers and 1,490 and 22,621 tons per year for indirect dischargers. For direct dischargers, these loadings reductions represent a very small percentage of total TRI chemical loadings to surface waters (0.03 to 0.20 percent). For indirect dischargers, these loadings reductions represent between 0.8 and 11.9 percent of all TRI loadings transferred to POTWs.

- Based on the results of the screening and more detailed risk assessments, the estimated baseline risks associated with only four wastestreams potentially exceed commonly assumed threshold cancer and noncancer risk levels. We estimated that three wastestreams containing aniline pose baseline cancer risks ranging from 1×10^{-5} to 2×10^{-3} which would be reduced to between 8×10^{-8} and 3×10^{-6} under the Phase III rule. A fourth wastestream containing acrylamide poses baseline cancer risk at a level of 2×10^{-3}. The rule is estimated to reduce this risk to between 2×10^{-4} and 4×10^{-3}.

These benefit estimates are based on two important assumptions that almost certainly lead to overstatement of the net improvements in environmental quality. First, the analysis assumed that all affected facilities comply by treating the affected wastestreams (rather than one of the other three options). Second, the analysis did not incorporate an adjustment to reflect the fact that some of the wastestreams identified as affected by the impacts analysis may not be managed in surface impoundments and thus would not be affected by the rule. Such an adjustment is warranted because the TRI data used in the affected quantities analysis does not include data on waste management locations. Though the cost analysis used adjusted results for the number of affected facilities based on the percentage of facilities in the industry managing wastewaters in surface water impoundments, such an adjustment for the risk assessment would require specific information on management practices for each affected wastestream -- information we do not have.

At the same time, however, there are a number of potential benefits that we were unable to consider. First, the TRI data that we used in the benefits assessment did not provide complete coverage of all non-priority pollutants. TRI loadings data were available for only 48 of the 101 non-priority constituents, and releases of less than 10,000 pounds per year were reported. Second, certain categories of benefits could not be analyzed with available data and methods. Ecological effects could not be considered due to the lack of water quality criteria, which in turn made it impossible to evaluate possible impacts on recreational fishing. Furthermore, no data are available on passive use values.

Based on available data, the benefits of regulating ICRT wastes in the Phase III rule appear to be quite small. While inclusion of additional pollutants and benefit categories could certainly increase the net benefits of the rule, we have no evidence suggesting that the increase is likely to be large, particularly given the relatively small number of affected facilities and the minimal reductions in total pollutant loadings for the 48 non-priority constituents that we were able to analyze.

Newly Listed Wastes

We believe that that the benefits of regulating spent aluminum potliners, the only newly listed waste examined in-depth, are likely to be small. The analysis suggests that the baseline risks of current waste management practices are negligible under central tendency assumptions. We believe that there is approximately a 10^{-8} central tendency cancer risk resulting from ingestion of groundwater contaminated by a Subtitle C landfill. In addition, the analysis shows that the expected daily intake of contaminated drinking water will not result in an exceedance of the reference dose for any of the regulated constituents in spent aluminum potliners. Under more conservative high-end assumptions, however, human health risks are higher. Individual cancer risk is approximately 10^{-4} while the reference dose is exceeded for four regulated constituents, arsenic, lead, cyanide, and fluoride.

Examination of the post-regulatory risks indicate that there are no appreciable risks associated with treatment of spent aluminum potliners to UTS levels. We based our assessment on a study performed by the EPA as well as a study performed as part of a RCRA Part B permit application submitted by Reynolds Metals Company. These two studies quantify the health risks of wastes treated by the thermal treatment technology developed by Reynolds Metals Company. There are, however, a number of different technologies that may be used to treat the waste. We did not investigate the risks related to these other technologies. It should be noted that several companies have provided EPA evidence that technologies they are developing can effectively treat spent aluminum potliners.

Comparison of baseline and post-regulatory risks suggests that the incremental risk reduction of the rule is likely to be small. Nevertheless, there is some chance that relatively high individual cancer risks on the order of 10^{-4}, as well as high noncancer risks, would be prevented by implementation of the rule.

This Regulatory Impact Analysis (RIA) estimates the costs, economic impacts, and benefits of the Phase III Land Disposal Restriction (LDR) rule. In the Phase III LDR rule, EPA has proposed concentration-based treatment standards for:

- Underlying hazardous constituents in characteristic wastes managed in land-based units (e.g., surface impoundments, underground injection control wells). Prior to final discharge or disposal in a well, underlying hazardous constituents in these wastes must meet universal treatment standards (UTS) or Clean Water Act best available treatment (BAT) standards.

- The following newly-listed wastes: carbamates (K158 through K161) and spent aluminum potliners (K088). Hazardous constituents in these wastes will also be required to meet UTS levels before disposal in a land-based unit.

EPA proposed the Phase III LDRs in February 1995 and expects to promulgate a final Phase III rule by early 1996.

In accordance with the requirements of Executive Order No. 12866, EPA must develop and submit to the Office of Management and Budget (OMB) an RIA for any significant regulatory action. The purpose of this document is to present the industries and wastes that will be affected by the Phase III LDR rule, estimate the cost associated with treating those wastes to comply with LDR standards, determine the impact that these additional treatment costs will have on facilities' operating costs, and evaluate the human health and ecological benefits attributable to reductions in pollutant discharges required by the rule.[1]

[1] Under EPA's revised guidelines for implementing the Regulatory Flexibility Act, the Agency also evaluates separately potential economic impacts of regulation on small entities. However, with respect to the Land Disposal Restrictions program, EPA has determined that legal avenues do not exist to provide regulatory relief to small entities. Therefore, we have not conducted a regulatory flexibility analysis for this rule. It is worth noting, however, that our results suggest that few, if any, small entities will be affected by the Phase 3 LDR rule.

BACKGROUND

LDR Program

The Phase III Land Disposal Restriction (LDR) rule is one in a series of regulations that restricts the continued land disposal of hazardous wastes under the 1984 Hazardous and Solid Waste Amendments (HSWA) to the Resource Conservation and Recovery Act (RCRA).[2] Section 3004(g) of RCRA outlines a schedule for the development of waste treatment and disposal practices for wastes that EPA determines are hazardous. Under RCRA, waste is deemed hazardous either because it demonstrates the characteristic of ignitability, corrosivity, reactivity, or toxicity (ICRT wastes), or because it contains constituents listed as hazardous by EPA.[3]

At the time HSWA was enacted, EPA was required to promulgate treatment and disposal standards by May 8, 1990 for wastes already identified or listed as hazardous. EPA established treatment standards and waste management practices for these wastes in five rules promulgated between 1986 and 1990 (the solvents and dioxins rule, the California list rule, and the First Third, Second Third and Third Third rules).

Treatment standards for wastes subsequently identified or listed as hazardous must be developed by EPA within six months of waste listing or identification. EPA is addressing these wastes in "phases." The Phase I LDR rule established standards for hazardous debris and several newly identified wastes. The Phase II LDR rule established treatment standards for newly identified pesticide wastes (D012 through D017) and newly identified toxic organic wastes (D018 through D043). The Phase II LDR rule also established Universal Treatment Standards (UTS) for 216 constituents in hazardous waste. UTS levels, which set a common treatment standard for a constituent across all waste types, were developed for both wastewaters and nonwastewaters based on the best demonstrated achievable technology (BDAT) for reducing these contaminants.

Phase III LDR Rule

Characteristic Wastes Affected

As part of its series of regulations governing hazardous waste land disposal, EPA promulgated the "Third Thirds" rule on May 8, 1990. This rule established treatment standards for waste demonstrating the characteristics of ignitability, corrosivity, and reactivity. The Third Third rule required that these wastes be decharacterized or deactivated to below characteristic levels prior to disposal in a land-based unit. Generators could apply a number of treatment technologies, including dilution, to decharacterize the waste.

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[2] Land disposal includes any placement of hazardous waste in a landfill, surface impoundment, waste pile, injection well, land treatment facility, salt dome formation, salt bed formation, or underground mine or cave.

[3] Appendix VIII of 40 CFR part 261 identifies these hazardous constituents, as well as the eleven factors that EPA considers in determining whether the constituent poses significant human health risks.

The litigants in *Chemical Waste Management (CWM) v. EPA* challenged this treatment standard, arguing that, because decharacterization would not necessarily remove or destroy the underlying hazardous constituents in this waste, the standard was incompatible with RCRA treatment requirements.[4] On September 25, 1992, the U.S. Court of Appeals for the District of Columbia Circuit determined that RCRA Section 3004(m) requires that short- and long-term risks from hazardous waste be minimized either by treating or removing the hazardous constituents in waste, or disposing of the waste in a no-migration unit. The court also ruled that Section 3004(m) grants EPA the authority to require treatment methods more stringent than decharacterization for characteristic waste.[5] Under this ruling, dilution, decharacterization, and subsequent management of characteristic waste in land-based units is only permissible if EPA can demonstrate that hazardous constituents in this waste are destroyed or treated to the same extent they would be under otherwise applicable RCRA standards. The court opinion states:

> ". . . where aggregation and dilution does not eliminate the characteristic, or (more likely) does not minimize the toxicity of the constituents, then RCRA requires further treatment."[6]

Wastes affected by this ruling include those managed in CWA land-based units, wastes managed in SDWA underground injection control (UIC) wells, and waste managed in RCRA as Subtitle D non-hazardous units.[7] In its decision, the court recognized that RCRA Section 1006(b) requires EPA to integrate provisions of RCRA with those of the CWA in order to avoid duplication between the two statutes. Therefore, it provided the opportunity for EPA to defer to CWA treatment standards for underlying hazardous constituents in characteristic wastes, provided these standards are RCRA-equivalent. The court opinion states:

> "If the treatment in the CWA surface impoundment succeeds in removing the toxicity to the extent [RCRA] 3004(m) would have required, then RCRA does not require a separate treatment regimen."[8]

In its decision the court vacated treatment standards for ignitable and corrosive wastes managed in non-CWA and non-SDWA units, and remanded treatment standards for characteristic wastes managed in CWA and SDWA units. EPA issued an interim final rule for the wastes that were vacated under the *CWM* decision on May 24, 1993. For those standards that were remanded, the Agency has considered a range of regulatory options, including imposing concentration-based

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[4] *Chemical Waste Management Inc. v. U.S. EPA,* 976 F.2d 2 (D.C. Cir 1992)

[5] *Ibid*

[6] *Ibid* p. 32

[7] An analysis of the impacts on wastes managed in SDWA underground injection control (UIC) wells being conducted by the Office of Water.

[8] *Ibid* p. 32

or technology-based standards, or requiring reductions in mass loadings of contaminants. An important topic that EPA has considered is how to accommodate or integrate with CWA standards in implementing new requirements, as most characteristic wastes affected by Phase III LDRs are managed in CWA systems. EPA discussed possible regulatory options and presented preliminary estimates of the quantity of waste potentially affected by the court decision in the document "Supplemental Information Concerning the EPA's Potential Responses to the Court Decision on the Land Disposal Restrictions Third Thirds Final Rule" ("Supplemental Information").[9] In that document, EPA requested that industry respond to the regulatory options presented and to the Agency's preliminary estimates of affected quantities.

One of the fundamental problems in assessing the potential impacts of the *CWM* decision has been the lack of data on concentrations of toxics in affected wastewaters. Under the Third Thirds rule, these wastes were considered nonhazardous once decharacterized, and therefore often were not reported by generators in hazardous waste data collection efforts like EPA's Biennial Report Survey. Data collected by the Office of Water are also inadequate, as OW has until recently focused on collecting data on priority pollutants.[10]

Regulatory Approach for Characteristic Wastes

Based on its interpretation of the *CWM vs. EPA* decision, the Agency has determined that the Phase III LDR rule must establish treatment standards for the underlying hazardous constituents found in ignitable, corrosive, reactive, and toxicity characteristic (ICRT) wastewaters that are managed in land-based units. The majority of this waste is treated in CWA surface impoundments, and is already subject to treatment and monitoring requirements specified by the Clean Water Act. Therefore, these wastes are potentially subject to two sets of regulatory requirements -- those specified under the CWA and those specified under RCRA. In developing Phase III LDRs, EPA sought to minimize the burden and potential redundancy that dual treatment and monitoring could cause. It therefore has proposed four compliance options. The first three apply to direct dischargers.

- **Treat to UTS** -- Under this option, generators would treat underlying hazardous constituents in characteristic waste to the UTS standard. Waste would be required to meet this standard prior to final discharge, and facilities would have to comply with RCRA monitoring and reporting requirements.[11] Enforcement would occur solely under RCRA.

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[9] Published in March, 1993

[10] Discharge of these pollutants has been a major focus of National Pollutant Discharge Elimination System (NPDES) permits, thus they are less of a concern under this rule.

[11] Also under consideration by EPA is the incorporation of Hazardous Waste Identification Rule (HWIR) risk-based exit levels as additional or replacement treatment standards. HWIR exit levels could be incorporated into the Phase III LDR rule in one of three ways. First, HWIR exit levels could act as a cap on UTS levels at the point of disposal (i.e., the less stringent standard would apply). Second, HWIR levels could replace UTS values as the point of disposal criteria for RCRA equivalency. Or, third, HWIR exit levels could be applied only at the point of generation, most likely in conjunction with additional point of disposal requirements. See Appendix U for an analysis of the possible effects of incorporating HWIR exit levels into the rule.

- **Modify NPDES permit to include CWA BAT standard** -- EPA has determined that BAT standards developed under CWA may be equivalent to UTS (i.e., BDAT) standards developed under RCRA. Therefore, generators have the option of asking CWA to specify BAT levels in their permits, in lieu of treating to UTS levels. Under this option, control authorities would have to determine whether treatment taking place in CWA units adequately reduces or removes the constituent in question. The modified permit limits would be CWA requirements enforceable solely under that statute.

- **Seek a RCRA treatability variance** -- Under this option, generators could apply for a RCRA treatability variance if they have implemented a treatment recognized as BAT by the CWA, and are treating UTS constituents of concern but not achieving UTS levels.

In addition to the options cited above, indirect dischargers have a fourth compliance option. As written in the rule, indirect dischargers also may be exempt from treating underlying hazardous constituents to UTS or BAT levels if they can demonstrate that the POTW to which they are sending their waste is treating these constituents to UTS or BAT levels.

EPA has proposed to grant a two year capacity variance before enforcing this rule in order that facilities may open and modify their NPDES permits or install the treatment technology necessary to comply with RCRA UTS levels.

Newly Listed Wastes

The Phase III LDR rule also includes treatment standards for two newly listed wastes: carbamates and spent aluminum potliners.

<u>Carbamates</u>

Carbamates are the active ingredient in many pesticide products (e.g., insecticides, fungicides and herbicides). EPA proposed listing six carbamate wastes (K156 - K161) in March 1994, and as part of the Phase III rule includes LDRs for waste codes associated with their production. These wastes frequently contain toxic solvents at concentrations that could present human health risks. EPA has proposed that the underlying constituents of concern in these wastes meet UTS levels.

Spent Aluminum Potliners

Potliners are large blocks of solid carbon that line the electrolytic cells used in primary aluminum reduction processes. Spent potliners (K088 waste) often contain higher concentrations of fluoride and cyanide, as well as a lesser amount of polynuclear aromatic hydrocarbons and other organics. K088 wastes were originally listed as hazardous waste in 1980[12]; however, the Bevill amendment deferred this listing.[13] A reinterpretation of the Bevill amendment in 1988 reinstated the initial listing.

For K088 waste, EPA has identified several options for treatment, recycling, reclamation and reuse. Although the Agency prefers those technologies that recycle or reclaim spent material, it recognizes that limited data are available on the effectiveness of these technologies. The Agency has therefore proposed numerical standards for this waste, and any technology that meets these standards is acceptable.

ORGANIZATION OF THIS REPORT

The remainder of this report presents the methodology and results of this regulatory impact analysis as follows:

Chapter 2	Discusses constituents and waste quantities affected by the rule.
Chapter 3	Presents the estimated compliance cost and economic impacts for those industry sectors affected by the rule.
Chapter 4	Describes the benefits of the rule.
Appendix A	Results of Screening Analyses of the Organic Chemical Industry
Appendix B	Results of Screening Analyses of the Petroleum Refining Industry
Appendix C	Results of Screening Analyses of the Pesticide Industry
Appendix D	Results of Screening Analyses of the Inorganic Chemical Industry
Appendix E	Results of Screening Analyses of the Iron and Steel Industry
Appendix F	Results of Screening Analyses of Steam Electric Generators
Appendix G	Results of Screening Analyses of the Electrical and Electronic Component Industry

[12] 45 CFR 261.32 July 16, 1980

[13] The Bevill Amendment (RCRA Section 3001(b)(3)(A)(ii)) exempts from Subtitle C regulation all "solid wastes from the extraction, beneficiation, and processing of ores and minerals."

Appendix H	Results of Screening Analyses of the Food Industry
Appendix I	Results of Screening Analyses of Metal Parts and Machinery and Electroplating/Metal Finishing
Appendix J	Results of Screening Analyses of the Pulp and Paper Industry
Appendix K	Results of Screening Analyses of the Pharmaceutical Industry
Appendix L	Results of Screening Analyses of Industrial Laundries
Appendix M	Results of Screening Analyses of the Leather Treating Industry
Appendix N	Results of Screening Analyses of Federal Facilities
Appendix O	Results of Screening Analyses of the Transportation Equipment Cleaning Industry
Appendix P	Approach and Results of the Screening Analyses of the Biennial Report Survey (BRS)
Appendix Q	Cost Methodology for the Organic Chemical and Petroleum Refining Industries
Appendix R	Economic Impact Calculations
Appendix S	Risk Assessment Calculations
Appendix T	American Airlines Comment
Appendix U	Analysis of the Effect of the Hazardous Waste Identification Rule (HWIR) on the Affected Universe for the Petroleum Refining and Organic Chemicals Industries

The first step in assessing the costs, economic impacts and benefits of the Phase III LDR rule is to determine the constituents and waste quantities that will be affected. The Phase III rule includes standards for underlying toxic constituents in the following characteristic wastes:

- Ignitable (D001), corrosive (D002) and reactive (D003) characteristic wastewaters managed in Clean Water Act (CWA) and CWA-equivalent wastewater treatment systems, and underground injection control (UIC) systems;[1]

- Characteristic pesticide wastewaters (D012 - D017 wastes) managed in CWA, CWA-equivalent, and UIC systems; and

- Toxic organic wastes (D018 - D043 wastes) managed in CWA, CWA-equivalent, and UIC systems[2].

The Phase III LDR rule also establishes standards for several newly listed wastes managed in land-based units, including:

- Carbamate wastes (K156 - K161);

- Spent aluminum potliners (K088 wastes).

In this chapter we discuss the methodology and sources that we used to estimate the number of facilities and quantity of ignitable, corrosive, reactive, and toxic (ICRT) waste affected by the rule, followed by our results for these wastes. We then review our approach for estimating the quantities of newly-listed waste affected and the results of this analysis.

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[1] Air emissions from these wastes, as well as impoundment leaks and sludges generated during management of these wastes, will be regulated under the Phase IV LDR rule.

[2] The Phase II LDR rule regulates pesticide (D012 - D017) and TC organic (D018 - D043) wastewaters, nonwastewaters, soil and debris with the exception of those wastewaters managed in CWA, CWA-equivalent and UIC systems.

METHODOLOGY FOR ESTIMATING AFFECTED QUANTITIES OF CHARACTERISTIC WASTES

Characteristic waste is generated in significant quantities by many different industries. Corrosive wastewaters in particular are produced by a wide variety of processes and industries, and include commonly used cleaning solvents, blowdown from industry boilers and scrubbers, and acids and alkalis used in formulating chemicals, pharmaceuticals, fertilizers, and pesticides. Toxic organic wastewaters are also very common among all industries that use or produce organic constituents in their processes. In Exhibit 2-1 below, we present the definition of each type of characteristic waste covered by this rule, and some examples of the industries in which they are generated.

Exhibit 2-1

DEFINITION AND DESCRIPTION OF CHARACTERISTIC WASTES

Waste	Definition	Industries or Processes
Ignitable Waste (D001)	Flash point less than 60° C; capable of causing fire through friction under standard temperature and pressure.	Organic chemical production, laboratories and hospitals, paint manufacturing, cosmetics and fragrances, pulp and paper, construction
Corrosive Waste (D002)	Has a pH less than or equal to 2, or greater than or equal to 12.5.	Organic chemical production, laboratories and hospitals, cosmetics and fragrances, equipment cleaning, soaps and detergents, electronics manufacturing, iron and steel production, pulp and paper
Reactive Waste (D003)	Normally unstable; reacts violently with water or forms potentially explosive mixtures with water.	Organic chemical production, petroleum refining
Toxic Organic Waste (D012 -D043)[3]	Contains toxic constituents in excess of regulatory level.	Organic chemical production, plastics, pesticide production, petroleum refining, waste management and refuse systems

While many industries generate ICRT waste, not all facilities will be affected by the Phase III rule. Only those facilities that generate ICRT waste that is managed in a land-based unit and that contains constituents present above UTS levels and not currently regulated by the CWA could be subject to additional treatment.

[3] Note that the Phase III rule does not apply to D004 through D011 wastes (i.e., toxic metals).

Industry Profiles

In developing this RIA, EPA focused on the impact of Phase III LDRs in 16 industry sectors. Because so many industries are potentially affected by this rule, it was not possible to develop an individual industry profile for each sector. Therefore, EPA developed a set of criteria which it used to identify the 16 industries that were studied in detail. These criteria were:

- **Quantity of waste reported in the Biennial Report Survey (BRS)** -- Every two years, as required by RCRA, states submit Biennial Reports to EPA summarizing information on hazardous waste generation, treatment, and disposal practices. EPA evaluated and selected for further analysis manufacturing sectors that are responsible for at least one percent of total quantities reported in the BRS. These include organic chemicals (OCPSF), inorganic chemicals, petroleum refining, pulp and paper, metal parts and machinery manufacture, and iron and steel.

- **Number of land-based treatment units** -- Another measure of the potential impact on an industry is its use of surface impoundments as treatment units. Based on an analysis of the PCS database, EPA identified several additional industry sectors in which surface impoundments are common, and which might produce ICRT waste. These include the food industry, electric power producers, and federal facilities.

- **Prevalence of ICRT wastes** -- Based on industry knowledge and discussion with Office of Water experts, EPA also chose to develop profiles for leather treating, electroplating and metal finishing, pesticides, and transportation equipment cleaning, as these processes are known to produce ICRT waste.

- **Response to EPA information requests** -- One indicator of the facilities most likely to be affected by Phase III are comments to the Third Thirds court decision and the Notice of Data Availability (NODA), responses to EPA requests for information, and participation in EPA meetings on possible regulatory approaches. Several industry sectors have shown significant interest in contributing to discussion on waste management approaches, and have made clear to EPA that their facilities may be affected by changes in treatment standards for ICRT wastes. These industries include chemical manufacturing, pulp and paper manufacturing, petroleum refining, electric power generation and pharmaceuticals. Their interest confirms many of the selections made using the other criteria.

In Exhibit 2-2 we present the industries and industrial processes for which EPA developed specific profiles for the Phase III LDR rule. These are expected to capture the majority of wastes affected by the Phase III rule because they represent more than 90 percent of the wastes reported in the BRS, and significant quantities of wastes managed large CWA systems.

Exhibit 2-2 INDUSTRY CATEGORIES ANALYZED	
• Organic Chemicals (OCPSF)	• Industrial Laundries
• Inorganic Chemicals	• Metal Products and Machinery
• Pulp and Paper	• Electroplating/Metal Finishing
• Electrical and Electronic Components	• Transportation Equipment Cleaning
• Electric Power Generation	• Food
• Iron and Steel	• Federal Facilities
• Petroleum Refining	• Pesticides
• Pharmaceuticals	• Leather Treating

Screening Analyses

After identifying industry sectors for in-depth analysis, EPA reviewed potentially useful data gathered in support of CWA and RCRA rules. Although our approach varied somewhat among the different industries based on data availability and the sources we used, our preferred methodology was to:

- Determine the percentage of an industry's wastewater that was likely to be ICRT;
- Examine the industry's use of land-based units and determine the quantity of ICRT waste likely to be treated in these units;
- Examine data on industry wastewaters to determine the presence of UTS constituents; and
- Compare available concentration data to UTS levels for these constituents, or in the absence of such data, develop estimates of concentrations based on loadings reported in Toxic Release Inventory (TRI) database and on industry wastewater flow rates.

In our analysis, we focus on determining the concentrations of UTS constituents that are *not* priority pollutants, and compare these concentrations to UTS levels. We do not consider priority pollutants in our analysis because these constituents are expected to be adequately controlled under the Clean Water Act's BAT standards. Of the 216 UTS constituents, 101 are non-priority pollutants.

Due to the fact that no single data source contained all the information necessary to assess the potential impacts of this rule, EPA's approach was to evaluate many sources that might contain relevant, if limited, information on these wastes. Below, we briefly describe these analyses and sources, explaining both their usefulness and limitations.

Primary Sources

Section 308 Survey Data

Under Section 308 of the Clean Water Act, the Office of Water (OW) collects data to support the development of effluent guidelines and pretreatment standards. Section 308 data include constituent concentration measures at a facility's final discharge point to receiving waters or to a POTW. Earlier Section 308 surveys focused only on concentrations of the 126 contaminants known as priority pollutants; however, in recent years, effluent sampling efforts have expanded to evaluate a wider range of contaminants. We were able to use recent Section 308 data to analyze the pulp and paper industry, pharmaceuticals, and metal parts and machinery manufacturing.

One limitation of the Section 308 data is that decharacterized ICRT wastes are not explicitly identified. However, pH levels prior to treatment are often measured. We relied on this indicator and expert knowledge of the industry to determine whether wastewaters might be ICRT. Data on whether or not wastewaters are managed in a surface impoundment are also limited. We relied on other sources, such as the Industry Studies Database, the Permit Compliance System, and the knowledge of industry experts to make judgments about impoundment use.

Toxics Release Inventory (TRI)

The TRI database was developed in compliance with the Emergency Planning and Right to Know Act (EPCRA) of 1986. It contains information on loadings of 320 contaminants released to air, land, and water. Forty-eight of these contaminants are also among the set of 101 non-priority UTS constituents that we considered for this analysis. Applying upper and lower bound estimates of industry-specific total wastewater flows, we used TRI data to identify facilities almost certain to have effluent concentrations greater than UTS (i.e., UTS exceedences even at very high wastewater flows) and facilities that might have exceedences (i.e., UTS exceedences at very low wastewater flows). Applying this method, we established upper and lower bounds on the numbers of affected facilities in the organic and inorganic chemical industries, electrical and electronic component manufacturers, the iron and steel industry, petroleum refining, pesticides, leather treating, and food production industries.

This analysis provided an indication of the wastestreams that might exceed UTS levels for each industry. However, TRI does not provide any indication of an industry's use of land-based units or whether wastestreams are ICRT. As noted above, we considered information from other sources to evaluate the number of facilities within these industries that would likely treat ICRT wastewaters in surface impoundments. Also, only those facilities generating more than 10,000 pounds annually of TRI constituents are required to report to TRI. This may cause us to underestimate the number of facilities potentially affected.

Secondary Sources

Biennial Report Survey (BRS)

The 1991 Biennial Report Survey provides the most recent summaries available on waste management practices at the individual wastestream and facility level. Approximately 85 percent of the waste reported in the BRS comes from the Chemical and Allied Products and the Petroleum and Coal Products industries (SIC codes 28 and 29). From the perspective of this RIA, the major deficiency of the BRS is its failure to include any data on concentrations of toxic constituents in the waste. As a result, reliance on the BRS alone does not allow an assessment of which ICRT wastes do not meet UTS levels. Moreover, the BRS does not include many wastes that were diluted immediately upon generation and therefore not reported to EPA as hazardous waste.[4] However, the BRS does provide an indication of the industries that generate ICRT waste and manage these wastewaters in land-based units. The database was therefore most helpful in determining which industries to include in this analysis. Data in the BRS also served as a reference point against which to evaluate estimates that we developed from other sources (see Appendix P).

Industry Studies Database (ISDB)

The ISDB has been developed by EPA over a number of years in conjunction with hazardous waste listings. Information collected in support of listings is compiled in the ISDB, and includes data on loadings of some priority and non-priority pollutants for several industry sectors. The primary limitation of this database is that it tends to contain data on subsectors of industries, rather than an industry as a whole. Also, much of the information contained in the database is old (e.g., from the early to mid-1980s). Nonetheless, for certain industry sectors (e.g., organic chemicals) the ISDB contains potentially useful information on wastewater flows. We used this information along with that from other sources to develop estimates on the quantity of waste passing through land-based units.

Permit Compliance Database (PCS)

The Permit Compliance System (PCS) database is maintained by the Office of Wastewater Enforcement and Compliance to track the permit, compliance, and enforcement status of facilities regulated by NPDES. The database contains information on "major" facilities that discharge wastewaters directly to surface waters. Discharges from these major facilities account for approximately 80 percent of the total wastewater discharges to U.S. surface waters. Data for the smaller facilities that account for the remaining 20 percent of discharges are very incomplete. Also, data on treatment methods are limited, and PCS does not explicitly identify ICRT wastes. Therefore, we used the PCS database primarily to obtain a current count of the number of facilities with discharge permits in each industry sector and the number of land-based units in each of these sectors.

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[4] In fact, such wastes should have been included in the BRS; however EPA discussions with industry suggest this requirement has been broadly misinterpreted in the past.

Capacity Analysis for the Phase III RIA Rule

The goal of EPA's capacity analysis (conducted by EPA's Capacity Programs Branch (CPB)) was to determine the annual quantity of waste that would require additional treatment under the Phase III rule, and whether sufficient capacity exists to treat these wastes. Based on the Capacity Analysis conducted for this rule, EPA has decided to issue a two-year capacity variance for characteristic wastes requiring additional treatment. This will allow industry to maintain its current waste management practices for a two year period, during which facilities can establish additional treatment capabilities. In some cases, we used industry profiles developed for the capacity analysis results as background information sources.

Other Sources

In developing this rule, the Office of Solid Waste worked closely with the Office of Water to assess regulatory options and resolve implementation issues associated with imposing RCRA rules on CWA systems. OSW also drew on Office of Water knowledge about wastewaters and CWA treatment systems to help determine the constituents and waste quantities that might require additional treatment to meet UTS levels at the point of discharge. EPA also considered information provided by industry in meetings and in comments to the docket.

Limitations of Sources

While each of the sources described here yielded some valuable information, historical generator reporting patterns and the differences in CWA and RCRA reporting requirements limit their usefulness. Two important general limitations that we encountered include:

- **Generator reporting patterns** -- Under the original Third Thirds rule, ICR wastes were not considered hazardous once decharacterized. Therefore, in responding to RCRA surveys (e.g., the BRS), generators have frequently not reported characteristic waste among their hazardous waste streams, particularly if the waste was decharacterized near the point of generation. Also, facilities may not have reported in RCRA surveys those characteristic wastes managed in CWA systems. The result is that RCRA data sources probably underestimate the quantity of characteristic waste generated. In addition, since underlying constituents in these wastes previously did not require treatment, information on the concentration of these pollutants is typically very incomplete. In Appendix T we provide a comment submitted to the NODA docket by American Airlines. This comment provides an example of a generator that is likely to be affected by the Phase III LDR rule, but who may not have been included among EPA's hazardous waste data collection efforts.[5]

[5] Refer to pp 3-4 on this comment for a description of the wastewaters and processes that could be affected by the rule.

- **CWA v. RCRA reporting practices** -- CWA sources generally do not differentiate formerly characteristic wastes from other types of waste (i.e., they do not carry RCRA "D" codes). Thus, while data available through recent CWA surveys have good constituent concentration data, it was difficult to determine whether these wastes were ICRT. Also, CWA survey data for most of the industries we are evaluating measure only priority pollutants. Since most of these pollutants are controlled through NPDES permits or effluent guidelines, the focus of the Phase III rule is on UTS constituents that are *not* priority pollutants. Data on these constituents are sparse.

- **Coverage of non-priority UTS constituents by TRI** -- The TRI database was the primary data source used in estimating the number of affected facilities for eight of the 16 industries analyzed. TRI data only cover 48 of the 101 non-priority UTS constituents of concern for the rule. Therefore, the estimated impacts of the rule could be greater if facilities manage ICRT wastewaters containing any of the other 53 constituents at concentrations exceeding UTS in land-based units.

CHARACTERISTIC WASTE RESULTS

Based on our analysis, we categorized industries into four groups:

- Industries that could be significantly affected by the rule;
- Industries expected to experience minor effects;
- Industries that will not be affected; and
- Industries for which we did not have sufficient data to determine effects.

In Exhibit 2-3, we present the industries in each of these categories, along with estimates of the waste quantities affected. Appendices A through O describe in more detail the methods and results of the screening that estimated analyses of the number of facilities and quantity of waste that may be affected by the rule for each industry.

Exhibit 2-3 ESTIMATED QUANTITIES AFFECTED ICRT WASTE		
Industries with Major Impacts	**Estimated Quantity Affected (million tons)**	**Number of Facilities Affected**
Organic Chemicals (OCPSF)	24 to 95	28 to 73
Petroleum Refining	11 to 86	8 to 30
Industries with Minor Impacts		
Pesticides	≈ 4	≤ 1 percent of all facilities
Inorganic Chemicals	≤ 5	≤ 1 percent of all facilities
Iron and Steel	≈ 3	≤ 1 percent of all facilities
Steam Electric Power Generation	≤ 1	≤ 1 percent of all facilities
Electrical and Electronic Components	≤ 3	≤ 1 percent of all facilities
Food	≤ 10	≤ 1 percent of all facilities
Industries with No Impacts		
Metal Parts and Machinery	0	0
Electroplating and Metal Finishing	0	0
Pulp and Paper	0	0
Pharmaceuticals	0	0
Industrial Laundries	0	0
Leather Treating	0	0
Industries with Inadequate Data		
Federal Facilities	NA	NA
Transportation Equipment Cleaning	NA	NA

Industries with Significant Effects

We expect to see significant impacts (e.g., large quantities and a significant number of facilities affected) in only two industry sectors -- organic chemicals production and petroleum refining.

Organic Chemicals

The Organic Chemical, Plastics and Synthetic Fibers (OCPSF) industry is potentially a very large generator of wastewaters that might be affected by the Phase III rule.[6] Although no detailed single source of concentration and quantity data exists for determining this industry's affected

[6] The OCPSF industry includes SIC codes 2821 to 2824 and 2865 to 2869.

wastewaters, we were able to identify potentially affected facilities through an analysis of the TRI data and information on the percentage of facilities using surface impoundments. Our analysis suggests that between 28 and 73 organic chemical manufacturing facilities could be affected by the Phase III LDR rule.[7] These facilities are estimated to generate between 24 and 95 million tons of wastewaters that may exceed UTS standards. As discussed earlier, for this industry as well as others relying on an analysis of the TRI data, the resulting estimates may understate the impacts of the rule because the TRI analysis does not consider 53 of the 101 non-priority UTS pollutants of concern. The impacts of the rule would be higher if decharacterized ICRT wastewaters managed in land-based units contain any of these 53 pollutants at concentrations exceeding UTS. Unfortunately, no data were available the effects of the rule due to these pollutants and additional data and comments from industry on the presence of these pollutants in wastestreams would be useful.

In developing our analysis of Phase III rule impacts on the organic chemical industry, we reviewed a wide variety of sources of information on the industry's wastewaters. As a first step in our evaluation, we looked at data from the BRS. According to this survey, approximately 33.5 million tons of ICRT waste was managed in land-based units during 1991. Our discussions with industry representatives, however, suggest that this number does not include large quantities of decharacterized waste managed in CWA systems. Representatives of the Chemical Manufacturers Association estimate that approximately 282 million tons of formerly ICR wastes are managed in 123 impoundments by their ten largest members.[8] A review of the PCS database confirmed that a large quantity of wastewaters may be managed in land-based units by facilities in this industry. Of the 200 facilities reporting treatment data in PCS, we estimated that 88 facilities managed wastewaters in land-based units (in 234 units).[9] Scaling up from the known quantity in 123 impoundments, we estimated that the 234 units included in PCS could manage in excess of 500 million tons of formerly ICRT waste per year.[10] This quantity could be greater if we considered facilities not addressed in the PCS data (e.g., indirect dischargers and facilities not reporting treatment data).

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[7] The Chemical Manufacturers Association (CMA) submitted effluent concentration data from 14 member companies listing end-of-pipe wastewater concentrations for constituents found at greater than UTS at the point of generation. Our analysis of this data found that 7.1 percent of these facilities would be affected (1 out of 14), whereas our analysis found that 9.7 to 17.9 percent of the facilities would be affected (113 to 233 out of 1305). Considering the small sample size of the CMA data, however, results from these two data sets appear to be consistent. A comparison of the non-priority constituents found in each data set shows that all but one of the constituents listed in the CMA sample, are also found in the TRI data. The single constituent found only in the CMA sample, vanadium, is not included in the Toxic Release Inventory.

[8] See memorandum entitled "Potential Impact on Industries Affected by the Third Third Court Decision" prepared by IEc for the U.S. EPA Office of Policy Analysis, March 10, 1994.

[9] Reporting of treatment data in PCS is voluntary. Our estimates of the percentage of facilities using land-based units for this industry, as well as others analyzed in this chapter, are based on an analysis identifying facilities using treatment types likely to occur in land-based units for those facilities reporting treatment data.

[10] CMA representatives were not comfortable with this extrapolation because the data used are based on a sample of ten facilities that are not meant to be representative of the entire industry. However, CMA was unable to suggest a better method for evaluating total impacts.

We also reviewed available Section 308 data, consulting information collected in support of the OCPSF effluent guidelines, which were finalized in 1987. Although these data provided what we believe to be applicable information on industry flow rates, effluent sampling and constituent data focused primarily on priority pollutants.

Due to a lack of Section 308 data on non-priority UTS constituents in the OCPSF sector, we relied largely on TRI data to predict which facilities might have wastewaters containing non-priority UTS pollutants at concentrations exceeding UTS levels. To convert TRI information (which is reported as the annual number of pounds of constituent released to surface water or to POTWs) to concentration estimates, we needed to establish a range of wastewater flow rates for the industry. As described above, we used a high flow rate to identify facilities that were quite likely to exceed UTS levels and a low flow rate to identify additional facilities that might possibly be above UTS levels. In the case of direct dischargers, we used 100,000 gallons per day as an estimate of the low flow rate, which is an approximate minimum for facilities with surface impoundments. For the high flow scenario, we used 5.53 million gallons a day for direct dischargers, which according to the ISDB represents industry flow at the 95th percentile. For indirect dischargers, we relied on a study conducted in 1992 to estimate: (1) a low flow rate of 100,000 gallons per day (again, this is the minimum flow rate at which we would expect to see surface impoundment use); and (2) a high flow of two million gallons per day.[11]

Using these estimates of total flows, we projected annual allowable loadings at UTS levels and compared these with reported TRI loadings to identify facilities that would face problems. For example, under the indirect discharger high flow scenario (2 million gallons per day) and using the UTS level for acetone of 0.28 mg/l, we calculated an annual acetone maximum permissible loading of 1,706 pounds per year.[12] We next compared this loading to loadings reported in TRI, which are calculated based on end-of-pipe discharges to surface water or POTWs. For acetone, we found that 34 facilities had loadings greater than 1,706 pounds per year. Thus, even at these very high flow rates, we would still expect a certain number of facilities might have problems meeting UTS levels. This establishes an approximate lower bound on potential impacts. The low flow assumption is used to identify additional facilities that may have trouble meeting UTS, although the precise number will depend on the facilities' actual wastewater flows, information not available for this analysis.

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[11] *Draft OCPSF Industrial User Compliance Evaluation Report*, prepared by SAIC for the U.S. EPA Office of Water, September 1992. This report collected data from regional and state enforcement offices on 555 indirect dischargers, and evaluated flow data from 84 of these facilities.

[12] Two million gallons per day equals 7.57 million liters per day. At a concentration of 0.28 mg/liter, this volume contains 2.1 kilograms of acetone, or 4.67 pounds. Multiplied by 365 days per year this equals 1,706 pounds of acetone.

In Exhibit 2-4 we present the constituents with the greatest number of exceedences at the lower flow rate (i.e., 100,000 gallons per day). For example, among direct dischargers we found a total of 105 UTS exceedences, of which 27 (or 26 percent) were exceedences for methanol. We found 297 exceedences among indirect dischargers, of which 85 (or 29 percent) were exceedences for methanol. The constituents with frequent exceedences are found in many solvents commonly used in the chemical industry. It is worth noting that these constituents were among those most frequently detected in other industry sectors as well.

Exhibit 2-4

AFFECTED CONSTITUENTS IN THE CHEMICAL INDUSTRY

Constituent	Percent of Occurrences[13]	
	Direct Discharge	Indirect Discharge
Methanol	26	29
Acetone	16	17
Xylene	10	10
Aniline	6	6
Methyl isobutyl ketone	7	4
Methyl ethyl ketone (MEK)	6	5
Methyl methacrylate	5	5
n-Butanol	3	5

We completed the TRI analysis for each of the 48 non-priority pollutants reported in TRI and found that:

- Eight direct dischargers, 102 indirect dischargers, and three facilities that are both are *likely* to have trouble meeting UTS standards given that they exceed UTS standards for at least one constituent even in the high flow scenario; and

- An additional 49 direct dischargers, 68 indirect dischargers, and three facilities that are both *might* have trouble meeting UTS standards, although detailed site-specific flow information is needed to determine the actual number of facilities affected.

[13] Based on a total of 105 UTS exceedences among direct dischargers, and 297 UTS exceedences among indirect dischargers.

These estimates are based on total wastewater flows, rather than on ICRT wastewaters that pass through land-based units. A key unknown in our analysis is the extent to which the TRI facilities are discharging formerly characteristic wastes to land-based units. Data are not readily available for us to make this check. Other sources, however, suggest that assuming all TRI exceedences of UTS occur in land-based units managing decharacterized waste may overstate the actual impacts of the Phase III rule. For example, process data collected in support of the most recent Office of Water effluent guideline development process suggest that approximately 21 percent of all indirect dischargers use surface impoundments, while approximately 60 percent of direct dischargers use these units.[14] These data were collected in the mid-1980s, and comments from representatives of the OCPSF industry suggest that surface impoundment use has likely declined since that time. Nonetheless, these percentages correspond reasonably well to estimates of surface impoundment use developed from the PCS database; these estimates span the estimated range based on PCS. We estimated that 21 to 44 percent of the facilities reporting treatment data in PCS use surface impoundments.

If only 21 percent of indirect dischargers and 60 percent of the direct dischargers with UTS exceedences in TRI actually use surface impoundments, the impacts of the Phase III rule would be reduced substantially.

- At high flow rates, 7 direct dischargers (60 percent of 11) and 21 indirect dischargers (21 percent of 102) could have exceedences for at least one UTS constituent; and

- At low flow rates, an additional 29 direct dischargers and 14 indirect dischargers could have exceedences for at least one UTS constituent.[15]

To determine the quantity of waste that would be affected in these industries, we multiplied the number of direct and indirect dischargers affected by the mean daily discharge total wastewater flow rate for both types of facilities. Using these figures, we estimate that 24 to 95 million tons of wastewater could exceed UTS levels each year.[16]

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[14] *Development Document for Effluent Limitations Guidelines and Standards, New Source Performance Standards, and Pretreatment Standards for the Organic Chemicals, Plastics and Synthetic Fibers Point Source Category, Volume I and II*, U.S. EPA Office of Water, October 1987.

[15] These estimates classify facilities that are both direct and indirect dischargers as direct dischargers.

[16] High flow scenario: 7 direct dischargers at mean flow rate of 1.37 million gallons per day (mgd) = 9.6 mgd; 22 indirect dischargers at 280,000 g/day = 6.2 mgd. Converting this total to tons yields: 15.8 mgd x 365 days per year x 0.004171 tons per gallon = 24.0 million tons per year. Low flow scenario: 40 direct dischargers at 1.37 mgd = 54.8 mgd; 36 indirect dischargers at 280,000 gallons per day = 10.1 mgd. Converting this total to tons yields: 64.9 mgd x 365 days per year 0.004171 tons per gallon = 98.8 million tons per year.

The application of the surface impoundment use percentages to the TRI data creates some important uncertainties. Specifically, we have no way of knowing whether the distribution of land-based units at TRI facilities with likely or potential exceedences of UTS levels is the same as for the industry as a whole. In the absence of better data, however, we believe applying the overall chemical industry impoundment percentages provides the best estimate of the Phase III rule's impacts.

Petroleum Refining

To analyze the impacts of the Phase III rule on the petroleum industry, we reviewed information on quantities of potentially affected wastewaters and on the concentrations of non-priority pollutants in these wastes. In general, we found no single source of data that provides a good indicator of the impacts of the Phase III rule on refiners. Instead, we ultimately were forced to infer impacts based on analyses of the TRI data. Based on this analysis, we estimated that between eight and 30 facilities may be discharging wastewaters containing non-priority pollutants at above UTS levels. These facilities, which represent between four and eleven percent of the approximately 202 direct and indirect dischargers in the industry, generate between 11 and 86 million tons per year of potentially affected wastes.

An initial step in analyzing the petroleum refining industry was to review all available sources of information on ICRT wastewater quantities and concentrations of non-priority pollutants in these wastes. According to the 1991 BRS, approximately 4.3 million tons of ICRT waste was managed in land-based units. However, as a result of discussions with petroleum industry representatives and a review of Office of Water data, we believe this is an underestimate of potentially affected quantities. In particular, our sources suggest that the BRS does not include potentially large quantities of hazardous wastewaters that were decharacterized near the point of generation. Office of Water sources confirm that the petroleum industry manages very large quantities of wastewaters in land-based units. According to PCS, 52 percent of facilities reporting treatment data manage wastewaters in land-based units. Assuming average industry flows of approximately 3.2 million gallons per day among direct dischargers (based on ISDB data), this industry could be managing almost 336 million tons of wastewater in surface impoundments each year. Even if only a small percentage of these include decharacterized wastes, the potentially affected quantities of decharacterized ICRT wastewaters could be significant.

Data on concentrations of non-priority constituents in refinery wastewaters were sparse. Data used to support the 1982 effluent guidelines did not include sampling for non-priority pollutants. More recent sampling to support the development of new effluent guidelines did contain some data on the non-priority pollutants, and suggested that some facilities would have problems meeting UTS levels.[17] However, these newer data were not extensive enough to permit generalizations about the industry as a whole.

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[17] U.S. Environmental Protection Agency, Office of Water, *Summary Report of Results of Effluent Limitation Guidelines and Standards Special Study Review of the Petroleum Refining Industry*, publication pending.

In the absence of detailed quantity and concentration data, we relied instead on an analysis of the TRI data similar to the one described above for the organic chemical industry. Using wastewater flow data from the Industry Studies Database (ISDB), we selected high and low effluent flow rates to establish upper and lower bounds on the number of facilities exceeding UTS levels for non-priority pollutants reported in TRI. For direct dischargers we used a low flow rate of 250,000 gallons per day and a high rate of 10 million gallons a day. For indirect dischargers, we used a low flow rate of 200,000 gallons per day and a high of 1.77 million gallons per day. These low-end and high-end flows are based on the 5th and 95th percentile values for facilities in that database.[18]

Applying these assumptions, we found that:

- Sixteen facilities are likely to exceed UTS levels for xylenes, pyridine, acetone, methanol, and cresols given that they have exceedences even at the dilution rates assumed in the high flow scenario; and

- 42 additional facilities might exceed UTS levels for xylenes, methyl ethyl ketone, pyridine, acetone, barium, cresols and methanol, although this will depend on the actual wastewater flow at each facility.

We adjusted this estimated range of the number of affected facilities to reflect the number of facilities likely to manage wastewaters in surface impoundments. We estimated that 52 percent of petroleum refining facilities use surface impoundments based on the PCS database. Applying this 52 percent to the TRI analysis, we estimated that eight to 30 facilities may be affected by the rule. In addition, we estimated that the quantity of wastewater generated by these facilities ranges from 10.7 to 86.2 million tons per year.[19] This estimated range is based on an average flow rate for direct dischargers of 3.22 million gallons per day and indirect dischargers of 720,000 gallons per day.[20]

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[18] The 5th percentile of a range of values (e.g., flow rates for facilities in ISDBs) means that 95 percent of the values in the range are greater than that value. Similarly, the 95th percentile means that five percent of the values are greater than that value.

[19] In discussion with a petroleum refining industry trade association, it indicated that 100 million tons per year was a reasonable estimate of the quantity of waste potentially affected by the rule. Our upper bound estimate is of a similar magnitude and our lower bound estimate reflects the fact that most wastewaters managed by facilities in surface impoundments may not contain non-priority UTS pollutant at concentrations exceeding UTS.

[20] For the lower bound of this range: 720,000 gallons per day x 365 days per year x 0.004171 tons per gallon x 7.5 indirect dischargers + 3.22 million gallons per day x 365 x 0.004171 x 0.5 direct dischargers = 10.7 million tons per year. The upper bound is calculated in a similar fashion based on 30 facilities, 16 indirect dischargers and 14 direct dischargers, and the applicable flow rates.

Industries with Minor Effects

Relying largely on TRI data and following the approach described above, we found minor impacts in six industry sectors. We categorized these sectors as minor impact industries because fewer than approximately one percent of all facilities in the industry are expected to discharge wastewaters that exceed UTS concentration levels. In these industries, we estimate that relatively small quantities of waste might be affected.

Pesticide Industry

Our analysis of the pesticide industry includes both pesticide manufacturers and formulators/packagers (SIC 2879). Pesticide manufacturers produce the active ingredients for these products, while formulators/packagers process these ingredients with other substances and package pesticide products for sale.

Our analysis again suggests potential under-reporting of ICRT wastewaters in the BRS, which shows only 418,000 tons managed in land-based units. However, of the 11 facilities reporting treatment data in PCS, five (45 percent) use land-based units. At average industry flow rates this suggests much larger quantities of wastewaters managed in surface impoundments. We therefore turned to recent Section 308 data to better determine potentially affected wastes. The Office of Water recently collected data from 90 pesticide manufacturers and/or packagers in support of effluent guideline development. Thirty-two of these facilities are direct dischargers, while 36 are indirect dischargers (all others employ recycling or some other method to dispose of waste). These data include concentration information on only one non-priority UTS pollutant, methoxychlor. Therefore, we turned to TRI data to assess exceedences for non-priority UTS pollutants.

Based on an average flow rate of 2.33 million gallons per day (3.5 tons per year) and loadings estimated using TRI data, we found exceedences at one facility for methyl isobutyl ketone.[21] This facility represents approximately one percent of the 90 pesticide facilities. We estimated that the quantity of wastewater affected at this facility is about 3.5 million tons.[22] We also found potential exceedences of UTS constituents at 13 indirect dischargers. However, analyses conducted for the capacity analysis suggest that only direct dischargers within this industry operate surface impoundments.[23] Therefore, we do not believe these facilities will be affected.

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[21] van der Leeden, Frits, Fred L. Troise and David Keith Todd, *The Water Encyclopedia*, Lewis Publishers, 1990. See p. 349, Table 5-39 for data on water use in the pesticide industry.

[22] This estimated quantity was calculated as follows: 2.33 million gallons per day x 365 days per year x 0.004171 tons per gallon x 1 facility = 3.5 million tons.

[23] Analysis of Section 308 data conducted for the capacity assessment by Radian, Incorporated.

Inorganic Chemicals

Inorganic chemicals includes SIC codes 2812 through 2819. Our analysis of BRS data showed that 7.5 million tons of ICRT waste could be managed in land-based units. Because little current data on wastewaters exist for inorganic chemicals (effluent guidelines were developed in 1982 and only examine priority pollutants), we calculated concentrations in wastewaters for this industry using TRI data.

In the high flow rate scenario of 1 million gallons per day we found 17 facilities with UTS exceedences. Based on a low flow scenario of 50,000 gallons per day, we found that an additional 16 facilities exceeded UTS levels. These exceedences are for 14 constituents including barium, phthalic anhydride, methanol, acetone, methyl isobutyl ketone, methyl ethyl ketone, and methyl methacrylate. We believe, however, that impacts could be much lower than these numbers suggest. Information from industry experts suggests that very few of these wastestreams are managed in land-based units. Much of the treatment required for inorganic wastewaters involves chemical precipitation and other physical/chemical processes that take place in tanks. Using several sources, we estimate that only 17 to 36 percent of inorganic chemical facilities actually use surface impoundments.[24] Applying these percentages as correcting factors to our TRI data, we estimate that three to twelve facilities, or less than one percent of a total of 685 facilities reporting to TRI, may actually be affected by the Phase III LDR rule.[25] The total quantity of potentially affected waste from these facilities is estimated at between 1.0 and 4.5 million tons annually assuming an average industry flow rate of 250,000 gallons per day (based on effluent guidelines).[26]

Iron and Steel

The iron and steel industry includes all processes in SIC codes 3312 through 3325. BRS data show that only two million tons of ICRT waste are treated in land-based units in this industry each year, while PCS shows that only seven percent of facilities in the industry use land-based units to manage their wastewaters. For this industry as well, we calculated concentrations in wastewaters using TRI data because effluent guideline data from 1982 do not provide the information necessary to evaluate UTS constituents in these wastewaters.

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[24] Sources: PCS data show that 17 to 36 percent of inorganic chemical manufacturers discharging to surface waters use land-based units. The *Screening Survey of Industrial Subtitle D Establishments*, U.S. EPA Office of Solid Waste, December 1987, shows that 26 percent of the facilities in this industry report using surface impoundments.

[25] Sixteen facilities x 17 percent = 2.7 (rounds up to 3 facilities); 33 facilities x 36 percent = 11.9 (rounds up to 12 facilities);

[26] For the lower bound of this range, 250,000 gallons per day x 365 days per year x 0.004171 tons per gallon x 2.7 facilities = 1.0 million tons. The upper bound is calculated in a similar fashion based on 11.9 facilities.

We compared estimated concentrations to loadings of UTS constituents based on a low flow scenario of 250,000 gallons per day and a high flow scenario of 10 million gallons per day. These flow rates are based on data provided in the development document supporting effluent guidelines for this industry.[27] Using these assumptions, we found no facilities with exceedences at high flow rates. At the low flows, we found that four facilities may exceed UTS levels for barium, xylene, acetone, or vanadium. These facilities represent far less than one percent of the approximately 870 facilities in the iron and steel industry reporting to TRI, and would generate about three million tons of affected waste per year based on an average flow rate of 500,000 gallons per day. Note that this analysis does not adjust these estimates to consider whether these facilities manage these wastes in surface impoundments.

Electric Power Generation

Classified under SIC codes 4911 and 4931, the electric power generation industry includes public and privately-owned electric utilities that generate, transmit and/or distribute electrical energy. Based on a review of steam-electric wastes only two types of waste streams are likely to be affected by Phase III LDRs: demineralizer regenerate wastes and boiler chemical cleaning wastes. These are both corrosive wastewaters that may contain the non-priority metals barium and vanadium at concentrations exceeding UTS levels. However, in many instances, these wastes may be co-managed with wastes that currently are RCRA-exempt and thus would not be subject to Phase III LDRs.[28]

Based on an analysis of the BRS, EPA found that the impacts of the rule on this industry are likely to be minor. The Agency found that four facilities managed 60,000 tons of potentially affected ICR wastes in surface impoundments regulated under RCRA. However, note that there is significant uncertainty associated with this estimate. First, there are limited data available on whether the wastewaters contain non-priority pollutants at concentrations exceeding UTS levels and thus the BRS estimates may overstate the effects of the rule. Second, there is uncertainty over the extent to which facilities manage their ICR wastewaters in non-exempt surface impoundments. Finally, EPA believes that BRS data may underestimate the quantity of decharacterized ICR wastewaters managed in land-based units because many facilities may not have reported waste that were diluted immediately upon generation. Analyses of other data sources (PCS, TC RIA) and discussions with EEI suggested that the number of affected facilities may be higher, based on the number of facilities using surface impoundments. Unfortunately these databases did not allow us to estimate the number of affected facilities because they do not contain data on all the applicable criteria (e.g., whether wastewaters are ICR and contain non-priority UTS constituents are concentrations exceeding UTS). A TRI analysis also was not possible because TRI does not include SICs representing most steam-electric facilities. Due to these uncertainties, further analysis of the impacts of the rule on this industry may be warranted.

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[27] *Development Document for Effluent Limitations Guidelines and Standards, Iron and Steel Manufacturing*, U.S. EPA Office of Water, October 1982.

[28] Wastes generated from the burning of fossil fuels at electric utility plants mixed with other wastes (including ICRT wastes) are temporarily exempt from RCRA. EPA plans to consider whether to exempt these wastes permanently by April 1, 1998. For more information see Appendix F.

Electrical and Electronic Components

The electrical and electronic components (EEC) industry is a specialized subsector of the metal parts and machinery industry, and is limited to the manufacture of semiconductors, electronic crystals, cathode ray tubes, and luminescent materials. We had very little data on this industry from the effluent guidelines. Therefore, we estimated concentrations in wastewaters using TRI data at a low flow of 100,000 gallons per day and a high flow of 1 million gallons per day. These flow rates are drawn from limited data provided in the effluent guidelines development document for the EEC industry.[29]

Using these assumptions, we found that 29 facilities exceeded the UTS levels at high flow rates. At low flow rates, we found that an additional 26 exceeded UTS levels. We adjusted this estimated range of the number of affected facilities to reflect the number likely to manage wastewaters in land-based units. Based on PCS, 13 to 21 percent of facilities in the industry use surface impoundments. Applying these percentages, we estimated that four to 12 facilities, or less than one percent of the 1,898 facilities reporting to TRI, may actually be affected by the rule.[30] In addition, we estimated the quantity of wastewater generated by these affected facilities at between 579,000 and 2.6 million tons per year. This is based on an average flow rate of one million gallons per day for direct dischargers and 100,000 gallons per day for indirect dischargers.

Food Production

For this analysis, we evaluated six sectors within the food industry: dairy products, fruits and vegetables, grain mill products, meat products, sugar processing, and seafood processing. Less than 100,000 tons of ICRT waste were reported in the BRS as being treated in land-based units in the food industry, while PCS shows that about 43 percent of facilities in the industry use land-based units in managing wastewaters. Effluent guidelines for the sectors we consider were developed in 1974, and contain limited constituent and flow data. Because the flow data reported in this document are quite old, we relied on more recent published data to estimate average water use in the industry.[31]

Using the reported average wastewater flow rate of 570,000 gallons per day and TRI loadings information, we estimate that 11 indirect dischargers (out of 8,965 facilities) may have wastewaters with exceedences for either acetone, methanol, or ethylene oxide. Using this average flow rate, we estimated that the quantity of affected wastewater generated by these facilities is about ten million

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[29] *Development Document for Effluent Limitations Guidelines and Standards, Electrical and Electronic Components Industry*, U.S. EPA Office of Water, 1983.

[30] Twenty-nine facilities x 13 percent = 3.8 facilities (rounds to four facilities) and 55 x 21 percent = 11.6 (rounds to 12 facilities).

[31] *The Water Encyclopedia*, See p. 346, Table 5-39 for data on water use in the food industry.

tons per year.[32] It is important to note, however, that these estimates of the number of affected facilities and quantity of affected waste are not corrected for surface impoundment use or ICRT waste and thus that these estimates may overstate the effects of the rule.

Industries with No Impacts

Based on a review of all available data, we believe that six of the industries we analyzed are unlikely to be affected by the Phase III LDR rule.

Pulp and Paper

The pulp and paper industry includes all facilities engaged in manufacturing pulp, paper and paper board (principally SIC 2611, 2621, and 2631). Use of surface impoundments is quite common in this industry, and facilities also generate large quantities of characteristic waste. However, we believe that UTS constituents present in ICRT waste will be controlled through the industry's new effluent guidelines, which EPA proposed in October 1993. Data collected in support of this rule serves as the basis for our analysis.[33]

As part of the effluent guideline development process, EPA sampled effluent data from 20 facilities representing 104 pulp and paper mills.[34] Based on the prevalence of surface impoundments in this industry, we assumed that all of these facilities manage their wastewaters in land-based units. We then screened these data and found that 17 of the 20 facilities generated characteristic wastewaters. We examined the constituents in these wastestreams, and eliminated from further review all priority pollutants and pollutants specified in the industry's recently proposed effluent guidelines. A review of the remaining constituents that could be subject to regulation showed that none exceeded UTS levels at the final discharge point. However, this analysis may understate the effects of the rule because it does not consider the potential impacts on the 461 facilities not represented by the Section 308 data. To the extent that these facilities have wastestreams similar to those analyzed above, the rule is unlikely to affect them.

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[32] 570,000 gallons per day x 11 facilities x 365 days per year x 0.004171 tons per gallon = 9.5 million tons per year.

[33] *Development Document for Proposed Effluent Limitations Guidelines and Standards for the Pulp, Paper and Paperboard Industry*, U.S. EPA Office of Water, October, 1993.

[34] In developing these effluent guidelines, EPA focused on four subcategories of the industry: bleached papergrade kraft and soda, papergrade sulfite, dissolving kraft, and dissolving sulfite mills. EPA focused on these facilities because it was concerned by the constituents likely to be in the wastewaters generated by these facilities due to the processes they use (e.g., bleaching).

Pharmaceuticals

The pharmaceutical industry primarily includes facilities classified under SIC codes 2833 to 2836. Most pharmaceutical wastewaters are generated during fermentation and solvent extraction processes, which employ solvents such as acetone, methanol, and isopropanol.

Our primary source for assessing impacts to the pharmaceutical industry was recent Section 308 data collected by the Office of Water's effluent guideline program in 1991. OW's survey collected data on operations and wastewaters from 244 representative facilities. These samples contained data on non-priority pollutants, and thus served as the basis for our analysis of this industry. We were not able to determine from point of generation data whether these wastewaters were ICRT, and therefore screened first for use of land-based units. Only 15 of the 244 facilities were found to manage wastewaters in land-based units.

Effluent data from these 15 facilities showed that only one constituent, acetone, exceeded UTS levels at two facilities. However, acetone is among the constituents proposed for regulation in the pharmaceutical industry's revised effluent guidelines. As written in the Phase III LDR rule, constituents which are controlled to BAT by the Clean Water Act will not be subject to UTS standards under RCRA. As acetone will likely be among the pollutants controlled under the final pharmaceutical effluent guidelines, we do not think that these wastestreams will require additional treatment under Phase III.

Metal Products and Machinery and Electroplating/Metal Finishing

We discuss the Metal Products and Machinery (MP&M) industry and the Electroplating/Metal Finishing (EMF) industry together because their processes and waste streams are quite similar, and because our analysis of these industries drew from the same data sources.

The MP&M category, formerly known as the Machinery Manufacturing and Rebuilding (MM&R) category, includes the 15 industrial groups shown in Exhibit 2-5. EPA is currently developing revised effluent guidelines for the seven Phase I industries. Effluent guidelines for Phase II industries are expected to be proposed in 1997. The E/MF category covers a range of facilities in SIC codes 34 through 39 that conduct any one of the following six operations: electroplating, electroless plating, anodizing, conversion coating, chemical etching, or printed circuit board manufacturing.

Our analysis of the MP&M and E/MF industries draws on Section 308 data collected by OW and evaluated for the capacity analysis. This source contained good data on non-priority pollutants and thus serves as the basis for this analysis. EPA collected data to construct 446 "model" facilities that can be scaled up to represent the 10,600 facilities subject to MP&M Phase I effluent guidelines. We examined this database to identify ICRT wastestreams, and found that all 446 model facilities generated corrosive wastewaters. We next screened for land-based units, and found that only three model facilities (representing a total of ten actual facilities) manage waste in these units. We compared constituents in these wastestreams to UTS concentrations and found that none of the non-priority pollutants exceeded UTS levels.

Exhibit 2-5 MP&M INDUSTRIES	
Phase I	**Phase II**
Aircraft	Motor Vehicles
Aerospace Vehicles	Bus and Truck
Hardware (machine tools, screw machines, etc)	Railroad
Ordnance	Ships and Boats
Stationary Industrial Equipment	Office Machines
Mobile Industrial Equipment	Household Equipment
Electronic Equipment	Instruments
	Precious and Nonprecious Metals

Although sampling data have not been collected for MP&M Phase II and electroplating facilities not covered by MP&M effluent guidelines, industry experts believe that these industries' wastewaters and treatment processes are very similar to those of Phase I facilities.[35] Therefore, based on the very limited use of surface impoundments in the MP&M and E/MF industries and the lack of non-priority pollutants exceeding UTS in Phase I facilities, we do not believe that either of these sectors could be affected by Phase III LDRs.

Leather Treating

Leather treating processes (SIC code 3111) generate acidic wastewaters containing sulfides and chromium, as well as ammonia, biocides, chlorides and surfactants. Leather treating was included in this analysis because it generates characteristic wastewaters that could contain UTS constituents at elevated levels.

To assess the number of affected facilities, we combined the TRI loadings data with the estimated average wastestream flow rates for facilities in this industry and compared the resulting concentration estimates to UTS levels. Based on our analysis, we found that no facilities are likely to be affected by the rule because no facilities generate wastewaters containing non-priority UTS constituents exceeding UTS levels, assuming an average flow rate of 226,000 gallons per day.[36]

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[35] Personal communication with Paul Buellesbach, Radian Corporation

[36] This average flow rate was taken from van der Leeden, Frits, Fred L. Troise and David Keith Todd, *The Water Encyclopedia*, Lewis Publishers, 1990. See Table 5-39 for data on water use in the leather treating industry.

Industrial Laundries

Industrial laundries, classified under SIC code 7218 (Personal Services), provide laundered items to industrial and commercial users, including chemical and manufacturing plants, automotive services, janitorial services and other customers. EPA estimates that 1,000 to 1,500 industrial laundries are currently operating in the U.S. The Agency is currently collecting data on these facilities in support of new effluent guidelines, and for that reason has included it among the industries profiled for the Phase III rule. Analyses completed for the capacity assessment suggest that commercial industrial laundries discharge their wastewaters to POTWs, and most do not treat their wastewater prior to discharge.[37] Our analysis of BRS data, which focused on ICRT waste managed in land-based units, did not yield any quantity data on industrial laundries, and PCS data show only four units under the entire Personal Services SIC code. We therefore believe that the industry will not be affected by the Phase III LDR rule.

Industries with Inadequate Data

We were unable to characterize potential impacts to federal facilities and transportation equipment cleaners (TEC) due to poor data on these facilities.

Federal Facilities

Federal facilities include all operations managed by the U.S. federal government, and cover a wide range of services and processes. Since federal facilities are classified according to the manufacturing processes and products manufactured at the facility, many of these facilities are likely to be addressed in the analyses of other industries. However, EPA did investigate the availability of data for conducting a stand-alone analysis of federal facilities. EPA identified and used the Federal Facility Inventory for 1992 in an analysis of these facilities. As required under RCRA Section 3016, every two years EPA compiles this database from data submitted by federal agencies on treatment, storage, and disposal units at the facilities.

EPA's review of these data showed that of the 914 federal facilities in the database, 69 (eight percent) manage wastewaters in nonhazardous land-based units (i.e., land treatment units or surface impoundments).[38] This finding indicates that a small percentage of federal facilities are potentially affected by the rule. Unfortunately, the database did not support a more complete analysis since information on constituents and constituent concentrations in the wastes managed in these land-based units is not available from this source. EPA did not conduct any additional analysis for these facilities, assuming that those facilities potentially affected were addressed under the analyses conducted for other industries.

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[37] Based on an analysis of the industrial laundries category conducted for the capacity assessment, considering preliminary data currently being collected to develop revised effluent guidelines for this industry.

[38] Note that this estimate does not include facilities that manage wastes in underground injection wells.

Transportation Equipment Cleaning (TEC)

For purposes of developing effluent guidelines, EPA's Office of Water divided the TEC industry into two categories: truck, rail and barge tanks cleaning, and aircraft exterior and interior cleaning. Unfortunately, limited data were available to evaluate the extent to which facilities in this industry are likely to be affected by the Phase III LDR rule. We principally relied on the available data currently being collected by EPA to support development of these effluent guidelines for this industry. EPA initially included 11,900 facilities in the TEC database of known or potential facilities in the industry, including facilities in the two categories mentioned above. EPA distributed screener surveys to 3,240 tank cleaning facilities and 760 aircraft cleaning facilities to more accurately determine the scope of the industry. Based on the preliminary results of the tank cleaning subcategory survey, EPA identified 734 facilities in the rail, truck and barge cleaning subcategory. Scaling these results of the survey sample to the entire population, EPA estimated that there are 2,400 to 2,800 facilities in this subcategory.

Based on an analysis of the waste management practices at the 734 facilities identified in the screener survey, EPA estimated that 98 of these facilities (13 percent) use land-based units in managing their wastewaters (evaporation ponds, lagoons, or settling ponds). Unfortunately, additional information on constituents contained in wastewaters managed in these land-based units by these facilities is not available.[39] In reviewing existing data, EPA generally found that a wide array of constituents can be found at these facilities because hundreds of different chemicals are shipped in tanks. Thus these facilities potentially could be affected by the rule.

Preliminary screener survey data for the aircraft cleaning subcategory will not be available until the spring of 1995. EPA believes that some of these facilities may use land-based units in managing their wastes and thus may be affected by the rule.

Limitations of Characteristic Waste Analysis

In general our analysis of potentially affected industries is limited by poor and incomplete data. In most instances, data characterizing wastestreams are not available. We therefore had to piece together information from a variety of sources in order to determine constituent concentrations in wastestreams and whether these wastes are managed in surface impoundments. Although this analysis represents our best estimates, we cannot be certain that we have accurately captured all wastestreams likely to be affected. Particularly important uncertainties requiring more or better data to resolve include:

- **Limited constituent information in TRI data** -- Of the 101 non-priority UTS constituents that we consider in this analysis, only 48 are reported in TRI. Also, only those facilities generating more than 10,000 pounds annually of TRI constituents are required to report. Both of these limitations may cause us to underestimate the quantities of affected wastes.

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[39] Data on constituents and concentration levels will be available when EPA completes the detailed questionnaire, which EPA plans to distribute to a subset of the facilities in the industry in 1995.

- **Lack of data in TRI on ICRT waste and use of surface impoundments** -- As we described above, much of the constituent concentration data that we developed are based on TRI reporting. A significant limitation of these data is that they do not include information on management in land-based units or whether wastewaters are decharacterized ICRT wastes. This limitation likely serves to overestimate the quantity of waste that could be affected by the rule.

- **Poor testing for non-priority pollutants** -- Much of the Office of Water's testing data collected during previous effluent guideline development efforts was of little use in this analysis because it focused on priority pollutants. Only in recent years have testing efforts expanded to incorporate a wider range of contaminants. Therefore, few data exist on concentrations of non-priority pollutants, which are the focus of this analysis. This limitation also may cause us to underestimate the quantity of waste affected.

NEWLY LISTED WASTES

EPA conducted a number of analyses at the time that carbamates and spent aluminum potliners were proposed for listing to determine the quantity of waste that would affected by new treatment standards. These analyses, as well as studies conducted by industry, are the basis of the estimates in this RIA.

Carbamates

In an effort to gather data in support of the carbamate listing, EPA conducted a survey in 1991 of carbamate facilities. Data collected through this survey, as well as information obtained through other industry sampling efforts, were summarized in the capacity assessment that EPA produced for the carbamate industry.[40] This analysis served as the basis for waste quantity estimates provided in the carbamate listing.

Based on these sources, the EPA estimates that approximately 440,000 tons of newly listed carbamate K156 - K161 wastes are generated each year. An estimated 4,500 tons of this waste will require additional treatment to meet UTS levels listed in the Phase III LDR rule. In Exhibit 2-6 we present the quantities associated with each waste code.

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[40] *Draft Non-CBI Capacity Assessment for the Carbamate Industry* (in support of preliminary LDR capacity assessments), U.S. Environmental Protection Agency, Capacity Programs Branch, June 13, 1994.

Exhibit 2-6 QUANTITY OF CARBAMATE WASTE AFFECTED	
Wastecode	**Quantity (tons)**
K156	0
K157	0
K158	10
K159	0
K160	740
K161	3,700
TOTAL	4,500

In addition, small quantities of U and P commercial chemical product waste included in the carbamate listing could be affected. EPA estimates that 13 tons of carbamate P waste and 28 tons of carbamate U waste will require additional treatment.

Spent Aluminum Potliners

EPA and industry have conducted a number of studies to characterize aluminum production processes and estimate the quantity of spent aluminum potliners generated annually. This analysis draws primarily on the survey that EPA conducted in 1991, which investigated most of the 23 facilities generating this waste, and a survey of the primary aluminum production industry conducted by the Reynolds Metal Company in 1992.[41] Based on these surveys and current market conditions, EPA estimates that 120,000 tons of K088 waste are produced annually. All of this waste will require alternative treatment to meet UTS levels. The Capacity Analysis Branch estimates that some of this waste currently may be thermally treated. Because we are uncertain as to the quantity of waste undergoing treatment, we estimate the impact of LDR standards on the total generated quantity.

[41] *Summary of Generation, Disposal and Treatment Practices for Spent Aluminum Potliners from the Primary Reduction of Aluminum*, U.S. EPA Risk Reduction Engineering Lab, March 12, 1990.

INTRODUCTION

In this chapter, we estimate the costs and economic impacts to industry of meeting Phase III LDR requirements. This analysis focuses on the incremental cost of compliance with the new standards, which is the difference between the cost of current waste management practices and that necessary to comply with the rule. In this section, we first present a brief synopsis of our results. We next discuss the methodology that we used to develop cost estimates for affected decharacterized ICRT wastes and present detailed results. In the third section of this chapter, we review in greater detail our estimates of compliance costs for the newly listed wastes. Finally, we describe the economic impacts of the rule.

Summary of Results

Our analysis of Phase III rule costs considers compliance costs and economic impacts for both the characteristic and newly listed wastes affected by the rule. These costs are summarized in Exhibit 3-1.

For facilities with characteristic wastes regulated under the Phase III rule, affected generators face four potential compliance options. Briefly, these options are to: (1) seek a CWA permit modification specifying that pollutants exceeding UTS are treated to BAT levels; (2) obtain a RCRA treatability variance for constituents that exceed UTS; (3) demonstrate that a POTW to which the facility discharges wastewaters provides adequate treatment of constituents that exceed UTS levels; or (4) treat to UTS levels prior to discharge.

In general, we expect facilities will seek permit modifications, treatability variances, or certification of adequate POTW treatment because these compliance options can be implemented at much lower cost than the option requiring treatment to UTS levels. We estimate the total annualized costs of the rule for these wastes will range from approximately $197,000 to $598,000, with the majority of the costs incurred by the organic chemicals industry. These are the costs of sampling, analysis, and administrative processing of applications to modify Clean Water Act permits and additional on-going monitoring of wastestreams to comply with the permits.

Exhibit 3-1 ESTIMATED INCREMENTAL COSTS OF THE PHASE III LDR RULE	
Waste Type	**Annualized Costs**
Characteristic Wastes	
Organic Chemical Industry	$154,000 to $425,000
Petroleum Refining Industry	$43,000 to $173,000
Total Characteristic Wastes	$197,000 to $598,000
Newly Listed Wastes	
Carbamates	$5.5 million
Spent Aluminum Potliners	$6.4 to $42.4 million
Total Newly Listed Wastes	$11.8 to $47.2 million
TOTAL Phase III Incremental Costs	$12.0 to $47.8 million
Note: These estimated costs represent the incremental costs of the rule based on a comparison of the costs of treating and disposing of the wastes with and without the rule. Annualization is based on a period of 20 years and an interest rate of 7.0 percent.	

The costs of treating the newly listed wastes to LDR standards are substantially higher and are expected to occur each year. These costs range from approximately $11.8 million to $47.2 million per year, and are attributable primarily to thermal treatment of aluminum potliner wastes (K088). These costs represent a substantial increase in the average expenditures on pollution control in the aluminum industry (approximately 40 percent), but are not expected to have as significant an impact on the total cost of producing aluminum.

Overall, the estimates presented in Exhibit 3-1 provide an accurate assessment of the impacts of the Phase III rule, as long as generators of characteristic wastes can obtain CWA permit modifications indicating that BAT treatment occurs for those constituents exceeding UTS levels at the end-of-pipe. However, if this is not possible, costs of the Phase III rule could increase significantly. We estimate that average per facility costs of treating all constituents to UTS levels in the organic chemical industry could be as high as $1 million per year. In a sensitivity analysis, we considered the costs of the rule under two scenarios: (1) assuming that 80 percent of the facilities comply with the rule by obtaining permit modifications and 20 percent comply by treating their wastes and (2) assuming that 60 percent comply by obtaining permit modifications and 40 percent comply by treating their wastes. Based on the first scenario, the estimated annualized costs of the rule would range from $6.6 million to $18.2 million. Based on the second scenario, the estimate annualized costs are expected to be between $12.9 million and $35.7 million. While these costs do not represent a major increase in annual pollution control expenditures for large chemical or petroleum refining plants, they are substantially higher than the costs of all facilities obtaining CWA permit modifications.

CHARACTERISTIC WASTES

In our analysis of affected characteristic wastes, we estimate potentially significant impacts in two industry sectors -- organic chemical manufacturing and petroleum refining. These two industries are the only ones for which we have conducted a detailed analysis of costs. In addition, we estimate that twelve other industries will experience either minor effects (i.e., no more than one percent of all facilities affected) or no effects. For two industry sectors, we lacked the data necessary to determine impacts.

Methodology

We calculated facility costs of compliance under two options: (1) modifying NPDES permits to specify a Clean Water Act (CWA) Best Achievable Technology (BAT) standard for UTS constituents; or (2) implementing the treatment technologies necessary to bring concentrations to UTS levels. We review each of these options below.

Permit Modification

Under this option, we evaluated different approaches for direct and indirect dischargers. We assume that indirect dischargers, rather than modifying their permits, will seek to demonstrate to regulatory authorities that the POTW to which they are sending their wastewater is adequately treating for UTS constituents. We make this assumption because it represents the least costly approach for these facilities to take. We assumed that direct dischargers are operating under BAT. NPDES permit writers would therefore be able to modify these facilities' existing permits to specify a BAT standard for all UTS constituents amenable to treatment in CWA systems.

Our costs are based on the estimated number of indirect and direct dischargers with UTS exceedences. For direct dischargers, we first evaluated the costs associated with determining whether constituents in their effluent exceeded UTS. According to the Office of Solid Waste, facilities will be able to rely on best professional judgment to determine whether UTS constituents are present at levels exceeding the standard. Only those facilities that believe they are exceeding UTS levels for non-priority pollutants will be required to test their wastewaters.[1] Hence, the costs of testing should be limited primarily to those facilities that exceed UTS levels.[2]

We next evaluated the administrative costs associated with permit modification. We assume that indirect dischargers would provide data to the CWA control authority demonstrating that the POTW to which they are discharging their wastewater is meeting BAT or UTS levels for regulated constituents. We are uncertain as to the costs that generator facilities would encounter under this option. For example, it is not clear whether generators or POTWs would assume the costs

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[1] Personal communication with Peggy Vyas, OSW, September 30, 1994.

[2] Some additional facilities who are unsure about whether their effluent meets UTS levels would also be likely to test. At this point, we have not attempted to quantify the costs for these additional facilities.

associated with effluent testing. For purposes of this analysis, we assume that generators would be responsible for these costs, but would not incur the administrative costs associated with permit modification.

In addition, we calculated the incremental annual cost of on-going monitoring of constituents that are added to CWA permits. On-going monitoring takes place on a regular basis as required in facility permits.

For the permit modification compliance option, we calculated the total cost to facilities associated with:

- **On-site effluent sampling** -- We assume this is carried out by facility personnel. While contractors often conduct sampling at smaller facilities, we believe that most of the facilities affected by the Phase III rule are larger and would use their own personnel to conduct sampling. We assume that four sampling efforts would be conducted within a four week period.

- **Laboratory testing necessary to determine concentration levels achieved through BAT treatment** -- Due to the variability of effluent on the organic chemical industry (which is the industry primarily affected by this rule) we assume that facilities will collect and test four samples to characterize their wastewaters.[3] We assume that facilities will send these samples to commercial laboratories for testing.

- **Administrative costs** -- This includes the personnel resources required to complete and finalize a permit modification. The Office of Water has not determined whether facilities would be required under this compliance option to submit a new permit application, or simply send a letter requesting that certain constituents be added to their existing permit.

- **On-going monitoring** -- Facilities with CWA permits are required to monitor the waste stream concentrations of constituents included in the permit. Our cost estimates include the annual cost of sampling, analysis, and reporting. Unlike the preceding three categories of cost, we assume that the costs of on-going monitoring will continue to be incurred after the initial modification of the permit.

In Exhibit 3-2 we present our cost estimate for this compliance option. To calculate costs for this option, we apply total costs to all direct dischargers with UTS exceedences, and sampling and testing costs to all indirect dischargers with exceedences. We assume that the costs of on-going monitoring are applicable to both direct and indirect dischargers.

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[3] Information from Dow Chemical suggests that four analyses are typical for a permit application. Sheila Frace of EPA's Office of Water confirms that this is a reasonable estimate.

Exhibit 3-2 PER FACILITY PERMIT MODIFICATION COSTS	
Activity	**Costs**
On-site sampling[4]	$7,680
Laboratory testing[5]	$10,800 to $16,800
Administrative costs[6]	$9,600 to $15,360
On-going monitoring[7]	$3,180
ANNUALIZED TOTAL[8]	
Indirect dischargers	$4,920 to $5,490
Direct dischargers	$5,830 to $6,940

For indirect dischargers, an average annualized permit modification cost of $5,210 is used in the analysis. For the direct dischargers, the average annualized costs are $6,390.

It is worth noting that a number of facilities will renew their permits in conjunction with the normal five year permit cycle. According to EPA's Office of Water, approximately 20 percent of NPDES permits are renewed each year. Given that the Phase III rule will grant a two-year capacity variance, we would expect up to 40 percent of facilities to incorporate CWA BAT levels for UTS constituents into their permits as part of their permit renewal process. These facilities will likely incur some additional costs associated with testing their effluent for UTS constituents, although these costs will not be as high as those incurred by facilities modifying their permits. Because we are not certain as to the number of facilities that will be able to modify their permit within the

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[4] Assumes two two-person teams conducting 24 hour testing once each week over at four week period, at $40/hr. Total labor cost equals $7,680 (4 people x 12 hours = 48 hours of labor x $40 = $1,920 x 4 sampling efforts). Sampling would be conducted by manual grab, using flow proportioned automatic samplers.

[5] Range of sample costs ($2,500 to $4,000) based on quotes from one generator (Dow Chemical) and Huntingdon and ADL laboratories. We assume four samples would be tested, and include $200 for shipping for each sample. [4($2,500) + 4($200)] = $10,800; [4($4,000) + 4($200)] = $16,800.

[6] Personnel resources required for permit modification and negotiations with a state control authority estimated at 25 to 40 percent of a staff engineer's time over a six month period (240 to 384 hours). Personnel costs estimated at $40/hour. Based on engineering judgment, Mark Klingenstein and information provided by Helen Johnson of Dow Chemical, September 28, 1994.

[7] A detailed description of the methodology and data used to calculate on-going monitoring costs is included in Appendix Q.

[8] Annualization of costs associated with one-time on-site sampling, laboratory testing, and administrative costs is based on a 20 year period and an interest rate of 7 percent. On-going monitoring costs are already stated in terms of annual costs. We assume that indirect dischargers will only incur costs related to sampling, testing, and on-going monitoring. Direct dischargers will incur these costs, plus administrative costs.

renewal process, we do not adjust cost figures to reflect this option. However, we would expect to see somewhat lower incremental costs resulting from the rule for these facilities.

Treatment to UTS

In addition to the permit modification option, we also evaluated the per facility costs of treating to UTS levels in the organic chemical and petroleum industries. For this compliance option, we determined the treatment technologies that would be necessary to achieve UTS levels at facilities with exceedences. The appropriate technology for various facilities is largely a function of their total wastewater flow rates, the constituents requiring treatment, and whether the facility is a direct or indirect discharger. We selected technologies based on a review of industry effluent guideline development documents and EPA technology assessment information. All proposed treatment technologies would work within existing systems or be installed at end-of-pipe. Due to the limited time period for completion of this RIA, we were not able to evaluate upstream modifications to wastewater management, such as segregation and separate treatment of ICRT wastes, or the cost of transferring treatment to tanks, both of which might reduce the costs of the rule. Appendix Q provides additional information on the methodology used in estimating treatment costs.

For the organic chemical facilities, we calculated the costs associated with the following treatment scenarios:

- **Indirect dischargers** -- The estimates of UTS concentrations that we developed for the organic chemical industry using TRI data show relatively high levels of organics among indirect dischargers. We expect that extended aeration activated sludge is needed for these facilities to reduce overall organic loadings, followed by granular activated carbon to "polish" the remaining organics.[9] Some facilities showed exceedences for barium as well as organics. For these indirect dischargers, we also propose introduction of ferric sulfide in the secondary clarifiers to precipitate the barium. We assume non-hazardous waste incineration as the sludge management option, and an average facility wastewater flow of 280,000 gallons per day.[10]

- **Direct Dischargers** -- The estimates of UTS concentration levels that we developed for the organic chemical industry using TRI data show much lower organics levels among direct dischargers. The addition of a granulated carbon system is expected to be sufficient to control for organics at these facilities.[11] In only a few instances is barium likely to exceed UTS among

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[9] Sources for technologies: (1) *Innovative and Alterative Technology Assessment Manual*, U.S. EPA, 1980; and (2) *Development Document for Effluent Limitations Guidelines and Standards for the Organic Chemical, Plastics and Synthetic Fiber Industry*, U.S. EPA Office of Water, 1987.

[10] All flow rate assumptions based on organic chemical industry flow rate data reported in the ISDB and *Draft OCPSF Industrial User Compliance Evaluation Report*.

[11] Based on engineering judgment, Mark Klingenstein, SAIC.

direct dischargers -- at low flow rates we estimate only two facilities will have such exceedences. At the barium concentrations we estimated for these facilities, we would expect the proposed granulated carbon system to remove this constituent in addition to organics.[12] We assume an average flow for direct dischargers of 1.37 million gallons per day.

In Exhibit 3-3, we present the per facility cost for these scenarios. Capital costs are highest among direct dischargers, primarily due to the large wastewater flows at these facilities. However, operation and maintenance (O&M) costs are greater for the systems installed at indirect dischargers.

Exhibit 3-3

PER FACILITY TREATMENT COSTS: ORGANIC CHEMICAL INDUSTRY

Technology	Capital Cost	Annual O&M Costs	Total Annualized Costs[1]
Indirect Dischargers			
Extended aeration activated sludge (including belt press)	$1,327,000	$61,000	
Granulated carbon system	$1,131,000	$255,000	
Ferric sulfate addition[2]	$9,000	$61,000	
Sludge incineration (fluidized bed)	$1,060,000	$240,000	
Sampling and testing[3]		$21,480	
On-going monitoring		$1,120	
Total: Indirect dischargers with barium exceedences	$3,527,000	$639,600	$972,524
Total: Indirect dischargers without barium exceedences	$3,518,000	$578,600	$910,674
Direct Dischargers			
Granulated carbon system	$5,089,000	$198,000	
Sampling and testing		$21,480	
On-going monitoring		$1,120	
Total		$220,600	$700,965

1 Based on a 20 year operating life for capital equipment and an interest rate of 7.0 percent.
2 This treatment is only for those facilities that have exceedences of barium.
3 Based on an average of the range of testing costs provided by Dow and two laboratories.

[12] *Ibid.*

For the petroleum refining industry, we calculated the costs associated with the following treatment scenarios:

- **Indirect dischargers** -- As in the organic chemical industry, UTS concentrations that we developed for petroleum refiners using TRI data show higher levels of organics among indirect dischargers as compared to direct dischargers. We estimated that a granulated carbon system would be necessary to reduce organics, and assumed an average daily wastewater flow rate of 720,000 gallons per day.[13]

- **Direct Dischargers** -- Concentrations of organics among direct dischargers appear to be lower than those for indirect dischargers. Powdered activated carbon adsorption (PACT) would likely be sufficient to control for organics at these facilities.[14] For direct dischargers we assume an average flow of 3.2 million gallons per day.

In Exhibit 3-4, we present the per facility cost for these scenarios.

Results

For this analysis of the nationwide costs of the rule, we estimated the costs assuming all facilities comply with this rule by obtaining permit modifications. In addition, we conducted a sensitivity analysis to estimate the potential costs if some facilities are required to treat their wastes in order to comply with the rule. The sensitivity analysis evaluated the costs of the rule under two scenarios: (1) assuming that 80 percent of the affected facilities comply by obtaining permit modifications and 20 percent comply by treating their wastes, and (2) assuming that 60 percent comply by obtaining permit modifications and 40 percent comply by treating their wastes. The results of these analyses are summarized below.

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[13] In addition, one indirect discharger potentially has exceedences of barium. We did not cost out additional treatment for this facility, under the assumption that the granulated carbon system proposed would effectively reduce this constituent.

[14] Based on engineering judgment, Mark Klingenstein, SAIC. In addition, there were four direct dischargers with exceedences for barium. We did not cost out additional treatment for these facilities. Two of these facilities are unlikely to require additional treatment, assuming that the carbon adsorption treatment proposed would effectively reduce this constituent (since the concentration level in the wastestream was very close to the UTS level). The other two facilities may require additional treatment, with costs of a similar order of magnitude as for the treatment of barium for organic chemical facilities (i.e., $9,000 capital costs and $61,000 annual O&M costs).

Exhibit 3-4

PER FACILITY TREATMENT COSTS: PETROLEUM REFINING INDUSTRY

Technology	Capital Cost	Annual O&M Cost	Annualized Costs[1]
Indirect Dischargers			
Granulated carbon system	$4,119,000	$527,000	
Sampling and testing		$21,480	
On-going monitoring		$1,000	
Total		$549,480	$938,284
Direct Dischargers			
Powdered activated carbon adsorption	$265,000	$992,000	
Sampling and testing[2]		$21,480	
On-going monitoring		$1,000	
Total		$1,014,480	$1,059,494

1 Based on a 20-year operating life for capital equipment and a discount rate of 7.0 percent.

2 Based on an average of the range of testing costs provided by Dow and two laboratories.

Organic Chemicals

We estimated that the annualized national costs of obtaining CWA permit modifications for affected facilities in the organic chemical industry could range from approximately $154,000 to $425,000 at the 28 to 73 facilities potentially affected by the Phase III rule. If facilities cannot obtain a permit modification, however, the costs would be substantially higher. Annualized costs of treating to UTS for an individual facility could be as high as $1 million per year. The national costs under this scenario depend on the actual number of facilities that would need to install UTS treatment capacity. We conducted a sensitivity analysis to evaluate the costs under two alternative scenarios: (1) assuming 20 percent of the affected facilities must treat their wastes and (2) assuming 40 percent of the affected facilities must treat their wastes. EPA believes that these scenarios provide a reasonable estimate of the potential high-end costs of the rule for these affected facilities.

NPDES Permit Modification

Our aggregate national estimate of Phase III compliance costs is based on the estimated number of direct dischargers that would seek to modify their NPDES permit, and the number of indirect dischargers that could demonstrate compliance at POTWs. As described in the methodology section of this chapter, we estimated the per facility cost associated with this option, and multiplied it by the number of facilities affected under lower and upper bound assumptions about constituent concentrations. In Exhibit 3-5, we present the results of these calculations.

Under the lower bound estimates of affected facilities, a total of 28 organic chemical facilities are projected to have UTS exceedences. Annualized permit modification costs under this scenario are approximately $154,000. At the upper bound, we estimated UTS exceedences at 73 facilities. Annualized costs associated with this scenario are approximately $425,000.[15]

Exhibit 3-5

COSTS FOR PERMIT MODIFICATION FOR THE ORGANIC CHEMICALS INDUSTRY

Facility Type	Number of facilities	Annualized Cost per facility	Total Annualized Cost
Facilities with Exceedences at High Flow Rates			
Direct	7	$6,390	$44,730
Indirect (deferral to POTW)	21	$5,210	$109,410
Total	28		$154,140
Facilities with Exceedences at Low Flow Rate			
Direct[16]	38	$6,390	$242,820
Indirect (deferral to POTW)	35	$5,210	$182,350
Total	73		$425,170

Sensitivity Analysis

We believe that as many facilities as possible will take advantage of this compliance option, rather than treat to UTS. However, for some facilities with exceedences of constituents that are not amenable to biological treatment, permit modifications may be more difficult to obtain. Exhibit 3-6 presents cost estimates for the two scenarios considered in the sensitivity analysis.

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[15] As noted earlier, these estimates may lead to some overstatement of the cost impacts because some facilities will incur some of the permit modification costs as part of their normal permit renewal cycle.

[16] Includes two dischargers that potentially have exceedences of barium. We did not cost out additional treatment for these facilities, under the assumption that the granulated carbon system proposed would effectively reduce this constituent.

Exhibit 3-6

SENSITIVITY ANALYSIS OF THE COSTS FOR THE ORGANIC CHEMICALS INDUSTRY

Scenario 1: Assuming 80 Percent of the Affected Facilities Obtain Permit Modifications and 20 Percent Treat Their Wastes

Facility Type	Number of Facilities[1]		Annualized Costs per Facility		Total Annualized Costs[4]
	Permit Modifications	Treatment to UTS	Permit Modification[2]	Treatment to UTS[3]	
Facilities with Exceedences - Lower Bound					
Direct	5.6	1.4	$6,390	$700,965	$1,017,135
Indirect with Barium	1.6	0.4	$5,210	$972,524	$397,346
Indirect without Barium	15.2	3.8	$5,210	$910,674	$3,539,753
TOTAL					$4,954,234
Facilities with Exceedences - Upper Bound					
Direct	30.4	7.6[5]	$6,390	$700,965	$5,521,590
Indirect with Barium	2.4	0.6	$5,210	$972,524	$596,018
Indirect without Barium	25.6	6.4	$5,210	$910,674	$5,961,690
TOTAL					$12,079,298

Scenario 2: Assuming 60 Percent of the Affected Facilities Obtain Permit Modifications and 40 Percent Treat Their Wastes

Facilities with Exceedences - Lower Bound					
Direct	4.2	2.8	$6,390	$700,965	$1,989,540
Indirect with Barium	1.2	0.8	$5,210	$972,524	$784,271
Indirect without Barium	11.4	7.6	$5,210	$910,674	$6,980,516
TOTAL					$9,754,327
Facilities with Exceedences - Upper Bound					
Direct	22.8	15.2[5]	$6,390	$700,965	$10,800,360
Indirect with Barium	1.8	1.2	$5,210	$972,524	$1,176,407
Indirect without Barium	19.2	12.8	$5,210	$910,674	$11,756,659
TOTAL					$23,733,426

1. The number of affected facilities is calculated based on the total number of affected facilities multiplied by the percentage of facilities assumed to obtain permit modifications (80 percent or 60 percent) and to treat wastes to UTS (20 percent or 40 percent). For the purposes of this sensitivity analysis, we did not round these values.
2. These annualized costs include the costs incurred by facilities to obtain permit modifications and perform on-going monitoring.
3. These annualized costs equal the annualized capital and O&M costs incurred by facilities treating their wastes.
4. These values reflect annualized costs incurred by both those facilities that obtain permit modifications and those facilities that treat to UTS.
5. Under this scenario, for this industry there were two direct dischargers that potentially have exceedences of barium. We did not cost out additional treatment for these facilities, under the assumption that the proposed granulated carbon system would effectively reduce this constituent.

For the affected organic chemical facilities, Exhibit 3-6 shows the per facility and nationwide annualized costs for the facilities assumed to obtain permit modifications. In addition, it shows the annualized capital and operating costs per facility and the nationwide costs of the rule for the facilities assumed to treat their wastes. We evaluated separately those facilities with exceedences of barium (the only non-priority metal that exceeded UTS standards), as these waste streams will require specific treatment for this constituent. Under the first scenario, the annualized costs are estimated to be between $5.0 million and $12.1 million. Under the second scenario the total costs are higher; the estimated annualized costs are expected to range from $9.8 million to $23.7 million. This analysis indicates that if a substantial number of facilities must rely on treatment to comply with the rule, the national costs of the rule rise significantly. At this time, however, EPA believes that most facilities will be able to take advantage of the CWA permit modification option. Therefore, the cost estimates presented in Exhibit 3-5 should reflect the best estimate of the costs of the rule for organic chemicals facilities.

Petroleum Refining

We estimate that costs to petroleum refiners for compliance with the Phase III LDR rule are between approximately $43,000 and $173,000 per year, assuming compliance through permit modification. As in the case of organic chemicals, however, the costs could rise significantly if many of the facilities are unable to obtain permit modifications. Below we review these costs estimates and the results of the sensitivity analysis.

NPDES Permit Modification

As with the organic chemical manufacturing industry, our estimate of national costs is based on the number of indirect and direct dischargers expected to exceed UTS levels in their discharges. Exhibit 3-7 presents the costs associated with this option.

Exhibit 3-7

COSTS FOR PERMIT MODIFICATION FOR THE PETROLEUM REFINING INDUSTRY

Facility Type	Number of Facilities	Annualized Cost per Facility	Total Annualized Cost
Facilities with Exceedences at High Flow Rates			
Direct	1	$6,390	$6,390
Indirect (deferral to POTW)	7	$5,210	$36,470
Total	8		$42,860
Facilities with Exceedences at Low Flow Rates			
Direct	14	$6,390	$89,460
Indirect (deferral to POTW)	16	$5,210	$83,360
Total	30		$172,820

In the lower bound scenario, one direct discharger and seven indirect dischargers are estimated to have UTS exceedences. The cost of this compliance option for these facilities would be approximately $43,000 per year. In the upper bound scenario, we estimated that a total of 30 facilities could be affected. The annualized costs of compliance for this group would equal approximately $173,000. As with the organic chemical facilities, we believe that as many generators as possible will opt for this compliance approach.

Sensitivity Analysis

Exhibit 3-8 presents the per facility and nationwide cost estimates of the rule for the two scenarios considered in the sensitivity analysis: (1) assuming that 80 percent of the affected petroleum refiners comply by obtaining permit modifications and the remaining 20 percent comply by treating their wastes, and (2) assuming that 40 percent of the affected facilities would comply by treating their wastes, while the remaining 60 percent would obtain permit modifications. Under the first scenario, the estimated annualized costs range from $1.6 million to $6.1 million. Under the second scenario, the estimated annualized costs are expected to be between $3.1 million and $12.0 million. As can be seen from these results, nationwide compliance costs increase significantly if facilities cannot comply by obtaining a permit modification since the cost of treatment per facility is approximately $1 million. Again, however, EPA currently believes that most facilities will qualify for permit modifications.

Exhibit 3-8

SENSITIVITY ANALYSIS OF THE COSTS FOR THE PETROLEUM REFINING INDUSTRY

Scenario 1: Assuming 80 Percent of the Affected Facilities Obtain Permit Modifications and 20 Percent Treat Their Wastes

Facility Type	Number of Facilities[1]		Annualized Costs per Facility		Total Annualized Costs[4]
	Permit Modifications	Treatment to UTS	Permit Modification[2]	Treatment to UTS[3]	
Facilities with Exceedences - Lower Bound					
Direct	0.8	0.2	$6,390	$1,059,494	$217,011
Indirect	5.6	1.4	$5,210	$938,284	$1,342,774
TOTAL					$1,559,785
Facilities with Exceedences - Upper Bound					
Direct	11.2	2.8	$6,390	$1,059,494	$3,038,151
Indirect	12.8	3.2	$5,210	$938,284	$3,069,197
TOTAL					$6,107,348

Scenario 2: Assuming 60 Percent of the Affected Facilities Obtain Permit Modifications and 40 Percent Treat Their Wastes

Facilities with Exceedences - Lower Bound					
Direct	0.6	0.4	$6,390	$1,059,494	$427,632
Indirect	4.2	2.8	$5,210	$938,284	$2,649,077
TOTAL					$3,076,709
Facilities with Exceedences - Upper Bound					
Direct	8.4	5.6	$6,390	$1,059,494	$5,986,842
Indirect	9.6	6.4	$5,210	$938,284	$6,055,034
TOTAL					$12,041,876

1. The number of affected facilities is calculated based on the total number of affected facilities multiplied by the percentage of facilities assumed to obtain permit modifications (80 percent or 60 percent) and to treat wastes to UTS (20 percent or 40 percent). For the purposes of this sensitivity analysis, we did not round these values.
2. These annualized costs include the costs incurred by facilities to obtain permit modifications and perform on-going monitoring.
3. These annualized costs equal the annualized capital and O&M costs incurred by facilities treating their wastes.
4. These values reflect annualized costs incurred by both those facilities that obtain permit modifications and those facilities that treat to UTS.

NEWLY-LISTED WASTES

Methodology

Two newly-listed wastes are included in the Phase III LDR rule: carbamates and spent aluminum potliners. To estimate the costs of the rule for these wastes, we evaluate the incremental costs associated with requiring treatment. We estimate the incremental costs based on the costs of treatment plus disposal under the rule less the baseline costs of disposing of the wastes in a Subtitle C landfill without treatment. We base treatment costs for affected carbamate wastes on thermal destruction at a Subtitle C incinerator, followed by ash disposal at a Subtitle C landfill. Because the generators lack the technology to incinerate this waste on-site, it will likely be sent to commercial thermal treatment units. We estimate the cost of this treatment at $1,484 per ton, which includes:

- Commercial thermal treatment costs of $1,382 per ton;[17]
- Transportation costs of $50 per ton;[18] and
- Subtitle C disposal costs for the ash of $207 per ton.[19] This translates to a cost of $52 per ton of waste prior to incineration, assuming that the quantity of ash residuals that will require disposal after incineration equals 25 percent of the quantity of waste incinerated.[20]

The baseline costs are estimated at $257 per ton, based on the same estimates of transport and Subtitle C landfill disposal costs.

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[17] Incineration cost obtained from survey of facilities conducted from 1989 to 1993 by *EI Digest*, see "Hazardous Waste Incineration 1994," Jon Hanke, *EI Digest*, June 1994. Costs in 1993 inflated to 1994 using the GDP deflator for services from 1993 to 1994: $1,335 x (1+.035) = $1,382 per ton.

[18] Source: *Estimating Costs for the Economic Benefits of RCRA Noncompliance*, prepared by DPRA Incorporated for EPA's Office of Regulatory Enforcement, September 1994. Cost based on the commercial transportation price per ton-mile for bulk solid hazardous waste shipped 200 miles (we estimate that most carbamate generators are within this distance of a commercial incinerator). Costs in 1992 were inflated to 1994 using the average GDP deflator for services from 1992 to 1994: $45.85 x $(1+.0405)^2$ = $49.64 per ton.

[19] Landfill costs obtained from *Draft Economic Impact Analysis of the Identification and Listing of Carbamate Production Waste (Non-CBI Version)*, U.S. EPA Office of Solid Waste, October 1993. Costs in 1993 inflated to 1994 using the average GDP deflator from 1993 to 1994: $200 x (1+.035) = $207 per ton.

[20] Source: *Baseline and Alternative Waste Management Cost Estimates for Third Third Land Disposal Restrictions*, prepared by DPRA Incorporated for EPA's Office of Solid Waste, May 1990.

For spent aluminum potliners, we assume that under the rule all waste will be treated and disposed at the Reynolds Metals facility in Gum Springs, Arkansas. According to Reynolds management, treatment costs to generators will vary based on the quantity of waste delivered and other factors. We estimate the cost of this treatment at $310 to $610 per ton, which includes:

- Treatment at Reynolds Metals at a cost of $200 to $500 per ton, which includes ash disposal.[21] Ash generated from combustion of this waste has been delisted for the Reynolds facility only, and will be landfilled at this site or another Reynolds site in Arkansas.

- Transportation costs of $110 dollars per ton.[22]

For the baseline, we assume that these wastes would be disposed at a Subtitle C landfill, at the cost of $257 per ton, which includes transportation costs of $50 per ton and landfill costs of $207 per ton.

Several technologies have been or are being developed to recover materials from spent potliners, including cryolite recovery, carbon recovery and aluminum fluoride recovery. An analysis completed in 1990 compared the costs of these recovery processes to that of disposal in a Subtitle C landfill.[23] This study found that capital costs for implementing these technologies are significant, and, in most instances, were not off-set by the value of recovered materials to the point where recycling was more economical then Subtitle C landfilling.

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[21] Based on conversation with Jack Gates, Vice President, Reynolds Metals Company, September 28, 1994.

[22] Source: *Estimating Costs for the Economic Benefits of RCRA Noncompliance*, Cost based on the commercial transportation price for bulk solid hazardous waste at a distance of 500 miles or more (at least 19 of the 23 affected aluminum reduction facilities are located further than 500 miles from Reynolds). Costs in 1992 were inflated to 1994 using the average GDP deflator from 1992 to 1994: $\$105.80 \times (1+.0405)^2 = \$114.54$ per ton.

[23] *Analysis of the Recycling Incentives Created by Proposed Statutory Changes to RCRA: K061 and K088 Case Studies*, prepared by DPRA Incorporated for the U.S. EPA Office of Solid Waste, July 1990.

Recycling technologies, however, may be less expensive than use of the Reynolds thermal treatment process. Several recycling processes are currently being evaluated for their ability to comply with LDR standards and their cost-effectiveness.[24] Representatives at several companies developing alternative recycling or treatment technologies suggest that their technologies offer a method of waste management that is less expensive than the Reynolds process.[25] Precise cost estimates of using alternative recycling technologies are difficult to obtain because these technologies have not yet been implemented on a full-scale commercial basis. However, these representatives believe that their recycling processes would be less expensive when compared to the cost of using the Reynolds thermal treatment. A large portion of the potential cost savings could come from reduced transportation costs because at least some of these alternative technologies could be located near aluminum production facilities, particularly in the Pacific Northwest. In addition, sale of the recycled product could reduce costs further. In some cases, sale of the recycled product could offset all operation and maintenance costs of using the technology (capital costs may not be recouped, however).

We were unable to determine when alternative technologies would be implemented on a commercial basis and the extent to which they would be used by aluminum producers. Nevertheless, representatives of the companies we contacted suggest that the cost of compliance could be reduced substantially if these alternative technologies are used.[26] Consequently, the cost estimates based on the assumption that all spent aluminum potliners would be treated at the Reynolds facility may represent an upper bound on the actual compliance costs that would be incurred in response to the rule.

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[24] Personal communications with Paul Woodin, Columbia Aluminum Corporation, October 5, 1994 and November 16, 1994, and Don Backfish, Noranda Aluminum, November 15, 1995. These companies also indicated that their decisions on recycling options will depend on whether EPA determines that potliners are inherently waste-like (such a determination may increase the cost of recycling).

[25] We contacted representatives from Ausmelt Technology Corporation; Barnard Environmental; Enviroscience, Incorporated; and Ormet Primary Aluminum Corporation. These companies are developing technologies that can recycle spent aluminum potliners into products such as mineral wool and vitrified material.

[26] The cost of compliance may depend on whether EPA grants a capacity variance. Conversations with representatives of companies that produce aluminum or are developing alternative technologies suggest that there is uncertainty about how a capacity variance would affect the cost and use of the technologies. For example, if a capacity variance *is not* granted and alternative technologies are not readily available, aluminum producers may enter into long-term contracts to use the Reynolds thermal treatment process and reduce the incentive to develop alternative technologies; in contrast, the lack of a variance could increase pressure to implement quickly alternative technologies. If, however, a variance *is* granted, there would be additional time to develop alternative technologies, but the incentive to implement them quickly may be reduced. Because of these uncertainties, we are unable to specify how a capacity variance would affect compliance costs.

Carbamates

As described in Chapter 2, approximately 4,450 tons of carbamate waste will require thermal treatment to meet standards under the Phase III LDR rule. To estimate the incremental cost of the rule, we multiplied the affected quantity of waste by the estimated cost per ton for treatment and the estimated cost per ton of disposal in a Subtitle C landfill and subtracted the baseline costs from the treatment costs. In Exhibit 3-9, we present treatment and baseline cost estimates for carbamate waste and an estimate of the incremental costs of the rule.

Exhibit 3-9

ESTIMATED INCREMENTAL COSTS OF THE CARBAMATE WASTES

	Tons	Total Costs		Total Incremental Costs
		LDR Treatment	Baseline	
Carbamate Wastes				
K158	10	$14,838	$2,570	$12,268
K160	740	$1,097,975	$190,180	$907,795
K161	3,700	$5,489,875	$950,900	$4,538,975
TOTAL	4,450	$6,602,688	$1,143,650	$5,459,038

The costs we present here represent those at the national average price for commercial incineration. However, it is important to note that these prices vary considerably by region and customer. Individual generators may therefore encounter different prices. In particular, generators already shipping large quantities of other wastes to a commercial facility may face lower prices.

Spent Aluminum Potliners

Based on information provided by generators and noted in the draft Phase III LDR rule, we have assumed that most spent aluminum potliner waste (K088) affected by the Phase III rule will be treated by thermal destruction at the Reynolds Metals facility. Based on a waste quantity estimate of 120,000, total incremental costs of the rule will range from $6.4 to $42.4 million each year.[27] According to the Capacity Analysis Branch, some of this waste may already be undergoing thermal treatment. Because we are uncertain as to the portion of waste that might currently be incinerated, we estimate the cost of treating the total quantity. EPA will continue to investigate current treatment for potliners, and for the present note that this cost estimate may be somewhat high.

[27] 120,000 tons x ($200 + $110 transportation cost) - 120,000 tons x ($207 + $50) = $6,360,000. 120,000 tons x ($500 + $110 transportation cost) - 120,000 tons x ($207 + $50) = $42,360,000.

ECONOMIC IMPACTS OF PHASE III LAND DISPOSAL RESTRICTIONS

We measure the economic impacts of the Phase III Rule by comparing the estimated costs of regulatory compliance with the historic costs in the industry activity. Based on the results of our cost analysis, we consider the potential economic impacts on:

- The aluminum industry's compliance with LDR standards for spent potliners.
- The organic chemical and petroleum refinery industry's compliance with LDR standards for characteristic waste; and

In the following sections we describe our methodology and results.

Methodology

Characteristic Wastes

As in our cost analysis, our assessment of economic impacts focuses on the two industries expected to incur significant costs -- the organic chemical and petroleum refining industries. We lacked the financial data that would be required to estimate economic impacts at the facility level. Therefore, we compared compliance costs to historic industry costs over a ten-year time period. To gather the historic data we referred to two measures:

- **Historic annual pollution control costs** -- We obtained data on pollution control capital expenditure and operating costs *Pollution Abatement Costs and Expenditures, 1982-1991*, and information on the number of establishments from *County Business Patterns: United States 1982-1991.*[28]
- **Historic annual cost of operations** -- Data on capital expenditure and operating costs are from the *Annual Survey of Manufactures: Statistics for Industry Groups and Industries, 1982-1991*, and information on the number of establishments from *County Business Patterns: United States 1982-1991.*[29]

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[28] *Pollution Abatement Costs and Expenditures, 1982-1991*, Bureau of the Census, U.S. Department of Commerce; *County Business Patterns: United States, 1982-1991*, Bureau of the Census, U.S. Department of Commerce.

[29] Historic cost of operation capital expenditure and operating cost data are from, *Annual Survey of Manufactures: Statistics for Industry Groups and Industries, 1982-1991*, Bureau of the Census, U.S. Department of Commerce; *County Business Patterns: United States, 1982-1991*, Bureau of the Census, U.S. Department of Commerce.

To arrive at the historic industry pollution control costs and cost of operations for average facilities, we first calculated average facility annual costs. This figure is based on total industry costs divided by the number of facilities in that industry. We then took the average of the per facility costs over a ten-year period to arrive at the historic average annual cost per facility. We use these costs as the baseline in our analysis.

As described earlier in this chapter, we developed compliance cost estimates representing the increase in annual capital expenditures and annual operating costs for average facilities in each industry sector. Our estimates assume that facilities are able to modify their permits to incorporate BAT levels for affected constituents. To determine the magnitude of economic impacts associated with compliance with the rule, we compare the cost of compliance to the historical data detailed above.

Newly-Listed Wastes

For newly-listed wastes, we focused on the incremental compliance costs for the spent aluminum potliner wastes. The estimated incremental compliance costs for these wastes represent the majority of the costs for treating all newly-listed wastes. To determine the economic impact of the rule on this industry, we compared the incremental cost of the rule to historic pollution control operating costs and historic operating costs.

Based on studies conducted by the EPA, we estimate that 23 facilities will be affected by the rule.[30] In this analysis, we assumed that facilities generate on average 5,000 tons of spent potliners each year, and face an average incremental cost of $203 per ton.[31]

Results

Characteristic Wastes

For characteristic wastes, our analysis shows that the impact on organic chemical producers and petroleum refiners will be quite minimal. Compliance costs represent less than one percent of historic pollution control and operating costs for both of these industries. However, for those facilities that must treat to UTS in order to comply, costs would be more significant. Here again we emphasize that few facilities are likely to comply by treating to UTS, and that as many facilities as possible will try to comply by modifying their permits. In Exhibit 3-10, we detail the costs and economic impacts of this compliance option.

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[30] *Summary of Generation, Disposal and Treatment Practices for Spent Aluminum Potliners from the Primary Reduction of Aluminum*, U.S. EPA Risk Reduction Engineering Laboratory, March 12, 1990.

[31] Average generation based on production of 120,000 tons of waste by 23 facilities. Average incremental cost based on treatment cost range of $200 to $500 per ton and transportation costs of $110 per ton: [($200 + $500)/2 + 110] - ($207 + $50) = $203.

Exhibit 3-10 ECONOMIC IMPACTS OF PHASE III RULE COMPLIANCE				
	Historic Pollution Control Costs (per facility)	Historic Operating Costs (per facility)	Compliance Costs (per facility)[32]	Economic Impact
Option 1: Modify Permit				
Organic Chemical	$3 million	$76 million	$5,800	≤ 1 percent
Petroleum Refining	$11 million	$471 million	$5,800	≤ 1 percent

Newly-Listed Wastes

The estimated incremental compliance costs for treating the newly-listed spent aluminum potliners represents the majority of the costs for treating all newly-listed wastes affected by the rule. As shown in Exhibit 3-11, the incremental costs of treating spent aluminum potliners represents an estimated 40 percent of historic pollution control operating costs for aluminum producers.[33] Treatment costs represent only one percent of total historic operating costs. The difference between the economic impact figures suggests that, while the compliance costs of the rule may pose significant additional pollution control costs, these costs are less significant when compared to the total operating costs, suggesting the rule has only small impacts on the price of aluminum.

[32] Per facility compliance costs were based on average costs to direct and indirect dischargers.

[33] We did not consider the impact on capital costs, as the assumed compliance option (off-site treatment) will not incur capital expenditures. It is worth noting that the majority of the 31 aluminum reduction facilities included in our historic cost estimates are large facilities (i.e., greater than 500 employees). Therefore, historic costs for aluminum producers are not skewed towards those of small facilities, as might be the case for organic chemical historic costs.

Exhibit 3-11 HISTORIC OPERATING COSTS FOR SPENT ALUMINUM POTLINERS			
Per Facility Costs	**Historic Cost (per facility)**	**Compliance Costs (per facility)**	**Economic Impact**
Pollution Control Operating Costs	$2.6 million	$1.0 million	40 percent
Total Operating and Management Costs	$135.6 million	$1.0 million	1 percent

EPA also assessed the effect of Phase III compliance costs on the competitiveness of domestic producers in the international market, in part because our data may not reflect recent fluctuations in the aluminum market. During the early 1990's international aluminum prices fell drastically as cheap aluminum from the Commonwealth of Independent States (CIS) flooded an international market already above capacity. In 1991 international prices averaged approximately $0.68 per pound, while U.S. production costs were between $0.67 and $0.68.[34] During the next two years, however, CIS production increased 17-fold, as producers were able to compete due to artificially low costs caused by large government energy subsidies.[35] During the next three years only those countries with cheap power sources, such as hydroelectricity, and inexpensive labor pools, were able to compete with Russian producers, while smelters in Central Europe, who maintained the highest production costs, began to close.[36]

Since 1994, however, international aluminum prices have risen as global supplies have decreased and demands have continued to grow. CIS exports have decreased during this period because of a 1994 agreement between international producers in which CIS producers agreed to reduce production rates in return for western technical and financial assistance to update their facilities. Russian production rates also decreased because of increased alumina prices and energy costs, due in part to pressure from the International Monetary Fund on the Russian government to raise energy prices to international levels.[37] During this same period international aluminum demands have continued to grow, driven by the automotive, beverage container, and construction

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[34] *Aluminum Manufacturers - Industry Report*, prepared by Kember Securities Group, Inc., April 26, 1991.

[35] "Optimism Despite Cutbacks: Aluminum Industry is Concerned About Continuing Outflow of Cheap Produce from USSR," *Aluminum Today*, September 1994.

[36] "Survey of Aluminium: Russia is in the Market - Amid Continuing Recession, the Industry is Trying to Adjust to the Deluge of Metal Exported by Former Soviet World," *Financial Times (London)*, October 19, 1993.

[37] "Optimism Despite Cutbacks," *Aluminium Today*, 1995.

industries.[38] During the last two decades primary aluminum consumption has grown 3.7 percent per year, out-pacing copper, zinc, and lead.[39] Between 1993 and 1994, however, western world consumption rates grew by 8.7 percent, and have not subsided in 1995.[40]

This shift in international supply and demand has been reflected by increasing prices: the average international price per pound jumped from 72 cents in the fourth quarter of 1994, to 97 cents in the first quarter of 1995.[41] Though initial 1995 prices were higher than the annual average to date, mid-year predictions estimated prices of approximately 85 cents per pound,[42] and analysts expect prices to continue increasing as producers are slow to increase capacity and as demands continue to grow. In response to these market factors, industry analysts at Merrill Lynch and Lehman Brothers have estimated 1996 primary aluminum prices of $1.00 to $1.10 per pound, respectively, while Merrill Lynch has estimated an even further increase in 1997, to an estimated price of $1.15 per pound.[43] During the last several years primary aluminum costs have also grown, but not at the pace seen for aluminum prices.

To analyze the effect of the Phase III rule on the domestic aluminum industry, we compared the estimated compliance costs with average aluminum costs and prices. Based on estimated compliance costs of $6.4 to $42.4 million, and historic annual production rates of approximately 8.1 million pounds per year, the Phase III compliance costs correspond to an incremental cost of $0.001 to $0.005 per pound.[44] In relation to present average western production costs ($0.564 per pound[45]), this would account for an additional 0.2 to 0.8 percent of costs. Industry analysts also estimate that prices will increase by 35 percent during the next two years. These price increases are driven by an international market where supplies are struggling to meet demands. This rising market suggests that the relatively small incremental costs of the Phase III LDR rule will not have a significant impact on the competitiveness of domestic primary aluminum producers.

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[38] "Survey of Aluminum," 1993.

[39] *Aluminum Outlook Update - Industry Report*, prepared by Lehman Brothers, Inc., August 10, 1995.

[40] *Aluminum Fundamentals, Pricing Outlook to 1997 - Industry Report*, Salomon Brothers Inc., August 14, 1995.

[41] *Nonferrous Metals & Mining Monthly: Global Industry Report*, prepared by Merrill Lynch Capital Markets, August 4, 1995.

[42] *Global Industry Report*, Merrill Lynch, 1995.

[43] *Global Industry Report*, Merrill Lynch, 1995, and *Aluminum Price Outlook*, Lehman Brothers, 1995.

[44] Estimated annual production rates are based on the average of 1982 to 1991 annual production rates, as reported in *Annual Survey of Manufactures: Statistics for Industry Groups and Industries*.

[45] "Aluminum Market Facing 'Hangover'," **American Metal Market**, February 1, 199, p. 4.

INTRODUCTION

This chapter presents an assessment of the benefits of the Phase III LDR rule for both ICRT wastes and newly listed wastes. For ICRT wastes, the magnitude of benefits depends on the compliance option implemented by the affected facilities. As discussed earlier, generators of affected wastewaters will have a number of compliance options under the rule. For direct dischargers, facilities may: (1) treat their waste to meet UTS standards; (2) seek modifications to their CWA permits to include BAT standards for UTS constituents; or (3) seek a treatability variance under RCRA for UTS constituents. For indirect dischargers, a fourth option includes demonstrating that the POTW treating their wastewater provides adequate treatment of affected pollutants.

In this benefits assessment, we estimate the loadings and risk reductions likely to occur if facilities comply with the rule under the first option (i.e., that treatment occurs). If facilities can comply under the second, third or fourth options, loadings reductions and risk reductions may be lower or zero, depending on whether any facilities must treat their wastes.[1]

As a starting point for the benefits assessment, we used the results of the affected quantities analysis described in Chapter 2. We evaluated the pollutant loadings reductions and risk reductions for those industries estimated to have major impacts, including organic chemicals and petroleum refining. In addition, this benefits assessment only considered those wastestreams expected to require treatment under the rule (i.e., those with contaminant concentrations that exceed UTS levels). In the assessment, we used the wastestream quantity and loadings data developed for the Chapter 2 analysis.

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[1] EPA believes that most facilities will be able to comply by obtaining permit modifications. The cost analysis in Chapter 3 assumed that this was the case. If it is the case, loadings and risk reductions would be very small or zero. This assessment also did not include an adjustment to reflect the fact that some of the wastestreams identified as affected by the TRI analysis may not be managed in land-based units and thus would not be affected by the rule. The assessment may understate benefits to the extent that we omitted benefit categories and did not consider the effects of 53 non-priority pollutants not addressed in TRI, as discussed below.

Based on the results of this analysis, 20 of the 48 constituents considered were identified as pollutants of concern (i.e., a wastestream contained this constituent at a concentration level exceeding UTS), and thus warranted consideration in our benefits assessment.[2] In our risk assessment, we were able to evaluate the risks associated with 15 of these 20 constituents; health based criteria were not available for the other five constituents. The loadings reductions evaluation considered all 20 constituents.

For newly listed wastes, we assessed the potential benefits of the rule by estimating the incremental reduction in human health risks resulting from implementation of the rule. First, we quantified the baseline risks associated with current waste management practices, which typically consist of disposal in Subtitle C landfills. We used data on the concentration of regulated constituents, fate and transport processes, and various exposure scenarios to calculate cancer and noncancer risks to human health. We then compared these baseline risks to the post-regulatory risks assuming treatment to UTS levels before disposal of spent aluminum potliners. The incremental risk reduction is used as in indicator of the rule's benefits.

Scope of the Assessment

There are a broad range of benefits that may result from environmental regulations that improve and maintain water quality, including human health, ecological, and economic welfare benefits. To evaluate these benefits, it is necessary to evaluate the physical effects of the regulations, identify the categories of benefits likely to result from these physical changes, and evaluate the scope and magnitude of these benefits. This requires linking the expected physical effects to goods and services valued by society.

ICRT Wastes

In this assessment, we considered human health benefits related to avoiding cancer and noncancer risks. We evaluated these effects in terms of the estimated reductions in risks likely to result from the rule. In addition, we estimated the loadings reductions potentially resulting from the rule. While loadings reductions are an imperfect measure of benefits because they do not indicate how these reductions affect human health or the environment, they do provide a baseline indicator of the physical effects of the rule.

We were unable to evaluate the potential ecological benefits from the rule. EPA Ambient Water Quality Criteria were not available for any of the 20 constituents of concern, and thus we were unable to compare estimated baseline constituent concentrations with ecological standards to evaluate ecological risk. We also were unable to evaluate the potential recreational benefits under

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[2] Recall that in the impact analysis, we focused on those UTS constituents that are non-priority pollutants, based on the fact that priority pollutants are expected to be adequately controlled under the CWA. In addition, we limited our analysis to those constituents that had data available through TRI. Of the 216 UTS constituents, 101 are non-priority pollutants. TRI data were available for 48 of these 101 constituents.

the rule. Recreational benefits could arise if constituent concentration levels affect fish populations, which potentially may reduce catch rates and consumer welfare. Our assessment did not consider this category of benefits because we did not have data on the ecological effects of the rule.

Finally, we did not consider passive use benefits in our analysis. People may hold passive use values for water resources; passive use value reflects the value placed on a resource for reasons other than use, such as the value of knowing that the resource exists and will be available to future generations. The information required to value the passive use benefits associated with this rule is not available.

Newly Listed Wastes

As discussed earlier, the rule establishes standards for two categories of newly listed wastes: carbamate wastes and spent aluminum potliners. The benefits of the rule depend on the incremental risk reductions that may result from treatment of the wastes. We expect that the benefits of regulating carbamate wastes will be minimal because the quantity of waste affected is very small. As discussed in Chapter 2, an annual total of 4,500 tons of carbamate wastes are expected to be affected by the rule.

In contrast, EPA data show that each year 120,000 tons of spent aluminum potliners will require treatment to achieve UTS levels. Because of the relatively large quantity of spent aluminum potliners that will be treated, we believe that the largest incremental risk reduction for newly listed wastes is likely to result from regulation of spent aluminum potliners. Consequently, we performed a benefits assessment only for the regulation of spent aluminum potliners.

For this benefits assessment, we examined benefits related to the potential reductions in human health risks. First, we estimated the cancer and noncancer risks posed by the baseline management practice of disposing of untreated spent aluminum potliners in Subtitle C landfills. Next, we assessed the post-regulatory risks associated with the disposal of spent aluminum potliners after treatment to UTS levels. We limited the post-regulatory analysis by examining the risks related to what is expected to be the most prevalent compliance alternative, a thermal treatment process developed by Reynolds Metals Company. Finally, as a measure of the rule's benefits, we compared the baseline and post-regulatory risks to estimate incremental risk reductions. For both baseline and post-regulatory risks, we did not quantify benefits related to changes in property value or ecosystem function, although these might represent additional benefits of the rule.

Summary of Results

ICRT Wastes

The results of this assessment indicate that the benefits of the rule range between very small and zero, depending on whether facilities comply with the rule by treating their affected wastestreams (option one) or comply by either revising their CWA permit, obtaining a treatability variance under RCRA, or demonstrating that the POTW treating their wastestream provides adequate treatment of affected pollutants (options two, three, or four).

Even at the high-end (i.e., under option one), the estimated benefits are very small.

- High-end loadings reductions range between 36 and 269 tons per year for direct dischargers and 1,490 and 22,621 tons per year for indirect dischargers. For direct dischargers, these loadings reductions represent a very small percentage of total TRI chemical loadings to surface waters (0.03 to 0.20 percent). For indirect dischargers, these loadings reductions represent between 0.8 and 11.9 percent of all TRI loadings transferred to POTWs. The loadings reductions achieved under the rule are likely to be in the lower end of this range. This is the case because the lower end is based on the assumption that POTWs will not require treatment of wastestreams containing acetone, butanol, and methanol because POTWs effectively remove these constituents prior to discharge.

- Based on the results of the screening and more detailed risk assessments, the estimated baseline risks associated with only four wastestreams potentially exceed commonly assumed threshold cancer and noncancer risk levels. We estimated that three wastestreams containing aniline pose baseline cancer risks ranging from 1×10^{-5} to 2×10^{-3} which would be reduced to between 8×10^{-8} and 3×10^{-6} under the Phase III rule. A fourth wastestream containing acrylamide poses baseline cancer risk at a level of 2×10^{-3}. The rule is estimated to reduce this risk to between 2×10^{-4} and 4×10^{-3}. However, our analysis may overstate the baseline risk from these wastestreams. All four of these wastestreams are discharged to POTWs; if POTW treatment removes these constituents from the wastewater prior to discharge to surface water and/or if no drinking water intake is located downstream from the POTW's outfall, baseline risks will be lower. We currently do not have information related to these two factors for these wastestreams.

In reviewing the results of the benefits assessment for the Phase III rule, the reader should be aware that even the small estimates of benefits are based on two important assumptions that almost certainly lead to overstatement of the net improvements in environmental quality. First, the analysis assumed that all affected facilities comply with the rule by treating the affected wastestreams (rather than one of the other three options). Second, the analysis did not incorporate an adjustment to reflect the fact that some of the wastestreams identified as affected by the impacts analysis may not be managed in surface water impoundments and thus would not be affected by the rule. Such an adjustment is warranted because the TRI data used in the affected quantities analysis does not include data on waste management locations. The cost analysis (see Chapter 3) used the adjusted results of the affected facilities assessment (Chapter 2), based on the percentage of facilities in the industry managing wastewaters in surface water impoundments. For the risk assessment, such an adjustment would require specific information on management practices for each affected wastestream -- information we do not have.

At the same time, however, the reader should bear in mind that there are a number of potential benefits that we have been unable to consider. First, the data from TRI that we used in the benefits assessment did not provide complete coverage of all non-priority pollutants. TRI loadings data were available for only 48 of the 101 non-priority constituents, and releases of less than 10,000 pounds per year did not have to be reported. Second, certain categories of benefits

could not be analyzed with available data and methods. Ecological effects could not be considered due to the lack of water quality criteria, which in turn made it impossible to evaluate possible impacts on recreational fishing. Furthermore, no data are available on passive use values.

Based on available data, the benefits of the regulating ICRT wastes in the Phase III rule appear to be quite small. While inclusion of additional pollutants and benefit categories could certainly increase the net benefits of the rule, we have no evidence suggesting the increase is likely to be large, particularly given the relatively small number of affected facilities and the minimal reductions in total pollutant loadings for the 48 non-priority constituents that we were able to analyze.

Newly Listed Wastes

Our examination of the benefits of regulating newly listed wastes focused on the rule's effects on waste management practices for spent aluminum potliners. We calculated incremental benefits using different baseline risk scenarios. The analysis suggests that under central tendency assumptions, the incremental benefits for individual risks are negligible. Under high-end assumptions, however, there may be some reductions in individual risks. The analysis indicates that relatively high individual cancer risks on the order of 10^{-4}, as well as high noncancer risks, may be prevented by implementation of the rule.

The analysis of baseline individual risks indicates that there is less than a one in one million central tendency lifetime cancer risk resulting from ingestion of groundwater contaminated by a Subtitle C landfill. In addition, the analysis shows that the expected daily intake of contaminated drinking water will not result in an exceedance of the reference dose for any of the regulated constituents in spent aluminum potliners. Under more conservative high-end assumptions, however, human health risks are higher. Individual cancer risk is approximately 10^{-4} while the reference dose is exceeded for four regulated constituents, arsenic, lead, cyanide, and fluoride. These high-end estimates reflect approximately the 90th percentile scenario. That is, we believe that there is roughly a 90 percent probability that individual risk would be equal to or lower than the high-end risk levels.[3]

Examination of the post-regulatory risks indicate that there are no appreciable risks associated with treatment of spent aluminum potliners to UTS levels. We based our assessment on a study performed by the EPA as well as a study performed as part of a RCRA Part B permit application submitted by Reynolds Metals Company. These two studies quantify the health risks of wastes treated by the thermal treatment technology developed by Reynolds Metals Company. There are, however, a number of different technologies that may be used to treat the waste. We did not

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[3] As used here, the 90th percentile value for risk does not reflect the use of the 90th percentile values for each of the input parameters of the risk calculation. Although we did not perform Monte Carlo analysis for this risk assessment, the risk driving parameter--dilution/attenuation factors for fate and transport processes--was calculated by EPA using Monte Carlo analysis. The high-end risk values presented here reflect our use of the 90th percentile of EPA's distribution of dilution/attenuation factors in combination with average or central tendency assumptions for all other input parameters.

investigate the risks related to these other technologies. It should be noted that several companies have provided EPA evidence that technologies they are developing can effectively treat spent aluminum potliners.

METHODOLOGY

In this section we present the methodology used to evaluate the benefits of regulating ICRT and newly listed wastes and discuss the results in more detail.

ICRT Wastes

Loadings Reductions

We estimated the loadings reductions that result from the rule based on the difference between estimated loadings under baseline conditions and under the rule. We estimated loadings under baseline conditions using the following flow volumes and loadings data (these same data were used in the impacts analysis).

- For the organic chemicals industry, we estimated that wastestream flow rates range between 100,000 and 5.53 million gallons per day for direct dischargers and 100,000 and 2.0 million gallons per day for indirect dischargers. Constituent concentration levels were estimated based on loadings data from TRI.

- For the petroleum industry, we estimated that wastestream flow rates range between 250,000 and 10.0 million gallons per day for direct dischargers and 200,000 and 1.77 million gallons per day for indirect dischargers. Constituent concentration levels were estimated based on loadings data from TRI.

We estimated loadings under the rule using the same flow data described above and assuming concentration levels are equal to UTS.

Risk Assessment

For the risk assessment, we first conducted a screening analysis to identify the constituent/wastestream combinations that may pose risk to human health. The screening analysis used very conservative (i.e., high risk) assumptions to compare estimated concentration levels for the affected wastestreams with human health-based reference levels. For those wastestreams estimated to exceed the reference concentrations, we conducted a more detailed risk assessment based on site-specific data.

Screening Analysis

As a first step in the evaluation of potential risk reductions likely to result from the rule, we conducted a screening analysis. This screening analysis identified those wastestreams with constituents that exceed a lifetime risk level of 10^{-6} for cancer risks or that exceed the reference dose (RfD) for noncancer risks, under conservative baseline conditions. This screening approach implicitly assumes that significant benefits will not result unless risk levels are currently above these threshold levels.

Wastewater discharges may pose risk to exposed individuals via many pathways. In our analysis, we considered four pathways: (1) direct ingestion of drinking water; (2) ingestion of contaminated fish tissue; (3) human ingestion of dairy products contaminated because dairy cattle consumed water from affected surface waters; and (4) human ingestion of beef products contaminated because beef cattle consumed water from affected surface waters. Our analysis focused on these pathways because we expected these pathways to represent the most significant pathways of risk to human health.

The screening analysis consisted of three steps: (1) estimating the human health-based reference concentrations; (2) estimating the high-end exposure concentrations for baseline releases of non-priority pollutants; and (3) comparing reference concentrations to exposure levels for each affected wastestream to identify those potentially posing risk to human health.

Estimation of Reference Concentrations

For the purposes of the screening analysis, we estimated a reference concentration for each constituent using the following conservative approach.

- For each constituent/pathway combination, we "back-calculated" a health-based number (HBN). The HBN reflects the concentration in surface water that would result in human exposure at the threshold cancer or noncancer risk levels defined above.[4]

- The HBNs for each pathway were developed by applying equations for estimating fate of constituents in surface waters, uptake by dairy and beef cattle (when applicable), intake by humans, and the resulting exposure levels. In the analysis, we used high-end values for parameters that drive exposures (such as the volume flow rate of receiving waters) and central tendencies for other parameters. The equations used in the analysis were taken from Risk Assessment Guidance for Superfund and the Combustor Indirect Exposure

[4] This approach is similar to that taken in the Hazardous Waste Identification Rule (HWIR).

Methodologies report.[5] Cancer potency factors and RfDs were taken from IRIS. Appendix S contains a summary of the equations and input parameters used in the analysis.

- We compared the HBNs for the four pathways to determine the dominant pathway. The dominant pathway is the pathway posing the highest level of risk to an exposed individual. The HBN associated with the dominant pathway was used in the analysis.[6] (Note that under this back-calculation approach, the smallest HBN establishes the most stringent limit on concentration levels and thus represents the dominant pathway.)

Estimation of Exposure and Risk Levels

In the second step of the screening analysis, we estimated exposure concentrations based on a simple dilution model. For both direct and indirect discharges, the analysis accounts for mixing of the effluent discharges with the surface waters receiving these discharges (thus reducing exposure concentrations). We conservatively assumed that the effluent would be discharged into a third-order stream with average width of 18 feet, average depth of 0.6 feet, and average flow of 13.4 million cubic meters per year.[7]

In addition, for indirect discharges, we assumed additional reductions in exposure concentrations due to mixing of the affected wastestream with other wastewaters treated at the POTW. We assumed that flow rates at POTWs receiving effluent from affected facilities range from one to three million gallons per year. Also, we assumed that acetone, butanol, and methanol are fully treated by the POTW, and therefore there is no risk associated with these pollutants under baseline conditions. POTWs commonly are able to remove these three constituents from wastewaters and may even use them as inputs to stimulate biological activity in treatment processes.[8]

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[5] U.S. Environmental Protection Agency, Office of Emergency and Remedial Response, *Risk Assessment Guidance for Superfund: Volume I - Human Health Evaluation Manual (Part B, Development of Risk-Based Preliminary Remediation Goals)*, Interim, December 1991, and U.S. Environmental Protection Agency, Office of Research and Development, *Methodology for Assessing Health Risks Associated with Indirect Exposure to Combustor Emissions*, Interim Final, January 1990. (And Addendum, Review Draft, November 1993).

[6] Direct ingestion of drinking water was the dominant pathway for all 15 pollutants considered in the risk assessment.

[7] Frits van der Leeden, Fred L. Troise and David Keith Todd, *The Water Encyclopedia*, Second Edition, Chelsea, Michigan: Lewis Publishers, Inc., 1990; and U.S. Geological Survey, "Water Resources Data," State Water-Data Reports, Water Year 1992.

[8] Note that there may be some risk associated with discharges of these pollutants to POTWs if aeration treatment occurs prior to biological treatment, since aeration treatment may lead to emissions to air of these pollutants.

For the other constituents of concern, some reductions in effluent concentrations may occur prior to discharge by the POTW to surface waters due to treatment at the POTW. To be conservative, we assumed that no removal of these other constituents occurs at the POTW.

Overall, the exposure assessment approach used in the screening analysis is very conservative. For example, we did not consider biodegradation or hydrolysis of the constituents in surface waters, and we assumed that the receiving water bodies are small (third-order) streams. In addition, for indirect discharges, we do not consider the effectiveness of current POTW treatment at removing constituents prior to discharge to surface waters. Use of this conservative approach seeks to ensure that the screening analysis identifies all wastestreams potentially posing human health risk.

Comparison of Reference and Exposure Concentrations

In the third step of this screening analysis, we compared the HBN concentrations with exposure concentrations to identify those wastestreams potentially posing risk to human health in excess of the assumed threshold limits for cancer and noncancer risk.

Overall, this three step assessment approach should overstate the potential risk associated with exposure to constituents in the affected wastestreams, and thus should serve as an effective screen. Any wastestreams not posing baseline risks under these high-end assumptions will not generate significant benefits as concentrations are reduced to UTS levels under the rule. Wastestreams that show exceedences of the reference concentrations under the screening analysis required additional analysis based on actual conditions to better evaluate exposure and risk levels. This additional analysis was conducted in the more detailed risk assessment.

More Detailed Risk Assessment

For those wastestreams with risk levels exceeding the cancer or noncancer risk thresholds, we conducted a more detailed risk assessment, relying on actual site-specific data for these identified wastestreams, rather than the conservative assumptions used in the screening analysis. In particular, we collected data on the flow rate of the surface water body receiving the effluent discharges. Also, as necessary we collected data on the actual flow rate of the POTW receiving the identified wastestream. All other assumptions used in this more detailed risk assessment are the same as those used in the screening analysis.

To obtain flow rate data, we used TRI data and the Select Industrial Discharge System (SIDS) to identify the location of the facility and the name of the water body or POTW receiving the discharge. We then identified the water body to which the POTW discharges. For the identified water bodies, we collected average flow rate data using SIDS.

In this more detailed assessment, we intended to consider the risks associated with the dominant pathway, as well as risks for other pathways for which the HBN was within one order of magnitude of the HBN for the dominant pathway. For the 15 constituents analyzed, however, none of the other three pathways met this criterion.

Newly Listed Wastes

We examined the incremental risk reduction associated with regulating spent aluminum potliners. This required the identification of both baseline (pre-regulatory) and post-regulatory disposal management practices and their resulting risks. According to EPA data, approximately 120,000 tons of spent aluminum potliners are generated each year by 23 aluminum reduction facilities operating in 14 states. Currently, the waste is managed in a variety of ways, including disposal in Subtitle C landfills, recycling, and incineration. The most frequently used strategy for waste management is the disposal in Subtitle C landfills; about 80 percent or more of the generated spent aluminum potliners is landfilled.[9] We assume in this analysis that the baseline risks result from the placement of untreated spent aluminum potliners into Subtitle C landfills.

The rule would require treatment of spent aluminum potliners to meet UTS levels before it is land disposed. Because concentration-based numerical treatment standards are being used in the rule, any treatment technology may be used as long as UTS levels are attained. EPA believes that there several technologies that could potentially treat the waste to UTS levels. For example, EPA stated in the proposed delisting of kiln residue from the thermal treatment process used at the Reynolds Metals Company facility in Gum Springs, Arkansas that spent aluminum potliners treated in this manner have been shown to be nonhazardous.[10] Several primary aluminum producers are currently using the Reynolds' treatment technology for their spent aluminum potliners. Reliable data characterizing spent aluminum potliners treated by other technologies are not available. In this analysis, we base our assessment of post-regulatory risks on the use of the Reynolds' treatment technology.

Baseline Risks

The rule establishes 27 concentration standards for constituents found in spent aluminum potliners. These regulated constituents may cause cancer and noncancer effects in humans. Spent aluminum potliners disposed in the Subtitle C landfills should not pose any risk to public health because these landfills are designed to prevent the release of contaminants into underlying groundwater. Leachate collection and monitoring systems as well as landfill liners are required to operate a Subtitle C landfill. In most cases, these engineered and operational leak controls effectively reduce the risks of groundwater contamination. There is, however, the possibility that these leak controls may partially fail over time, releasing leachate into groundwater. Contaminated groundwater may then travel down-gradient where it may serve as the supply for a drinking water well. Ingestion of groundwater contaminated with the regulated constituents may cause carcinogenic and noncarcinogenic effects in humans. We believe that direct ingestion of contaminated groundwater is the dominant pathway of exposure. We did not examine in this assessment the risks associated with indirect human exposure to contaminated groundwater, such as the use of contaminated groundwater to irrigate crops or water livestock that are consumed by humans.

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[9] USEPA (1995). *Proposed Best Demonstrated Available Technology (BDAT) Background Document for Spent Potliners from Primary Aluminum Reduction -- K088.* Prepared by the Office of Solid Waste.

[10] USEPA (1991). "Hazardous Waste Management System; Identification and Listing of Hazardous Waste; Proposed Use of EPA's Composite Model for Landfills (EPACML) and Proposed Exclusion," 56 FR 32993-33012, July 18.

This general description of the potential risks posed by disposal of spent aluminum potliners in Subtitle C landfills indicates that the following data are needed to characterize and quantify the risks: the concentration of toxic constituents, the extent of failure of Subtitle C leak controls, fate and transport of hazardous constituents, and human receptor characteristics. We discuss below the methodology for the risk assessment by presenting the assumptions used.

Toxicity and Concentration of Regulated Constituents

Information on the toxicity and concentration of regulated constituents is necessary to assess the risks of landfilled spent aluminum potliners. Due to data limitations, we are unable to analyze the risks posed by all of the regulated constituents. For example, we found toxicity information consisting of values for cancer slope factors (CSFs) and/or reference doses (RfDs) for only some of the regulated constituents; CSFs and RfDs are used to assess cancer and noncancer risks, respectively. In addition, data characterizing the concentration of one regulated constituent was not available from EPA. Therefore, we examine approximately 60 percent of the regulated constituents. This may result in an understatement of the risks of spent aluminum potliners.

We obtained information on the toxicity of the regulated constituents from the SmartTox Database, which compiles information from EPA's IRIS and HEAST databases. For some constituents, toxicity data are available for different pathways of exposure. Since we believe that landfilled spent aluminum potliners pose risk mainly through the ingestion of contaminated groundwater, we used CSFs and RfDs for the oral pathway.

For the concentration of regulated constituents, we use data from several EPA studies. Our analysis requires information on the constituent concentrations found in the leachate from spent aluminum potliners. These leachate concentrations were measured by EPA using the Toxicity Characteristic Leaching Procedure (TCLP).[11] We use in our analysis TCLP data for the 11 regulated constituents that are metals. For organic constituents, TCLP data are not readily available. However, EPA has characterized the total concentrations of organic constituents in the waste.[12] To convert total concentration into leachate concentration, we assume that the ratio of total concentration to leachate concentration is 20 for the five organic constituents examined in our analysis.[13] In Exhibit 4-1, we summarize the toxicity and concentration data.

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[11] USEPA (1991). *Characterization of Spent Aluminum Potliners from the Primary Reduction of Aluminum.*

[12] USEPA Office of Solid Waste (1995). *Proposed Best Demonstrated Available Technology (BDAT) Background Document for Spent Potliners from Primary Aluminum Reduction - K088.* EPA analyzed eight samples; we use a value that averages over these samples.

[13] This assumption is consistent with the approach taken in Regulatory Impact Analysis for the proposed Hazardous Waste Identification Rule.

Exhibit 4-1

TOXICITY AND CONCENTRATION OF REGULATED CONSTITUENTS

Constituent	Average Leachate Concentration (mg/l)	Oral CSF $(mg/kg/day)^{-1}$	Oral RfD (mg/kg/day)
Antimony	0.07		0.0004
Arsenic	0.243	1.75	0.0003
Barium	0.213		0.07
Beryllium	0.0267	4.3	0.005
Cadmium	0.015		0.0005
Chromium (Total)	0.015		0.005[1]
Lead	0.115		0.0001[2]
Mercury	0.0002		0.0003
Nickel	0.0475		0.02
Selenium	0.03		0.005
Silver	0.02		0.005
Cyanide (total)	108.8		0.02
Fluoride	2332		0.05
Benzo(a)pyrene	1.19	7.3	
Fluoranthene	1.74		0.04
Pyrene	1.41		0.03

[1] The RfD for Chromium VI is used.

[2] No CSF or RfD is available for lead, but we included this regulated constituent in our analysis because the neurobehavioral effects of lead have been the subject of regulatory measures. In lieu of an RfD, we rely on EPA's proposed Maximum Contaminant Level (MCL) for lead in source water. This MCL value of 0.005 mg/l reflects the detection limit for lead and does *not* necessarily imply a safe level of ingestion. Assuming a body weight of 70 kg and a daily intake of 1.4 liters of water, we assume in lieu of an RfD that the intake of lead should not exceed 0.0001 mg/kg/day.

Leak Rates for Subtitle C Landfills

Health risks will result from the landfilling of spent aluminum potliners only if leachate escapes the leachate controls at Subtitle C landfills. Although leak controls should be effective at least in the near-term, the possibility remains that they will become less effective over time. For example, over the long run, the integrity of the liner and the leachate collection system may decrease and leakage may go unaddressed by the landfill operator. The amount of leachate that is likely to be released from a Subtitle C landfill is not known with certainty.

Based on the judgment of EPA, we believe that Subtitle C leak controls may be 70 to 85 percent effective in preventing leachate releases.[14] That is, we assume in this analysis that between 15 and 30 percent of the total leachate generated at a Subtitle C landfill could escape the leak controls and contaminate underlying groundwater.

Fate and Transport

Once leachate escapes leak controls at a Subtitle C landfill, it can enter groundwater and migrate to down-gradient drinking water wells. The fate and transport of the pollutants will be subject to various physical and chemical process that will cause the contaminants to dilute and attenuate. The result is that the contaminant concentration at the well will be lower than the concentration of the contaminants in the "pure" leachate at the landfill.

EPA has modeled fate and transport processes and has incorporated their effects on contaminant concentration by the use of dilution/attenuation factors (DAFs). The value of a DAF is simply the ratio of the contaminant concentration in "pure" leachate to the concentration at a down-gradient well. Due to time and resource constraints, we did not perform facility- or constituent-specific fate and transport modeling to calculate DAFs for this risk assessment. We relied on DAFs calculated for EPA's Toxicity Characteristic (TC) Rule.[15] For the TC Rule, different assumptions about hydrogeologic settings, degradation rates, and distances to the nearest well were used to calculate a distribution of DAF values. It is assumed that there is an infinite source and that the DAFs apply identically to each individual constituent.

It is important to note that the DAF distribution for the TC Rule reflects assumptions for unlined Subtitle D landfills. Since the risk assessment for spent aluminum potliners examines the conditions at Subtitle C landfills, we adjusted the Subtitle D DAFs to account for the leak controls present at Subtitle C landfills. We use the approach taken in the Phase II Land Disposal Restriction rule. We assume that leak controls at Subtitle C landfills will prevent most of the leachate from escaping from the landfill, but that some leachate will leak and contaminate groundwater. If, for example, 30 percent of the leachate leaks from a Subtitle C landfill, then we assume that the contaminant concentrations at a down-gradient well will be 70 percent less than would be the case for an unlined Subtitle D landfill. Since the down-gradient well concentrations from a Subtitle C

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[14] EPA stated in the 1994 Regulatory Impact Analysis for the Phase II Land Disposal Restriction rule that after 30 years of operation, the liner of a Subtitle C landfill would be about 85 percent effective. Other sources at EPA's Office of Solid Waste suggest that the effectiveness ranges between 70 and 80 percent.

[15] USEPA Office of Solid Waste (1990). *Background Document, Toxicity Characteristic Regulatory Impact Analysis.*

landfill are expected to be *lower* than for a Subtitle D landfill, the DAFs will be *higher* for Subtitle C than for Subtitle D landfills. For example, in this analysis we use the 50th and 90th percentile Subtitle D DAF values 182,000 and 47, respectively. A 30 percent leak rate implies that the corresponding 50th and 90th percentile Subtitle C DAF values are 607,000 and 157, respectively.

Human Receptor Characteristics

We examine in this analysis the risks to people who obtain drinking water from wells drawing contaminated groundwater. The risks will depend on human receptor characteristics such as the duration of exposure, body weight, and daily intake of water.

Risk Calculations

Using the parameters described above, we calculated the individual risk resulting from the disposal of spent aluminum potliners in Subtitle C landfills. Due to the uncertainty and variability in the values for these parameters, we performed risk calculations using a range of values. We combined various combinations of the following parameter values.

- Leak rates at Subtitle C landfills were assumed to be 15 percent or 30 percent. An average value of 23 percent was also examined.

- Fate and transport modeling results a DAF distribution for Subtitle D landfills; the 50th and 90th percentile values of the distribution are 182,000 and 47, respectively. These values were adjusted to reflect a range of partially effective leak controls and Subtitle C landfills.

- Human receptor characteristics are assumed to be a body weight of 70 kg, ingestion of 1.4 liters of water per day, and an exposure duration of nine or 30 years.

We used these parameter values and the data on leachate concentration and constituent toxicity to calculate the risk to an exposed individual. The cancer risk was estimated for each individual constituent for which a CSF exists; these values were summed to calculate the lifetime cancer risk. For noncancer risks, we quantified the daily intake of each contaminant and compared it to the RfD for each constituent. We identified those constituents for which the hazard quotient (the ratio of the daily intake to the RfD) was greater than one.

Post-Regulatory Risks

The rule requires that the regulated constituents in spent aluminum potliners meet concentration limitations specified as UTS before the waste may be land disposed. EPA believes that a number of technologies may be implemented to treat the waste adequately. In the preamble to the rule, EPA identified six companies that are developing such technologies. These technologies use a variety of treatment and/or recycling approaches, such as vitrification or precipitation of regulated constituents in K088. These technologies, however, have not been examined thoroughly by the Agency. EPA has examined another technology that appears to meet the rule's standards. After analysis of the Reynolds Metals Company thermal treatment process, EPA has proposed that

residuals from spent aluminum potliners treated in this manner be delisted as a hazardous waste. The Agency's delisting process, as well as the permitting process required for operation of the Reynolds treatment facility in Gum Springs, Arkansas, provide information on the possible risks posed by that treatment technology.

This treatment technology consists of thermal treatment of spent aluminum potliners, which will result in the release of pollutants into the air. Following thermal treatment, the kiln residue is placed in a Subtitle D nonhazardous waste landfill where there may be potential contamination of groundwater.

It is beyond the scope of this analysis to characterize the risks involved in all of the treatment technologies being developed. Consequently, we relied on the risk assessments for the Reynolds treatment process performed for the Arkansas Department of Pollution Control and Ecology and for EPA. Although other treatment technologies may be implemented in the near future, we use the data available for the Reynolds process to describe the risks associated with treatment of spent aluminum potliners to UTS levels.

RESULTS

ICRT Wastes

The results described below provide a high-end estimate of the benefits of the rule, assuming facilities comply with the rule by treating the affected wastestreams to meet UTS levels (option 1 described above). Actual benefits may be lower or zero, if facilities comply through one of the other three options.

Loadings Reductions

Based on our analysis, we estimated that the rule will result in total loadings reductions ranging from 1,527 to 22,890 tons per year. These reductions occur at 129 to 291 facilities involving 175 to 647 constituent/wastestream combinations. These results are summarized in Exhibit 4-2. Most of the reductions (98 percent) occur at organic chemicals facilities, with the remainder occurring at petroleum refiners.[16]

We expect that the loadings reductions achieved under the rule are likely to fall at the lower end of this range. This is so because biological treatment at POTWs usually removes acetone, butanol, and methanol from effluent discharged to the POTW. Therefore, indirect dischargers are likely to be able to reach agreements with POTWs allowing the facilities to continue to discharge these constituents to the POTW above UTS levels. This has a big impact on the loadings reduction estimates. Our loadings reduction estimates range between 20,817 to 21,322 tons per year including these constituents versus between 1,527 to 1,833 tons per year not including these constituents (the range varies depending on the flow rate assumptions).

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[16] Note that the number of affected facilities identified here does not match the numbers in Chapter 2 because for the benefits assessment we were unable to make adjustments to account for facilities not managing their wastewaters in surface impoundments.

Overall, these loadings reductions are very small compared to total toxic loadings to surface waters by direct dischargers based on TRI (for all TRI chemicals). The estimated loadings reductions by direct dischargers range between 0.03 and 0.20 percent of total TRI releases to surface waters. For indirect dischargers, these loadings reductions represent between 0.8 and 11.9 percent of TRI loadings in discharges to POTWs. Note that toxics in discharges to POTWs may be removed by POTW treatment prior to discharge to surface waters, as assumed for acetone, butanol, and methanol in the case of the lower bound estimates.

Exhibit 4-2

ESTIMATED LOADINGS REDUCTIONS BY AFFECTED FACILITIES

Industry	Estimated Loadings Reductions (tons/year)	
	Low Flow[1]	High Flow[1]
Organic Chemicals:		
Direct Dischargers	237	32
Indirect Dischargers[2]		
With Acetone, Butanol & Methanol	20,697	20,471
Without Acetone, Butanol & Methanol	1,393	1,338
Total		
With Acetone, Butanol & Methanol	20,934	20,503
Without Acetone, Butanol & Methanol	1,630	1,370
Petroleum Refining:		
Direct Dischargers	30	4
Indirect Dischargers[2]		
With Acetone, Butanol & Methanol	358	310
Without Acetone, Butanol & Methanol	173	153
Total		
With Acetone, Butanol & Methanol	388	314
Without Acetone, Butanol & Methanol	203	157
Total		
With Acetone, Butanol & Methanol	21,322	20,817
Without Acetone, Butanol & Methanol	1,833	1,527

1 Low flow and high flow refer to the wastestream flow rates assumed for the industries. Note that the estimated loadings reductions are higher under the low flow rate because facilities would need to remove more of the constituent from the wastestream to comply with the UTS level, the lower the wastestream flow rate. Numbers may not sum due to rounding.

2 Biological treatment at POTWs usually removes acetone, butanol, and methanol from effluent discharged to the POTW. Thus, indirect dischargers are likely to be able to reach agreements with POTWs allowing the facilities to continue to discharge these constituents to the POTW above UTS levels and the loadings reductions achieved under the rule would be significantly lower, as shown.

Screening Analysis Risk Assessment

Overall for the organic chemicals and petroleum refining industries 14 to 26 wastestreams at 14 to 25 facilities were identified as posing risk to human health based on the screening analysis. This range reflects uncertainty in the flow rates of the affected facilities. A summary of the screening analysis results appears in Exhibit 4-3.

Exhibit 4-3

COMPARISON OF ESTIMATED NUMBER OF FACILITIES AFFECTED BY THE RULE AND NUMBER OF FACILITIES WITH WASTESTREAMS EXCEEDING THRESHOLD RISK LEVELS

Industry	Estimated Number of Facilities Affected Based on the Impact Analysis		Estimated Number of Facilities with Wastestreams Exceeding Threshold Risk Levels	
	Low Flow	High Flow	Low Flow	High Flow
Organic Chemicals	233	113	25	13
Petroleum Refining	58	16	1	1
Total	291	129	26	14

Note that the number of affected facilities identified here does not match the numbers in Chapter 2 because for the benefits assessment we were unable to make adjustments to account for facilities not managing their wastewaters in surface impoundments.

Organic Chemicals

The impact analysis estimated that 113 to 233 organic chemical manufacturing facilities managing between 155 and 404 constituent/wastestream combinations would be affected by the rule. We were only able to evaluate the baseline risks associated with 346 of these 404 constituent/wastestream combinations because no health risk information was available for the six constituents in the 58 other wastestreams.[17]

The screening risk assessment identified nine to 20 wastestreams with cancer risk levels exceeding 10^{-6} under baseline conditions and three to six wastestreams with noncancer risk levels exceeding reference doses. These 12 to 26 wastestreams contain one of five constituents: aniline

[17] The six constituents for which we did not have health risk information include methyl methacrylate, ethylene oxide, methyl isobutyl ketone, chloroprene, p-cresol, and allyl chloride.

(nine to 19 wastestreams), acrylamide (zero to one wastestream), pyridine (two wastestreams in both scenarios), barium compounds (one wastestream in both scenarios), and acetonitrile (zero to two wastestreams).

For these 12 to 26 wastestreams, we conducted a more detailed risk assessment, using site-specific data, including data on the actual flow rate of the surface water bodies receiving these wastewater discharges. The results of the full risk assessment are described further below.

Petroleum Refining

The impact analysis estimated that 16 to 58 petroleum refining facilities involving 20 to 84 constituent/wastestream combinations would be affected by the rule. Based on the screening analysis, we identified one wastestream (containing pyridine) posing noncancer risk at levels exceeding threshold levels. The results of the more detailed risk assessment for this facility are describe below.

More Detailed Risk Assessment

We conducted a more detailed risk assessment for 21 of the 26 wastestreams identified as potentially posing risk based on the screening analysis for both the organic chemicals and petroleum refining industries. This risk assessment is based on the average flow rate data for the water bodies receiving these wastestreams. We were unable to obtain site-specific flow rate data for the other facilities because the wastestream ultimately was discharged to a large bay or lake. The dilution model that we used in our analysis to estimate mixing of effluent discharges with receiving waters is not able to address mixing for these water bodies. A summary of the results of this analysis appears in Exhibit 4-4.

The results of our more detailed risk assessment indicate that the benefits from the rule are extremely small. Based on our assessment, we identified four wastestreams potentially posing cancer risk exceeding the threshold risk levels.[18] Three wastestreams pose baseline cancer risk ranging from 1×10^{-5} to 1×10^{-4} due to exposure to aniline. We estimated that under the rule, treatment of these wastestreams to meet UTS levels will reduce these risks to between 8×10^{-8} and 3×10^{-6}. A fourth wastestream containing acrylamide poses baseline cancer risk of 2×10^{-3}. We estimated that treatment of this wastestream to UTS levels will reduce this risk to between 2×10^{-4} and 4×10^{-3}.

However, even for these facilities, our analysis may overstate the baseline risks associated with exposure to these constituents for two reasons. First, the affected facilities discharge these wastestreams to POTWs. Treatment at the POTWs may remove some or all of these constituents from these wastestreams prior to discharge to surface waters. For example, EPA's Treatability Manual (1983) indicates that 95 percent removal of aniline can be achieved through activated sludge

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[18] Note that for these four wastestreams, we attempted to verify whether these facilities managed their wastestreams in surface impoundments. We did verify that wastestreams 3 and 14 are managed in surface impoundments, and thus will be affected by the rule. We were unable to verify whether wastestreams 4 and 15 are managed in surface impoundments.

Exhibit 4-4

RESULTS OF DETAILED RISK ASSESSMENT

Wastestream	Constituent	Direct/ Indirect Discharger	Risk Type	Loadings (lbs/yr)	Baseline Risk Level Actual Flow Rate[1]	UTS Risk Level Actual Flow Rate[1]
1	ANILINE	D	C	1,800	$<10^{-6}$	-
2	ANILINE	I	C	17,155	$<10^{-6}$	-
3	ANILINE	I	C	392,304	$1x10^{-4}$	$<10^{-6}$
4	ANILINE	I	C	23,000	$1x10^{-5}$	$<10^{-6}$ to $3x10^{-6}$
5	ANILINE	D	C	750	$<10^{-6}$	-
6	ANILINE	I	C	3,000	$<10^{-6}$	-
7	ANILINE	I	C	33,000	$<10^{-6}$	-
8	ANILINE	I	C	300,000	$<10^{-6}$	-
9	ANILINE	I	C	750	$<10^{-6}$	-
10	ANILINE	I	C	2,100	$<10^{-6}$	-
11	ANILINE	D	C	2,900	$<10^{-6}$	-
12	ANILINE	D	C	815	$<10^{-6}$	-
13	ANILINE	D	C	7,419	$<10^{-6}$	-
14	ANILINE	I	C	200,000	$8x10^{-5}$	$<10^{-6}$ to $2x10^{-6}$
15	ACRYLAMIDE	I	C	53,638	$2x10^{-3}$	$2x10^{-4}$ to $4x10^{-3}$
16	ACETONITRILE	D	NC	33,000	<RfD	-
17	ACETONITRILE	I	NC	100,000	<RfD	-
18	BARIUM COMPOUNDS	I	NC	95,000	<RfD	-
19	PYRIDINE	I	NC	5,802	<RfD	-
20	PYRIDINE	I	NC	43,000	<RfD	-
21	PYRIDINE	D	NC	9,400	<RfD	-

[1] Based on our analysis, the order of magnitude of estimated baseline risk did not vary for the low flow and high flow scenarios (where low flow and high flow refer to the flow rate for the wastestream). The ranges presented in the last column reflect the order of magnitude of estimated risk at UTS levels for the two scenarios.

treatment.[19] If this rate of removal is achieved, the baseline risk associated with the wastestreams containing aniline would be on the order of 7×10^{-7} and 6×10^{-6}. We were unable to obtain information on the treatability of acrylamide. Second, if no drinking water intake is located downstream from the POTWs' outfalls, then no one would be exposed at these risk levels, and thus no risk reductions would result under the rule.

For the other 17 wastestreams analyzed, actual flow rates of the receiving waters were significantly greater than the conservative flow rate assumption used in the screening analysis. Using these data in our more detailed analysis, we estimated that these wastestreams will not pose any risk above threshold levels. The results of this risk assessment indicate that mixing of the effluent discharges with the actual flow of the receiving waters sufficiently reduces the concentration levels in the water to risk levels below threshold cancer or noncancer risk levels.

We were unable to evaluate whether the actual baseline risk exceeded threshold risks levels for five of the wastestreams identified by the screening analysis. For these wastestreams, the screening analysis estimated baseline risks ranging between 2×10^{-4} and about 1×10^{-6} (i.e., these estimated risks are only slightly above threshold risk levels). These wastestreams may pose baseline risk exceeding threshold levels and the rule may result in additional risk reduction benefits, depending on the actual flow rates of the receiving water bodies, as well as whether POTW treatment removes the constituent from the waste streams prior to discharge and whether a drinking water intake is located downstream from the discharge point. However, we do not expect these potential benefits to significantly increase the overall magnitude of the benefit estimates from the rule.

Newly Listed Wastes

We describe below the results of the human health risk assessment of spent aluminum potliners. Both baseline risks and post-regulatory risks are discussed. The reduction of risks reflects the benefits of regulating spent aluminum potliners.

Baseline Risks

As described previously, we evaluated the risks of disposing of untreated spent aluminum potliners in Subtitle C landfills. We estimated the risks using a range of assumptions for the failure of Subtitle C landfills, the effects of fate and transport, and human receptor characteristics.

The analysis shows that the risk calculations are most sensitive to the assumptions used for fate and transport processes, which are embodied in DAF values. The large degree of uncertainty and variability in fate and transport processes are expressed by the three to four orders of magnitude that separate the DAF values corresponding to the 50th and 90th percentiles of the DAF distribution. When the other parameters are varied between the ranges described previously, the resulting risk estimates change by no more than a factor of three.

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[19] U.S. Environmental Protection Agency, Office of Research and Development, *Treatability Manual, Volume I. Treatability Data*, February 1983.

The results of the analysis are summarized in Exhibit 4-5, which shows both central tendency and high-end risk estimates for risk-driving constituents. The baseline individual risks for both cancer and noncancer effects are expected to be negligible under central tendency assumptions; these risks, however, may be substantial under high-end assumptions. The values in Exhibit 4-5 are based on the 50th and 90th percentile Subtitle C DAF values (790,000 and 204, respectively, reflecting a leak rate of 23 percent) and an exposure duration of nine years.[20]

Exhibit 4-5

BASELINE RISKS

Type of Risk	Central Tendency Risk	High-End Risk
Cancer risk (lifetime risk)		
Arsenic	1.4×10^{-9}	5.3×10^{-6}
Beryllium	3.7×10^{-10}	1.4×10^{-6}
Benzo(a)pyrene	2.8×10^{-8}	1.1×10^{-4}
Sum	3.0×10^{-8}	1.1×10^{-4}
Chemicals with noncancer risk (hazard quotient)	None	Fluoride (3.8)

Post-Regulatory Risks

We assessed human health risks for managing spent aluminum potliners after the implementation of the rule by examining the risks that result from the use of the Reynolds treatment technology. Based on studies performed by the Arkansas Department of Pollution Control and Ecology and by EPA, we believe that there are no appreciable post-regulatory risks.

The state of Arkansas required Reynolds Metal Company to apply for permits to operate its facility and release contaminants into the environment. As part of this permitting process, Reynolds assessed the risks posed by the facility's air emissions. Air dispersion modeling was performed for emissions from pre-treatment operations as well as stack emissions from the facility's kiln. Several regulated constituents were examined, including PAHs and carcinogenic heavy metals. Fluoride and cyanide were not included in the Reynolds analysis. In addition, the analysis considered a multi-pathway exposure scenario that incorporated incidental ingestion of soil contaminated through direct particulate deposition and the consumption of fruits and vegetables

[20] The results presented here do not reflect all combinations of the different input parameter assumptions that we examined. The risk estimates do not change significantly from the results shown if the leak rate and exposure duration parameters are varied. In addition, the leak rate of 23 percent reflects the average of the 15 to 30 percent leak rate range suggested by EPA.

from home gardens contaminated through direct deposition onto plant surfaces and uptake from contaminated soil. Reynolds concluded that the excess cancer risk is less than 10^{-6} beyond the facility boundary.[21]

A risk assessment was also performed for the kiln residue (spent aluminum potliners that have undergone thermal treatment) from the Reynolds facility. As part of EPA's proposed delisting of the kiln residue, the Agency examined the risks posed by landfilled kiln residue. EPA used its Composite Model for Landfills to model groundwater contamination and subsequent exposure through the ingestion of the groundwater. In addition, the Agency considered the potential risks via non-groundwater routes of exposure, specifically, with regard to airborne and waterborne dispersal of contaminants. EPA concluded that the Reynolds process "can render spent potliners non-hazardous."[22]

Incremental Risk Reduction

The post-regulatory and baseline risks can be compared to estimate the incremental risk reduction resulting from implementation of the rule. Studies of the Reynolds treatment technology show that post-regulatory individual cancer risks from air emissions are expected to be less than 10^{-6} and risks due to groundwater contamination are expected to be negligible. Our assessment of baseline risks show that appreciable risks are not likely to result from disposal of spent aluminum potliners in Subtitle C landfills; the incremental risk reduction is negligible. Under high-end assumption, however, the incremental risk reduction could be appreciable since the corresponding baseline cancer risk could be on the order of 10^{-4}, while noncancer risks may be posed by arsenic, lead, cyanide, and fluoride.

We do not believe that the rule will result in significant benefits for incremental population risk reduction because baseline population risks are probably low. The magnitude of population risks depends on the level of individual risk and the number of people exposed to contaminated groundwater. For example, under the high-end individual lifetime cancer risk of 10^{-4}, one annual cancer case could result if the exposed population were 700,000 people. Available evidence suggests that a relatively low number of people are exposed to groundwater contaminated by landfilled spent aluminum potliners. According to interviews with personnel at several facilities generating spent aluminum potliners, a majority of the landfilled waste is disposed of in two Subtitle C landfills, one in a rural area near Arlington, Oregon and the other near the city of Fort Wayne, Indiana. The exposed population is expected to be low in sparsely populated areas, as well as in densely populated areas where people are likely to be served by public water supplies with sources sufficiently distant from the landfill. This suggests that the baseline population risks at these two landfills are likely to be low. It should be noted, however, that we have not investigated other landfills that receive or used to receive spent aluminum potliners; we are unable to specify the population that is likely to be exposed at these other locations.

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[21] The Reynolds study is included in the RCRA Part B Permit Application (Appendix V: Risk Evaluation) obtained from the Arkansas Department of Pollution Control and Ecology.

[22] USEPA (1991). "Hazardous Waste Management System; Identification and Listing of Hazardous Waste; Proposed Use of EPA's Composite Model for Landfills (EPACML) and Proposed Exclusion," 56 *Federal Register* 32993-33012, July 18.

Appendix A

RESULTS OF SCREENING ANALYSES OF THE ORGANIC CHEMICAL INDUSTRY

Appendix A

RESULTS OF SCREENING ANALYSES OF THE ORGANIC CHEMICAL INDUSTRY

The organic chemicals, plastics, and synthetic fibers (OCPSF) industry includes facilities manufacturing plastic materials, synthetic resins, and nonvulcanizable elastomers (SIC 2821); vulcanizable elastomers (SIC 2822); cellulosic man-made fibers (SIC 2823); synthetic organic fibers, except cellulose (SIC 2824); cyclic crudes and intermediates, dyes, and organic pigments (SIC 2865); and industrial organic chemicals not elsewhere classified (SIC 2869). According to the 1987 Census of Manufactures, there were 1,512 establishments in this industry.

Effluent guidelines for the industry were finalized in 1987. No information on non-priority UTS constituents of concern for the Phase III LDR rule were available from these effluent guidelines documents.

Approach for Identifying Facilities Affected by the Phase III LDR Rule

We identified facilities potentially affected by the rule based on facilities with wastestreams that met the following three criteria:

- Contained decharacterized ICRT wastewater;
- Managed in a land-based unit; and
- Contained non-priority UTS constituents at concentrations exceeding UTS.

Due to a lack of effluent guidelines data on non-priority UTS constituents in wastestreams generated by the organic chemical industry, we relied largely on TRI data to assess which facilities might have wastestreams containing non-priority constituents exceeding UTS levels. For this analysis, we combined TRI loadings data and industry-specific data on flow rates for wastewater discharges to estimate the concentrations of these constituents in facilities' wastestreams. We then compared these concentration levels to UTS levels to identify facilities and wastestreams potentially exceeding UTS. In addition, since the TRI does not contain information on waste management practices, we considered data from other sources to evaluate facilities likely to manage ICRT wastewaters in surface impoundments. Below we outline the steps and assumptions used in the analysis in more detail.

Step 1: Using TRI data, identify facilities that report discharges of non-priority UTS pollutants to POTWs or to surface waters and collect data on the reported loadings for each facility by constituent.

Step 2: Evaluate the flow rate of wastewater discharges by facilities in the industry. Establish low-end and high-end estimates of flow rates.

Step 3: Applying the low-end and high-end flow rate estimates to the TRI loadings data, identify facilities almost certain to have wastestreams with constituents concentrations exceeding UTS levels (i.e., UTS exceedences even at very high wastewater flows) and facilities that might have wastestreams exceeding UTS levels (i.e., exceedences at very low wastewater flows).

Step 4: Adjust the resulting estimates of the number of affected facilities to reflect the likelihood that facilities in the industry manage and treat their ICRT wastes in surface impoundments.

This approach may understate the number of facilities affected by the rule for two reasons. First, the TRI only includes data on 48 of the 101 non-priority UTS constituents. Second, only those facilities generating more than 10,000 pounds of TRI constituents per year are required to report to the TRI. Smaller facilities that manage ICRT wastewaters in surface impoundments also could be affected by the rule.

Results

Based on our analysis, we found that 28 facilities (7 direct dischargers and 21 indirect dischargers) are almost certain to be affected and an additional 45 (31 direct dischargers and 14 indirect dischargers) may be affected by the rule. Below we summarize how we calculated these estimates and provide additional information characterizing the industry.

In 1992, 1,305 OCPSF facilities reported releases of TRI chemicals, with 821 reporting releases to water or to POTWs. Of the 821 facilities reporting releases to water or to POTWs, 474 reported a quantifiable discharge of at least one of the 101 non-priority UTS pollutants. Of these 474 facilities, 159 directly discharged wastewaters to surface waters, 296 discharged wastewaters to POTWs, and 18 did both. Wastewaters from these facilities contained at least one of 20 non-priority UTS pollutants, including methanol, acetone, methyl methacrylate, xylene, pyridine, dichlorodiflouromethane, barium, phthalic anhydride, butanol, carbon disulfide, ethylene oxide, methyl ethyl ketone, cresol, methyl isobutyl ketone, aniline, acetonitrile, trichloroflouromethane, chloroprene, and acrylamide.

To assess the number of affected facilities, we combined the TRI loadings data with low-end and high-end wastestream flow rates for facilities in this industry and compared the resulting concentration estimates to UTS levels. Based on this analysis, we found that 113 facilities are likely to be affected by the rule because they generate wastewaters containing non-priority UTS constituents exceeding UTS levels at high-end flow rates of 5.33 million gallons per day for direct dischargers and two million gallons per day for indirect dischargers. Of these 113 facilities, 8 are direct dischargers, 102 are indirect dischargers, and 3 are both direct and indirect dischargers. This analysis also showed that an additional 120 facilities may be affected by the rule, based on a low-end flow rate of 100,000 gallons per day (for both direct and indirect dischargers). Of these 120 facilities, 49 are direct dischargers, 68 are indirect dischargers, and 3 are both direct and indirect dischargers. These flow rate data are based on data from the ISDB and an EPA study on indirect

dischargers.[1] Table A-1 shows the loadings levels for the pollutants of concern for these 233 facilities.

We adjusted this estimated range of the number of affected facilities to reflect the number of facilities likely to manage wastewaters in surface impoundments. The treatment process data collected by the Office of Water to support development of effluent guidelines for this industry suggest that approximately 21 percent of all indirect dischargers use surface impoundments, while approximately 60 percent of direct dischargers use these units.[2] These data were collected in the mid-1980s and comments from representatives of the OCPSF industry suggest that surface impoundment use has likely declined since that time. These estimates span the estimated range developed based on PCS. The PCS database shows that 506 OCPSF facilities have NPDES permits, affecting 2,812 outfalls and 200 of these facilities reported treatment information, affecting 577 outfalls.[3] Based on an analysis of the treatment data, 88 facilities reported treatment types likely to occur in surface impoundments, affecting 124 outfalls.[4] Comparing the number of outfalls and facilities with land-based units to the total number of outfalls and facilities for which treatment data were available, we estimated that 21 to 44 percent of direct dischargers use surface impoundments.[5] We decided to use the percentages from the effluent guidelines data because it is a more conservative estimate, and because it provides estimates for both direct and indirect dischargers (unlike the PCS data, which only provides information for direct dischargers).

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[1] *Draft OCPSF Industrial User Compliance Evaluation Report*, prepared by SAIC for the U.S. EPA Office of Water, September 1992. This report collected data from regional and state enforcement offices on 555 indirect dischargers, and evaluated flow data from 84 of these facilities.

[2] U.S. Environmental Protection Agency, Office of Water. "*Development Document for Effluent Limitations Guidelines and Standards, New Source Performance Standards, and Pretreatment Standards for the Organic Chemicals, Plastics and Synthetic Fibers Point Source Category,*" Volume I and II. October 1987.

[3] PCS only contains data for direct dischargers, thus explaining the difference in the number of facilities in PCS and the number reporting to TRI. Also reporting of treatment information to PCS is voluntary.

[4] Treatment types assumed to occur in land-based units included evaporation; sedimentation; equalization; neutralization; aerated, polishing, and sludge lagoons; oxidation, stabilization, and holding ponds; and extended aeration.

[5] Twenty-one percent equals 124 outfalls with treatment in surface impoundments divided by 577 outfalls for which facilities reported treatment information. Forty-four percent equals 88 facilities with treatment in surface impoundments divided by 200 facilities reporting treatment information.

Applying the estimates of 21 percent for indirect dischargers and 60 percent for direct dischargers to the TRI analysis, we estimated that between 7 and 38 direct dischargers and 21 and 36 indirect dischargers may actually be affected by the rule.[6] In addition, we estimated the quantity of wastewater generated by these affected facilities at between 24 and 95 million tons per year. This is based on average flow rates of 1.37 million gallons per day for direct dischargers and 280,000 gallons per day for indirect dischargers.[7]

In our analysis, we assumed that all facilities with exceedences of UTS manage decharacterized ICRT waste in their surface impoundments. As a check on this assumption, we analyzed data from BRS to evaluate the quantity of ICR waste that is managed in land-based units. This analysis showed that 33.5 million tons of ICR wastes were managed in land-based units by this industry in 1991. This value falls within our range estimated based on the TRI analysis, suggesting that our approach is reasonable. However, EPA believes that BRS data may underestimate the quantity of decharacterized ICR wastewaters managed in land-based units because many facilities may not have reported wastes that were diluted immediately upon generation as hazardous wastes.[8]

We also collected data on the quantity of wastewaters managed in surface impoundments potentially affected by the rule in conversations with the Chemical Manufacturers Association (CMA). These data showed a higher quantity of affected waste than estimated based on our TRI analysis. In a CMA survey of 10 large member companies (that together operate 199 facilities), these companies reported that the rule potentially would affect approximately 123 surface impoundments handling about 282 million tons per year of formerly characteristic waste. These impoundments represented non-hazardous impoundments managing wastes that were ICR at point of generation. This difference in reported quantities may result from the fact that the CMA data did not consider whether these wastewaters contained non-priority UTS constituents at concentrations exceeding UTS levels. Note, however, that the 282 million tons understates the quantity of waste potentially affected by the rule because it represents only a portion of the organic chemical manufacturing industry. We were unable to obtain data on quantities of potentially affected wastes for other facilities from the trade associations.

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[6] For direct dischargers, the range is calculated as follows: 11 facilities x 60 percent = 6.6 facilities (rounds up to 7 facilities), and 63 facilities x 60 percent = 37.8 (rounds up to 38 facilities). For indirect dischargers: 102 facilities x 21 percent = 21.4 (rounds down to 21 facilities); 170 facilities x 21 percent = 35.7 facilities (rounds up to 36 facilities). Note that in these calculations, we treated facilities that are both direct and indirect dischargers as direct dischargers.

[7] For the lower bound of this range, 7 direct dischargers at mean flow rate of 1.37 million gallons per day = 9.6 million gallons per day and 21 indirect dischargers at 280,000 gallons per day = 5.9 million gallons per day. Converting this total quantity to tons yields: 15.5 million gallons per day x 365 days per year x 0.004171 tons per gallon = 23.6 million tons per year. For the upper bound of this range, 38 direct dischargers x 1.37 million gallons per day = 52.1 million gallons per day and 36 indirect dischargers x 280,000 gallons per day = 10.1 million gallons per day. Converting this total quantity to tons yields: 62.1 million gallons per day x 365 days per year x 0.004171 tons per gallon = 94.6 million tons per year.

[8] In fact, such wastes should have been included in BRS; however, EPA discussions with industry suggest that this requirement has been broadly misinterpreted in the past.

The primary limitation of our approach is that the analysis of the TRI data does not consider 53 non-priority UTS constituents and thus may underestimate the effects of the rule. The impacts of the rule due to the remaining non-priority pollutants are unclear.

Table A-1

SUMMARY OF TRI LOADINGS DATA FOR FACILITIES WITH WASTESTREAMS CONTAINING NON-PRIORITY UTS CONSTITUENTS AT LEVELS EXCEEDING UTS

Facility Number	Constituent	Release to Water (lbs/yr)	Release to POTW (lbs/yr)	Almost Certain to Exceed UTS	May Exceed UTS
1	Methanol	0	322,000	✓	
2	Acetone	0	484,345	✓	
2	Methanol	0	25,000		✓
3	Methanol	0	38,016	✓	
4	Methyl Methacrylate	0	1,900	✓	
4	Xylene (Mixed Isomers)	0	250		✓
5	Pyridine	5	0		✓
6	Methanol	34,000	0		✓
7	Methanol	3,512	0		✓
8	Acetone	220	0		✓
8	Acetone	110	0		✓
8	Dichlorodifluoromethane	98	0		✓
9	Acetone	0	6,900	✓	
9	Acetone	0	250		✓
9	Barium Compounds	0	650		✓
9	Methanol	0	1,900,000	✓	
9	Methanol	0	1,200,000	✓	
9	Methanol	0	39,000	✓	
9	Phthalic Anhydride	0	250		✓
10	Acetone	0	71,000	✓	
10	Barium Compounds	0	790		✓
10	N-Butyl Alcohol	0	87,000	✓	
11	Acetone	0	71,782	✓	
11	Methanol	0	368,842	✓	
11	Methanol	0	39,982	✓	
11	Xylene (Mixed Isomers)	0	6,500	✓	
12	Carbon Disulfide	0	7,300		✓
13	Ethylene Oxide	0	3,753	✓	
14	Methanol	0	1,154,756	✓	
15	Acetone	0	406		✓
15	Xylene (Mixed Isomers)	0	750		✓
16	Methyl Ethyl Ketone	0	52,000	✓	
17	Methyl Ethyl Ketone	0	250		✓
18	Xylene (Mixed Isomers)	0	250		✓
18	Xylene (Mixed Isomers)	0	710		✓
19	Acetone	0	15,000	✓	

Table A-1

SUMMARY OF TRI LOADINGS DATA FOR FACILITIES WITH WASTESTREAMS CONTAINING NON-PRIORITY UTS CONSTITUENTS AT LEVELS EXCEEDING UTS

Facility Number	Constituent	Release to Water (lbs/yr)	Release to POTW (lbs/yr)	Almost Certain to Exceed UTS	May Exceed UTS
19	M-Cresol	0	5,223	✓	
19	Pyridine	0	250	✓	
20	Carbon Disulfide	0	3,707		✓
21	Methyl Isobutyl Ketone	0	2,000	✓	
22	Methanol	0	28,000		✓
23	Methanol	0	12,910		✓
23	Methanol	0	32,029		✓
24	Barium Compounds	0	11,378	✓	
25	Acetone	0	1,778	✓	
26	Aniline	0	97,707	✓	
27	Aniline	0	4,600		✓
27	Methanol	0	231,000	✓	
28	Ethylene Oxide	58	0		✓
29	Aniline	0	684		✓
30	Methanol	0	1,727,500	✓	
31	Aniline	0	250		✓
31	Ethylene Oxide	0	4,661	✓	
31	Methanol	0	531,967	✓	
32	Methanol	0	2,812,300	✓	
32	Methanol	0	1,800		✓
33	Methanol	0	236,000	✓	
34	M-Cresol	0	1,809		✓
35	Acetone	0	160,603	✓	
35	Acetone	0	10,000	✓	
36	Methyl Methacrylate	250	0		✓
37	P-Cresol	0	250		✓
38	Acetone	0	632		✓
39	Methyl Ethyl Ketone	0	112,305	✓	
39	Phthalic Anhydride	0	217		✓
40	Methanol	0	96,000	✓	
40	Xylene (Mixed Isomers)	0	5,011	✓	
41	Methanol	0	3,890		✓
41	O-Xylene	0	572		✓
42	Methyl Ethyl Ketone	0	250		✓
43	Methanol	0	1,400,000	✓	
44	Methanol	0	1,191,000	✓	

Table A-1

SUMMARY OF TRI LOADINGS DATA FOR FACILITIES WITH WASTESTREAMS CONTAINING NON-PRIORITY UTS CONSTITUENTS AT LEVELS EXCEEDING UTS

Facility Number	Constituent	Release to Water (lbs/yr)	Release to POTW (lbs/yr)	Almost Certain to Exceed UTS	May Exceed UTS
45	Xylene (Mixed Isomers)	0	250		✓
46	Aniline	0	602		✓
47	N-Butyl Alcohol	0	5,700		✓
48	Methanol	0	6,900		✓
48	Methyl Isobutyl Ketone	0	250		✓
49	Acetone	8,600	0	✓	
50	Methanol	0	10,000		✓
50	Methanol	0	20,000		✓
50	Methyl Ethyl Ketone	0	2,800	✓	
50	Methyl Isobutyl Ketone	0	37,996	✓	
51	Aniline	1,800	0		✓
51	Methanol	12,000	0		✓
51	Methyl Ethyl Ketone	180	0		✓
52	Acetone	700	0		✓
52	Methanol	2,312	0		✓
52	Methyl Methacrylate	320	0		✓
53	Acetone	1,772	0		✓
53	Methanol	22,225	0		✓
54	Methyl Ethyl Ketone	0	119		✓
55	P-Cresol	0	669,569	✓	
56	Acetonitrile	0	5,500		✓
57	Acetone	9,900	0	✓	
57	Trichlorofluoromethane	782	0	✓	
58	Methyl Methacrylate	0	257		✓
59	Barium Compounds	0	953		✓
60	Acetone	0	1,007		✓
61	Methanol	0	28,757		✓
62	Xylene (Mixed Isomers)	0	250		✓
63	Acetone	2,895	0		✓
64	Methanol	0	14,211		✓
65	Carbon Disulfide	18,000	0		✓
65	Methyl Methacrylate	104	0		✓
65	N-Butyl Alcohol	5,900	0		✓
65	Xylene (Mixed Isomers)	280	0		✓
65	Xylene (Mixed Isomers)	0	300		✓
66	Methanol	0	24,453		✓

Table A-1

SUMMARY OF TRI LOADINGS DATA FOR FACILITIES WITH WASTESTREAMS CONTAINING NON-PRIORITY UTS CONSTITUENTS AT LEVELS EXCEEDING UTS

Facility Number	Constituent	Release to Water (lbs/yr)	Release to POTW (lbs/yr)	Almost Certain to Exceed UTS	May Exceed UTS
66	Methyl Ethyl Ketone	0	1,484		✓
67	Acetone	0	5,900	✓	
67	Acetone	0	15,621	✓	
67	Acetone	0	731		✓
67	Methanol	0	272,100	✓	
67	Methanol	0	4,226		✓
67	Methyl Isobutyl Ketone	0	16,434	✓	
67	N-Butyl Alcohol	0	290,016	✓	
67	Phthalic Anhydride	0	250		✓
67	Phthalic Anhydride	0	250		✓
68	Aniline	0	17,155	✓	
69	Methanol	0	48,000	✓	
70	Ethylene Oxide	0	4,810	✓	
71	Barium Compounds	0	47,950	✓	
71	Phthalic Anhydride	0	26		✓
72	Methyl Isobutyl Ketone	5,600	0	✓	
73	Methanol	0	3,671		✓
73	N-Butyl Alcohol	0	4,838		✓
74	Methanol	0	176,375	✓	
75	Methanol	0	480,000	✓	
76	Methyl Methacrylate	0	250		✓
77	Aniline	0	392,304	✓	
78	Trichlorofluoromethane	22	0		✓
79	Pyridine	0	5,802	✓	
80	N-Butyl Alcohol	0	38,191	✓	
81	Methyl Methacrylate	0	172		✓
82	Acetone	28,000	0	✓	
82	Barium Compounds	0	28,000	✓	
82	Barium Compounds	0	3,114		✓
83	Ethylene Oxide	142	0		✓
83	Methanol	19,795	0		✓
84	Chloroprene	42	0		✓
85	Chloroprene	0	22,912	✓	
85	Methanol	0	2,691,557	✓	
86	Xylene (Mixed Isomers)	0	4,658	✓	
87	Acetone	0	750		✓

Table A-1

SUMMARY OF TRI LOADINGS DATA FOR FACILITIES WITH WASTESTREAMS CONTAINING NON-PRIORITY UTS CONSTITUENTS AT LEVELS EXCEEDING UTS

Facility Number	Constituent	Release to Water (lbs/yr)	Release to POTW (lbs/yr)	Almost Certain to Exceed UTS	May Exceed UTS
87	Acetone	0	250		✓
87	Methanol	0	9,902		✓
87	Methanol	0	2,321		✓
87	Methyl Methacrylate	0	250		✓
87	Xylene (Mixed Isomers)	0	250		✓
88	Methanol	0	48,600	✓	
89	Acetone	0	250		✓
89	Methanol	0	140,438	✓	
89	Methanol	0	30,000		✓
90	Trichlorofluoromethane	15	420	✓	
91	Ethylene Oxide	3	766	✓	
92	Acetone	0	1,900	✓	
93	Methanol	0	2,572,915	✓	
93	Methyl Ethyl Ketone	0	57,285	✓	
94	Acetone	0	365		✓
94	Aniline	0	23,000	✓	
94	Barium Compounds	0	13,623	✓	
95	Methanol	0	407,300	✓	
96	N-Butyl Alcohol	0	183,037	✓	
97	Methyl Isobutyl Ketone	0	48,000	✓	
97	O-Xylene	0	22,700	✓	
98	Acetone	3,026	0		✓
98	Ethylene Oxide	250	0		✓
98	Ethylene Oxide	0	250		✓
98	Methyl Isobutyl Ketone	560	0		✓
98	Xylene (Mixed Isomers)	250	0		✓
99	Acetone	0	229		✓
99	Acetone	0	250		✓
99	Barium Compounds	0	95,000	✓	
100	Acetone	0	688		✓
101	Methanol	250	140,000	✓	
101	Methanol	19,500	0		✓
101	Xylene (Mixed Isomers)	250	0		✓
102	Methanol	0	11,860		✓
103	Methanol	0	1,257,129	✓	
104	Methanol	2,970	0		✓

Table A-1

SUMMARY OF TRI LOADINGS DATA FOR FACILITIES WITH WASTESTREAMS CONTAINING NON-PRIORITY UTS CONSTITUENTS AT LEVELS EXCEEDING UTS

Facility Number	Constituent	Release to Water (lbs/yr)	Release to POTW (lbs/yr)	Almost Certain to Exceed UTS	May Exceed UTS
104	Methyl Isobutyl Ketone	84	0		✓
104	Xylene (Mixed Isomers)	130	0		✓
105	Methanol	0	2,700,000	✓	
105	Methyl Methacrylate	0	250		✓
106	Aniline	0	250		✓
107	Methyl Ethyl Ketone	0	250		✓
108	Methanol	0	4,200		✓
109	Acetone	0	5,773	✓	
109	Methanol	0	6,975		✓
110	Methanol	0	151,000	✓	
111	O-Cresol	0	33,225	✓	
111	Xylene (Mixed Isomers)	0	250		✓
111	Xylene (Mixed Isomers)	0	110		✓
112	Methyl Methacrylate	0	250		✓
113	Methanol	0	4,521		✓
114	Acetone	0	32,000	✓	
114	Methyl Ethyl Ketone	0	619		✓
115	Methyl Ethyl Ketone	598	0		✓
116	Methanol	0	4,000,000	✓	
117	Aniline	750	0		✓
117	Methyl Ethyl Ketone	1,500	0		✓
117	Xylene (Mixed Isomers)	220	0		✓
118	Acetone	0	2,633	✓	
118	Methanol	0	93,300	✓	
119	Acetone	250	0		✓
119	Acetone	0	9,900	✓	
119	Acetone	0	250		✓
119	Cresol (Mixed Isomers)	250	0		✓
119	Methanol	0	48,600	✓	
119	Methanol	3,855	0		✓
119	Methanol	13,000	0		✓
119	O-Xylene	470	0		✓
120	Acetone	0	650,000	✓	
120	Acrylamide	0	53,638		✓
121	Acetone	0	25,000	✓	
121	Methyl Ethyl Ketone	0	3,891	✓	

Table A-1

SUMMARY OF TRI LOADINGS DATA FOR FACILITIES WITH WASTESTREAMS CONTAINING NON-PRIORITY UTS CONSTITUENTS AT LEVELS EXCEEDING UTS

Facility Number	Constituent	Release to Water (lbs/yr)	Release to POTW (lbs/yr)	Almost Certain to Exceed UTS	May Exceed UTS
122	Acetone	0	420,665	✓	
122	M-Cresol	0	449		✓
123	Acetone	0	250		✓
124	Aniline	0	3,000		✓
125	Aniline	0	33,000	✓	
126	Xylene (Mixed Isomers)	250	0		✓
127	Aniline	0	300,000	✓	
127	Ethylene Oxide	0	127		✓
127	Methanol	0	193,000	✓	
127	Methanol	100,000	0	✓	
127	Methyl Methacrylate	0	250		✓
128	Ethylene Oxide	0	5,200	✓	
128	Methanol	99,000	0	✓	
128	Methanol	0	35,000	✓	
128	Methyl Isobutyl Ketone	0	5,200	✓	
128	O-Xylene	0	120		✓
129	Pyridine	0	43,000	✓	
131	Acetone	0	337,709	✓	
131	Acetone	0	371		✓
132	Methanol	6,608	0		✓
133	Methanol	4,500	0		✓
134	Acetone	393	0		✓
134	Methanol	9,137	0		✓
135	Methyl Methacrylate	10,000	0	✓	
136	Methyl Ethyl Ketone	0	250		✓
136	Methyl Methacrylate	0	11,197	✓	
137	Methanol	0	14,760		✓
137	Methanol	0	2,641		✓
138	N-Butyl Alcohol	0	53,347	✓	
139	Methanol	0	3,600		✓
140	Acetone	0	8,913	✓	
141	Methyl Isobutyl Ketone	0	680		✓
142	Phthalic Anhydride	0	250		✓
142	Xylene (Mixed Isomers)	0	250		✓
143	Methyl Ethyl Ketone	250	0		✓
144	Methanol	0	191,475	✓	

Table A-1

SUMMARY OF TRI LOADINGS DATA FOR FACILITIES WITH WASTESTREAMS CONTAINING NON-PRIORITY UTS CONSTITUENTS AT LEVELS EXCEEDING UTS

Facility Number	Constituent	Release to Water (lbs/yr)	Release to POTW (lbs/yr)	Almost Certain to Exceed UTS	May Exceed UTS
145	Trichlorofluoromethane	370	0	✓	
146	Methyl Isobutyl Ketone	0	135		✓
147	Acetonitrile	33,000	0		✓
148	Acetone	0	18,500	✓	
148	Acetone	0	198,200	✓	
148	Ethylene Oxide	0	250		✓
148	Methanol	0	1,100,000	✓	
148	N-Butyl Alcohol	0	2,489		✓
148	O-Xylene	0	1,353		✓
149	Methanol	0	310,000	✓	
149	N-Butyl Alcohol	0	23,200		✓
150	Methyl Ethyl Ketone	0	94		✓
150	Xylene (Mixed Isomers)	0	750		✓
151	Barium Compounds	0	500		✓
152	Acetone	0	6,900	✓	
152	Aniline	0	266		✓
152	Methanol	0	402,601	✓	
153	Acetone	6,700	20	✓	
153	Xylene (Mixed Isomers)	0	664		✓
154	Ethylene Oxide	0	9,815	✓	
155	Xylene (Mixed Isomers)	250	0		✓
156	Barium Compounds	1,534	0		✓
156	Barium Compounds	0	1,212		✓
156	Xylene (Mixed Isomers)	3,100	0		✓
157	Methanol	0	47,042	✓	
157	Xylene (Mixed Isomers)	0	250		✓
158	Methanol	0	2,100		✓
159	Methanol	0	5,600		✓
159	Methanol	0	125,883	✓	
159	Methanol	0	1,200,000	✓	
160	Aniline	0	22,022	✓	
160	N-Butyl Alcohol	0	32,077		✓
161	Methanol	0	852,933	✓	
161	Methanol	0	150,000	✓	
162	Methanol	0	2,400		✓
162	Methyl Ethyl Ketone	0	7,737	✓	

Table A-1

SUMMARY OF TRI LOADINGS DATA FOR FACILITIES WITH WASTESTREAMS CONTAINING NON-PRIORITY UTS CONSTITUENTS AT LEVELS EXCEEDING UTS

Facility Number	Constituent	Release to Water (lbs/yr)	Release to POTW (lbs/yr)	Almost Certain to Exceed UTS	May Exceed UTS
163	Acetone	0	63,252	✓	
163	Methanol	0	8,711		✓
164	Acetonitrile	0	100,000	✓	
165	Acetone	0	5,000	✓	
165	Methyl Isobutyl Ketone	0	20,611	✓	
165	Methyl Methacrylate	0	8,452	✓	
166	Xylene (Mixed Isomers)	0	150,000	✓	
167	Methyl Isobutyl Ketone	0	10,522	✓	
167	Methyl Methacrylate	0	250		✓
168	Methanol	0	1,358,253	✓	
169	Methyl Methacrylate	0	660		✓
169	M-Xylene	0	250		✓
169	N-Butyl Alcohol	0	2,393		✓
169	P-Cresol	0	2,100		✓
170	Methanol	0	1,800,000	✓	
170	Methyl Ethyl Ketone	0	7,109	✓	
170	Methyl Ethyl Ketone	0	4,088	✓	
171	Aniline	0	750		✓
172	Aniline	0	2,100		✓
173	Carbon Disulfide	1,453	0		✓
173	Pyridine	15	0		✓
174	Aniline	2,900	0		✓
175	Acetone	12,317	0	✓	
176	Methanol	0	22,959		✓
177	Ethylene Oxide	0	250		✓
177	Methanol	0	4,654		✓
177	Methanol	0	800,000	✓	
178	Methyl Methacrylate	0	250		✓
178	N-Butyl Alcohol	0	6,808		✓
178	Xylene (Mixed Isomers)	0	250		✓
178	Xylene (Mixed Isomers)	0	250		✓
179	Xylene (Mixed Isomers)	2	136		✓
180	Methanol	0	670,000	✓	
181	O-Cresol	0	89		✓
181	Xylene (Mixed Isomers)	0	2,278	✓	
182	Acetone	0	420,000	✓	

Table A-1

SUMMARY OF TRI LOADINGS DATA FOR FACILITIES WITH WASTESTREAMS CONTAINING NON-PRIORITY UTS CONSTITUENTS AT LEVELS EXCEEDING UTS

Facility Number	Constituent	Release to Water (lbs/yr)	Release to POTW (lbs/yr)	Almost Certain to Exceed UTS	May Exceed UTS
182	Methanol	0	830,000	✓	
182	Xylene (Mixed Isomers)	0	797		✓
183	Acetone	0	33,283	✓	
183	N-Butyl Alcohol	0	399,089	✓	
183	Xylene (Mixed Isomers)	0	107		✓
183	Xylene (Mixed Isomers)	0	270		✓
184	Carbon Disulfide	0	7,774		✓
185	N-Butyl Alcohol	0	6,264		✓
186	Methanol	0	125,000	✓	
187	Methanol	50,900	0		✓
188	Methanol	6,500	0		✓
189	Pyridine	0	5		✓
190	Methanol	24,000	0		✓
191	Methyl Ethyl Ketone	200	0		✓
191	P-Cresol	913	0		✓
192	Methyl Isobutyl Ketone	1,966	0		✓
193	Acetone	13	628,885	✓	
193	Methanol	5,400	0		✓
193	O-Xylene	339	0		✓
194	Barium Compounds	750	0		✓
195	Acetonitrile	2,674	0		✓
195	N-Butyl Alcohol	6,300	0		✓
196	Methanol	46,000	0		✓
197	Aniline	815	0		✓
197	Aniline	7,419	0		✓
197	Ethylene Oxide	1,500	0		✓
197	Methanol	5,200	0		✓
197	Methanol	4,593	0		✓
198	Acetone	3,300	0		✓
198	Methyl Isobutyl Ketone	62	0		✓
199	Acetone	580	0		✓
199	Methanol	60,000	0		✓
200	Methyl Ethyl Ketone	570	0		✓
201	Methanol	27,000	0		✓
202	Aniline	1,700	200,000	✓	
203	N-Butyl Alcohol	6,500	0		✓

Table A-1

SUMMARY OF TRI LOADINGS DATA FOR FACILITIES WITH WASTESTREAMS CONTAINING NON-PRIORITY UTS CONSTITUENTS AT LEVELS EXCEEDING UTS

Facility Number	Constituent	Release to Water (lbs/yr)	Release to POTW (lbs/yr)	Almost Certain to Exceed UTS	May Exceed UTS
204	Barium Compounds	1,800	0		✓
205	Acetone	0	15,000	✓	
206	Acetone	250	0		✓
207	Methanol	0	5,700		✓
208	Barium Compounds	0	24,872	✓	
209	Methyl Methacrylate	0	50		✓
210	Methanol	0	4,000		✓
211	Xylene (Mixed Isomers)	0	12,277	✓	
212	Barium Compounds	0	24,000	✓	
213	Aniline	0	250		✓
214	Methanol	0	25,000		✓
215	Acetone	0	95		✓
215	Barium Compounds	0	2,560		✓
216	Methanol	0	2,642		✓
217	Acetone	0	250		✓
218	Trichlorofluoromethane	250	0		✓
219	Methanol	18,000	98		✓
219	Methanol	2,512	0		✓
219	Methyl Isobutyl Ketone	250	0		✓
219	Methyl Isobutyl Ketone	250	0		✓
220	Methanol	3,300	0		✓
221	Trichlorofluoromethane	9	0		✓
222	Methanol	1,100	85,000	✓	
223	N-Butyl Alcohol	0	23,983		✓
223	Xylene (Mixed Isomers)	0	234		✓
224	Pyridine	0	48		✓
225	Acetone	0	1,200		✓
225	Acetone	0	250		✓
225	Acetone	0	340,952	✓	
225	Barium Compounds	0	7,300		✓
225	N-Butyl Alcohol	0	21,708		✓
226	Methyl Methacrylate	750	0		✓
227	Barium Compounds	5,093	0		✓
228	Methanol	0	43,518	✓	
228	Methyl Isobutyl Ketone	0	250		✓
229	Acetone	0	275,800	✓	
230	Dichlorodifluoromethane	2,100	0		✓

Table A-1

SUMMARY OF TRI LOADINGS DATA FOR FACILITIES WITH WASTESTREAMS CONTAINING NON-PRIORITY UTS CONSTITUENTS AT LEVELS EXCEEDING UTS

Facility Number	Constituent	Release to Water (lbs/yr)	Release to POTW (lbs/yr)	Almost Certain to Exceed UTS	May Exceed UTS
231	Acetone	0	530,000	✓	
232	Methyl Isobutyl Ketone	0	750		✓
233	Cresol (Mixed Isomers)	0	956		✓

"Almost certain to exceed UTS" includes those wastestreams with constituent concentrations exceeding UTS at high-end flow rates. "May exceed UTS" includes those wastestreams with constituents exceeding UTS at low-end flow rates. Note that those wastestreams exceeding UTS at high-end flow rates also exceed UTS at low-end flow rates.

Appendix B

RESULTS OF SCREENING ANALYSES OF THE PETROLEUM REFINING INDUSTRY

Appendix B

RESULTS OF SCREENING ANALYSES OF THE PETROLEUM REFINING INDUSTRY

The petroleum refining industry consists of facilities primarily engaged in producing gasoline, kerosene, distillate fuel oils, residual fuel oils, and lubricants, through fractionation or straight distillation of crude oil, redistillation of unfinished petroleum derivatives, cracking or other processes (SIC code 2911). According to the 1987 Census of Manufactures, there are 309 establishments in this industry, 221 with 20 or more employees. Effluent guidelines for this industry were finalized in 1982. EPA currently is reviewing these guidelines and collecting preliminary data on the industry to determine whether to revise these guidelines. As part of this preliminary data gathering, EPA identified 192 refineries that were operating in 1991.

Approach for Identifying Facilities Affected by the Phase III LDR Rule

We identified facilities potentially affected by the rule based on facilities with wastestreams that met the following three criteria:

- Contained decharacterized ICRT wastewater;
- Managed in a land-based unit; and
- Contained non-priority UTS constituents at concentrations exceeding UTS.

Unfortunately, no single data source contained all the information required to assess these three criterion for all industries. Therefore, we relied on various sources to provide data, as well as support development of reasonable assumptions in developing estimates of the number of facilities and quantity of waste affected.

In particular, for the petroleum refining industry, we principally relied on the TRI database. We also collected information from the BRS, ISDB and PCS databases and through discussions with representatives from an industry trade association. We combined TRI loadings data and industry-specific data on flow rates for wastewater discharges to estimate the concentrations of non-priority UTS pollutants in facilities' wastestreams. We then compared these concentrations to UTS levels to identify facilities and wastestreams potentially exceeding UTS. In addition, since TRI does not contain information on waste management practices, we considered data from other sources to evaluate facilities likely to manage ICRT wastewaters in surface impoundments. Below we outline the steps and assumptions used in the analysis in more detail.

Step 1: Using TRI data, identify facilities that report discharges of a non-priority UTS pollutants to POTWs or to surface waters and collect data on the reported loadings for each facility by constituent.

Step 2: Evaluate the flow rate of wastewater discharges by facilities in the industry. Establish low-end and high-end estimates of flow rates.

Step 3: Apply low-end and high-end flow rate estimates to the TRI loadings data to identify facilities almost certain to have wastestreams with constituents concentrations exceeding UTS levels (i.e., UTS exceedances even at very high wastewater flows) and facilities that might have wastestreams exceeding UTS levels (i.e., exceedances at very low wastewater flows).

Step 4: Adjust the resulting estimate of the number of affected facilities to reflect the likelihood that facilities in the industry manage and treat their decharacterized ICRT wastes in surface impoundments.

This approach may understate the number of facilities affected by the rule primarily for two reasons. First, the TRI database only includes data on 48 of the 101 non-priority UTS constituents. Second, only those facilities generating more than 10,000 pounds of TRI constituents per year are required to report to TRI. Smaller facilities that manage ICRT wastewaters in surface impoundments also could be affected by the rule. Our approach also may overstate the number of facilities and quantity of waste affected because we did not adjust our estimates to account for whether the identified wastestreams contain decharacterized ICRT wastes.

Results

Based on our analysis, we found that eight facilities are almost certain to be affected and an additional 22 facilities may be affected by the rule. Below we summarize how we calculated these estimates and provide additional information characterizing the industry.

In 1992, 202 petroleum refiners reported releases of TRI chemicals, with 155 reporting releases to water or to POTWs. These 202 facilities are likely to include most of the petroleum refiners potentially affected by the rule; 202 facilities approximately equals the number of facilities in operation in 1991 (192), as identified by EPA in its preliminary data search. Of the 155 facilities reporting releases to water or to POTWs, 108 reported a quantifiable discharge of at least one of the non-priority UTS pollutants. Of these 108 facilities, 69 directly discharged wastewaters to surface waters, 30 discharged wastewaters to POTWs, and nine did both. Wastewaters from these facilities contained at least one of 10 non-priority UTS pollutants, including xylene, methanol, methyl ethyl ketone, methyl isobutyl ketone, acetone, butanol, acetonitrile, pyridine, cresol or barium.

To assess the number of affected facilities, we combined the TRI loadings data with low-end and high-end wastewater flow rates for petroleum refining facilities and compared the resulting concentration estimates to UTS levels. Based on this analysis, we found that 16 facilities are likely to be affected by the rule because they generate wastewaters containing non-priority UTS constituents exceeding UTS levels at high-end flow rates of 10 million gallons per day for direct dischargers and 1.77 million gallons per day for indirect dischargers. This analysis also showed that an additional 42 facilities may be affected by the rule, based on a low-end flow rate of 250,000 gallons per day for direct dischargers and 200,000 gallons per day for indirect dischargers. These

flow rates are based on 1983 data from the ISDB. The high-end and low-end values represent the 95th percentile and 5th percentile values for the facilities in that database.[1] Table B-1 shows the loadings for the pollutants of concern for these 58 facilities.

We adjusted this estimated range of the affected number of facilities to reflect the number of facilities likely to manage wastewaters in surface impoundments. The PCS database shows that 262 petroleum refiners have NPDES permits and 105 of these facilities reported treatment information. Based on an analysis of these treatment type data, 55 facilities use treatment types likely to occur in land-based units.[2] Comparing the number of facilities with land-based units to the total number of facilities for which treatment data were available, we estimated that 52 percent of petroleum refining facilities use surface impoundments.

Applying this 52 percent to the TRI analysis, we estimated that eight to 30 facilities may be affected by the rule. In addition, we estimated that the quantity of wastewater generated by these facilities ranges from 10.7 to 86.2 million tons per year.[3] This estimated range is based on an average flow rate for direct dischargers of 3.22 million gallons per day and indirect dischargers of 720,000 gallons per day.[4]

In our analysis, we assumed that all facilities manage decharacterized ICRT wastes in their surface impoundments. To check this assumption, we analyzed data from the BRS to evaluate the quantity of ICRT waste generated and managed in land-based units. Unfortunately, this analysis did not yield a meaningful check on our assumption due to uncertainty over the quality of the BRS data. Based on 1991 BRS data, petroleum refiners managed 4.3 million tons of ICRT wastewaters in land-based units. However, EPA believes that this value understates the quantity of decharacterized ICRT wastewaters managed in land-based units because many facilities did not

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[1] The 5th percentile of a range of values (e.g., flow rates for facilities in ISDB) means that 95 percent of the values in the range are greater than that value. Similarly, the 95th percentile means that five percent of the values are greater than that value.

[2] Treatment types assumed to occur in land-based units included evaporation; sedimentation; equalization; neutralization; aerated, polishing, and sludge lagoons; oxidation, stabilization, and holding ponds; aerobic digestion; and extended aeration.

[3] In discussions with a petroleum refining industry trade association, it indicated that 100 million tons per year was a reasonable estimate of the quantity of waste potentially affected by the rule, Our upper bound estimate is of a similar magnitude and our lower bound estimate reflects the fact that most wastewaters managed by facilities in surface impoundments may not contain non-priority UTS pollutant at concentrations exceeding UTS.

[4] For the lower bound of this range: 720,000 gallons per day x 365 days per year x 0.004171 tons per gallon x 7.5 indirect dischargers + 3.22 million gallons per day x 365 x 0.004171 x 0.5 direct dischargers = 10.7 million tons per year. The upper bound is calculated in a similar fashion based on 30 facilities, 16 indirect dischargers and 14 direct dischargers, and the applicable flow rates.

report wastes that were diluted immediately upon generation as hazardous wastes.[5] This may explain the disparity between our estimated range and the BRS total. Thus, we were unable to use these data to evaluate the reasonableness of our assumption.

As indicated above, the lack of information on ICRT wastes in the TRI database may cause our analysis to overstate the effects of the Phase III LDR rule. Equally important in identifying the limitations of our TRI analysis is recognition that the analysis of the TRI data does not consider 53 non-priority UTS constituents and thus may underestimate the effects of the rule. Petroleum refiners already control for one of these pollutants, sulfides, as part of the effluent guidelines. The impacts of the rule due to the remaining non-priority pollutants is unclear.

[5] In fact, such wastes should have been included in the BRS; however, EPA discussions with industry suggest that this requirement has been broadly misinterpreted in the past.

Table B-1

SUMMARY OF TRI LOADINGS DATA FOR FACILITIES WITH WASTESTREAMS CONTAINING NON-PRIORITY UTS CONSTITUENTS AT LEVELS EXCEEDING UTS

Facility Number	Constituent	Release to Water (lbs/yr)	Release to POTW (lbs/yr)	Almost Certain to Exceed UTS	May Exceed UTS
1	XYLENE (MIXED ISOMERS)	250	0		✓
2	P-XYLENE	250	0		✓
2	O-XYLENE	250	0		✓
2	M-XYLENE	250	0		✓
3	XYLENE (MIXED ISOMERS)	0	220		✓
4	XYLENE (MIXED ISOMERS)	0	40,000	✓	
4	METHANOL	0	160,000	✓	
5	XYLENE (MIXED ISOMERS)	0	670		✓
6	XYLENE (MIXED ISOMERS)	289	0		✓
7	XYLENE (MIXED ISOMERS)	0	6,400	✓	
8	XYLENE (MIXED ISOMERS)	0	750		✓
9	P-XYLENE	0	634		✓
9	O-XYLENE	0	634		✓
10	XYLENE (MIXED ISOMERS)	0	250		✓
11	XYLENE (MIXED ISOMERS)	0	265		✓
12	XYLENE (MIXED ISOMERS)	0	2,963	✓	
13	XYLENE (MIXED ISOMERS)	0	11,000	✓	
14	M-XYLENE	310	5		✓
15	XYLENE (MIXED ISOMERS)	0	22,000	✓	
16	XYLENE (MIXED ISOMERS)	0	750		✓
17	XYLENE (MIXED ISOMERS)	0	210		✓
18	P-XYLENE	0	650		✓
18	O-XYLENE	0	650		✓
18	M-XYLENE	0	1,301		✓
19	XYLENE (MIXED ISOMERS)	250	0		✓
20	XYLENE (MIXED ISOMERS)	0	2,600	✓	
21	XYLENE (MIXED ISOMERS)	0	690		✓
22	XYLENE (MIXED ISOMERS)	0	640		✓
23	M-XYLENE	244	0		✓
24	XYLENE (MIXED ISOMERS)	5	250		✓
25	XYLENE (MIXED ISOMERS)	288	0		✓
25	METHYL ETHYL KETONE	220	0		✓

Table B-1

SUMMARY OF TRI LOADINGS DATA FOR FACILITIES WITH WASTESTREAMS CONTAINING NON-PRIORITY UTS CONSTITUENTS AT LEVELS EXCEEDING UTS

Facility Number	Constituent	Release to Water (lbs/yr)	Release to POTW (lbs/yr)	Almost Certain to Exceed UTS	May Exceed UTS
26	XYLENE (MIXED ISOMERS)	314	0		✓
26	METHYL ETHYL KETONE	1,016	0		✓
26	BARIUM COMPOUNDS	17,049	0		✓
27	METHYL ETHYL KETONE	1,200	0		✓
27	ACETONE	1,500	0		✓
28	XYLENE (MIXED ISOMERS)	1,500	0		✓
29	BARIUM COMPOUNDS	3,286	0		✓
30	XYLENE (MIXED ISOMERS)	823	0		✓
30	METHYL ISOBUTYL KETONE	117	0		✓
30	METHYL ETHYL KETONE	1,052	0		✓
30	BARIUM COMPOUNDS	6,890	0		✓
31	P-XYLENE	0	68,900	✓	
31	O-XYLENE	0	26,500	✓	
31	METHYL ETHYL KETONE	0	1,300		✓
31	M-XYLENE	0	68,900	✓	
32	XYLENE (MIXED ISOMERS)	250	6,200	✓	
33	XYLENE (MIXED ISOMERS)	1,062	0		✓
33	METHYL ISOBUTYL KETONE	200	0		✓
34	XYLENE (MIXED ISOMERS)	790	0		✓
35	METHYL ETHYL KETONE	7,000	0		✓
36	XYLENE (MIXED ISOMERS)	0	3,360	✓	
37	XYLENE (MIXED ISOMERS)	260	0		✓
37	PYRIDINE	9,400	0	✓	
37	ACETONE	2,300	0		✓
38	METHANOL	4,500	0		✓
39	XYLENE (MIXED ISOMERS)	0	1,110		✓
39	ACETONE	0	1,266		✓
40	ACETONE	0	140,000	✓	
41	BARIUM COMPOUNDS	1,400	0		✓
42	XYLENE (MIXED ISOMERS)	0	4,678	✓	
43	XYLENE (MIXED ISOMERS)	250	0		✓
44	XYLENE (MIXED ISOMERS)	5	780		✓

Table B-1

SUMMARY OF TRI LOADINGS DATA FOR FACILITIES WITH WASTESTREAMS CONTAINING NON-PRIORITY UTS CONSTITUENTS AT LEVELS EXCEEDING UTS

Facility Number	Constituent	Release to Water (lbs/yr)	Release to POTW (lbs/yr)	Almost Certain to Exceed UTS	May Exceed UTS
45	XYLENE (MIXED ISOMERS)	250	0		✓
46	METHYL ETHYL KETONE	220	0		✓
47	P-XYLENE	0	486		✓
47	O-XYLENE	0	636		✓
47	M-XYLENE	0	1,302		✓
47	CRESOL (MIXED ISOMERS)	0	8,566	✓	
47	BARIUM	0	1,725		✓
48	XYLENE (MIXED ISOMERS)	5	7,025	✓	
49	CRESOL (MIXED ISOMERS)	14	29,500	✓	
50	METHYL ETHYL KETONE	250	0		✓
51	XYLENE (MIXED ISOMERS)	530	0		✓
52	XYLENE (MIXED ISOMERS)	0	29,000	✓	
52	METHANOL	0	76,000	✓	
53	XYLENE (MIXED ISOMERS)	250	0		✓
54	METHYL ETHYL KETONE	7,400	0		✓
55	XYLENE (MIXED ISOMERS)	5	250		✓
56	XYLENE (MIXED ISOMERS)	5	250		✓
57	XYLENE (MIXED ISOMERS)	481	0		✓
58	XYLENE (MIXED ISOMERS)	1,079	0		✓
58	P-XYLENE	1,043	0		✓

"Almost certain to exceed UTS" includes those wastestreams with constituent concentrations exceeding UTS at high-end flow rates. "May exceed UTS" includes those wastestreams with constituents exceeding UTS at low-end flow rates. Note that those wastestreams exceeding UTS at high-end flow rates also exceed UTS at low-end flow rates.

Appendix C

RESULTS OF SCREENING ANALYSES OF THE PESTICIDES INDUSTRY

Appendix C

RESULTS OF SCREENING ANALYSES OF THE PESTICIDES INDUSTRY

The pesticides industry includes both manufacturers and formulators/packagers.[1] Pesticide manufacturing facilities produce the pesticide active ingredients. Formulators/packagers process active ingredients with other ingredients into pesticide formulations and package them for distribution and sale. Of the two sectors of the pesticides industry, the pesticide manufacturing sector is of greater concern for the purposes of the Phase III LDR rule because facilities in this sector are more likely to generate wastewaters of concern and to manage them in land-based units.

In developing effluent guidelines for the pesticides manufacturing industry, EPA divided the industry into two subcategories: (1) facilities that produce organic pesticide chemicals, and (2) facilities that manufacture metallo-organic pesticide chemicals. These facilities typically are classified under SIC 2879 (pesticides and agricultural chemicals not elsewhere classified). These facilities also may be part of an integrated chemical manufacturing plant that produces other chemical products and may be classified under one or more of the following SIC groups within Chemical and Allied Products (SIC code 28): 2833, 2834, 2842, 2843, 2861, 2865, 2869, or 2899. EPA promulgated the final rule for the effluent guidelines for the pesticides industry in September 1993.

According to 1986 data collected by EPA in support of the pesticide manufacturing effluent guidelines, the pesticide chemicals manufacturing industry includes 90 facilities. Over half of these pesticide manufacturing facilities also conduct pesticide formulating and packaging activities. In addition, more than half of the pesticide manufacturing facilities are also currently regulated under the effluent guidelines for the Organic Chemicals, Plastics, and Synthetic Fibers (OCPSF) industry category. Of these 90 facilities, 32 facilities are direct dischargers, 36 are indirect dischargers, 15 facilities dispose of their wastewaters by either on-site or off-site deep well injection or incineration, and eight facilities do not generate process wastewater because they recycle, reuse or do not use water.[2]

There are approximately 128 pesticide active ingredients and classes of pesticide active ingredients representing 186 individual active ingredients manufactured by 225 separate production processes. Of these 225 processes, 178 are batch processes. A "typical" facility in the pesticide industry manufactures only one active ingredient and is the only facility in the country producing that pesticide active ingredient. "Typical" production is between 1,000,000 and 10,000,000 pounds of total product per year.

Because of the wide variety of raw materials and processes used and products manufactured, a wide variety of pollutants are found in this industry's wastewaters. Pesticide manufacturers use a range of in-plant and end-of-pipe controls to treat these pollutants, such as steam stripping,

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[1] This appendix is largely drawn from an analysis of the effluent guideline Section 308 data for this industry conducted by Radian Corporation.

[2] The sum of this breakdown exceeds 90 because one facility was counted under two categories.

biological treatment, activated carbon, chemical oxidation, and hydrolysis. In the effluent guidelines surveys, pesticide manufacturing facilities reported three types of wastewaters: pesticide active ingredient process wastewaters, other pesticide wastewaters, and other facility wastewaters. Pesticide active ingredient process wastewaters are those waters leaving the manufacturing process. Other pesticide wastewaters are pesticide-containing wastewater generated from sources not directly associated with the manufacturing process, such as employee shower water or contaminated stormwater. Other facility wastewaters are generated by other manufacturing operations, such as organic chemicals production occurring at the facility.

Approach for Identifying Facilities Affected by the Phase III LDR Rule

We identified facilities potentially affected by the rule based on facilities with wastestreams that met the following three criteria:

- Contained decharacterized ICRT wastewater;
- Managed in a land-based unit; and
- Contained non-priority UTS constituents at concentrations exceeding UTS.

Unfortunately, no single data source contained all the information required to assess these three criterion for all industries. Therefore, we relied on various sources to provide data, as well as support development of reasonable assumptions in developing estimates of the number of facilities and quantity of waste affected.

Because the effluent guidelines data for this industry only provided concentration data on one non-priority UTS constituent (methoxychlor), we relied largely on TRI data to assess the number of facilities that may be affected by the rule. In our analysis, we combined TRI loadings data and industry-specific data on flow rates for wastewater discharges to estimate the concentrations of these constituents in facilities' wastestreams. We then compared these concentration levels to UTS levels to identify facilities and wastestreams potentially exceeding UTS. In addition, since TRI does not contain information on waste management practices, we considered data from other sources to evaluate facilities likely to manage ICRT wastewaters in surface impoundments. Below we outline the steps and assumptions used in the analysis in more detail.

Step 1: Using TRI data, identify facilities that report discharges of a non-priority UTS pollutants to POTWs or to surface waters and collect data on the reported loadings for each facility by constituent.

Step 2: Evaluate the flow rate of wastewater discharges by facilities in the industry.

Step 3: Applying the flow rate estimate to the TRI loadings data, identify facilities may have wastestreams exceeding UTS levels.

Step 4: Eliminate from the universe of affected facilities those facilities that are indirect dischargers. Indirect dischargers were eliminated from the Phase III universe because these facilities generally are the smaller facilities in the category, are located close to POTWs and use their services, and do not have wastewater flow rates of large enough quantities to use a land-based unit.

Assumption: To retain as many facilities as possible in this analysis, it was assumed that all direct dischargers use land-based units as part of their wastewater treatment systems.

This approach may understate the number of facilities affected by the rule for two reasons. First, the TRI database only includes data on 48 of the 101 non-priority UTS constituents. Second, only those facilities generating more than 10,000 pounds of TRI constituents per year are required to report to TRI. Smaller facilities that manage ICRT wastewaters in surface impoundments also could be affected by the rule.

Results

Based on the results of the analysis of the TRI data, we estimated that one facility may be affected by the rule. Below we summarize the results of this analysis and provide additional information characterizing the industry.

In 1992, 207 facilities in SIC code 2879 reported releases to TRI, 91 of which reported releases to surface waters or POTWs.[3] Of these 91 facilities, 51 facilities reported a quantifiable discharge of at least one of the 101 non-priority UTS pollutants; 20 facilities directly discharged to surface waters, 30 discharged their wastewaters to POTWs, and one did both.

For the 20 direct dischargers, we identified one facility that may be affected by the rule because it generates wastewaters containing UTS pollutants at concentrations exceeding UTS levels, assuming an average flow rate of 2.33 million gallons per day.[4] Wastewater at this facility contained methyl isobutyl ketone. We estimated that the quantity of wastewater affected at this facility is

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[3] The TRI data record multiple SIC codes for facilities that report multiple SIC codes because they manufacture more than one product. Our analysis included all observations with 2879 anywhere in the SIC code field (i.e., SIC 2879 may not be the primary code of the facility). This approach may overstate the effects of the rule on this industry, if the affected wastewater identified in the analysis is generated during the manufacture of a product other than pesticides.

[4] This average flow rate was taken from van der Leeden, Frits, Fred L. Troise and David Keith Todd, *The Water Encyclopedia*, Lewis Publishers, 1990. See Table 5-39 for data on water use in the pesticide industry. We were unable to obtain flow rate data from the effluent guidelines development documents that could be used to estimate a lower bound flow rate.

about 3.5 million tons.[5] Table C-1 shows the loadings data for this facility. We also found potential exceedances of UTS constituents at 13 indirect dischargers. However, as previously explained, only direct dischargers within this industry are likely to operate surface impoundments. Therefore, we do not believe these facilities will be affected by the rule. Thus, we estimated that only one facility will be affected by the Phase III rule. This facility represents approximately one percent of the 90 pesticide facilities.

In addition, we analyzed the effluent guidelines data to determine whether any facilities are likely to be affected by the rule due to exceedances for methoxychlor. Based on that analysis, we found only one facility generated wastewaters containing this constituent. However, the concentration level of the methoxychlor in the facility's wastestream did not exceed the UTS level, and thus this facility would not be affected by the rule.

In our analysis, we assumed that all direct dischargers in this industry manage wastewaters containing UTS constituents in surface impoundments. To review the reasonableness of this assumption, we evaluated PCS data. The PCS database showed that 43 pesticide manufacturers have NPDES permits, 11 of which reported information on treatment type.[6] Based on an analysis of treatment types, five of these 11 facilities (45 percent) manage their wastewaters in land-based units.[7] This suggests that our assumption that all direct dischargers use surface impoundments is very conservative.

In addition, we reviewed the BRS to evaluate the quantity of ICR waste managed in land-based units by the pesticides industry. Based on this analysis, pesticide manufacturers managed 418,000 tons of ICR wastes in land-based units in 1991. However, EPA believes that this value may understate the quantity of decharacterized ICR wastewaters managed in land-based units because many facilities did not report wastes that were diluted immediately upon generation as hazardous wastes.[8] This may explain why our estimated quantity exceeds the quantity of ICR managed in land-based units reported in BRS. Thus, it is difficult to use these data to evaluate the reasonableness of our assumption.

The primary limitation of this analysis is that the TRI data does not consider 53 non-priority UTS constituents and thus may underestimate the effects of the rule. Ten of these 53 non-priority UTS constituents are pesticides addressed under the effluent guidelines for this industry. The impacts of the rule due to the remaining non-priority pollutants are unclear.

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[5] This estimated quantity was calculated as follows: 2.33 million gallons per day x 365 days per year x 0.004171 tons per gallon x 1 facility = 3.5 million tons.

[6] Reporting of treatment type is optional in PCS.

[7] Treatment types assumed to occur in land-based units included evaporation; sedimentation; equalization; neutralization; aerated, polishing and sludge lagoons, oxidation, stabilization and holding ponds; aerobic digestion; and extended aeration.

[8] In fact, such wastes should have been included in BRS; however, EPA discussions with industry suggest that this requirement has been broadly misinterpreted in the past.

Table C-1

SUMMARY OF TRI LOADINGS DATA FOR FACILITIES WITH WASTESTREAMS CONTAINING NON-PRIORITY UTS CONSTITUENTS AT LEVELS EXCEEDING UTS

Facility Number	Constituent	Release to Water (lbs/yr)	Release to POTW (lbs/yr)	May Exceed UTS[1]
1	Methyl Isobutyl Ketone	1,966	0	✓

1. Based on an average flow rate of 2.33 million gallons per day.

Appendix D

RESULTS OF SCREENING ANALYSES OF THE INORGANIC CHEMICAL INDUSTRY

Appendix D

RESULTS OF SCREENING ANALYSES OF THE INORGANIC CHEMICAL INDUSTRY

The inorganic chemicals industry includes facilities manufacturing alkalies and chlorine, industrial gases, inorganic pigments, and other inorganic chemicals (SIC codes 2812 through 2819). According to the 1987 Census of Manufactures, there are 1,393 establishments in this industry, up from 1,365 based on the 1982 Census. Note that these values include some double counting because a facility may operate within two or more of these four digit SIC codes. In 1982, there were 802 facilities classified under SIC 821.

Effluent guidelines for this industry were finalized in 1982. These guidelines principally addressed priority pollutants. No information on the non-priority pollutants of concern for the Phase III LDR rule were available from the effluent guideline development documents. The Office of Water currently is reviewing guidelines for this industry.

Approach for Identifying Facilities Affected by the Phase III LDR Rule

We identified facilities potentially affected by the rule based on facilities with wastestreams that met the following three criteria:

- Contained decharacterized ICRT wastewater;
- Managed in a land-based unit; and
- Contained non-priority UTS constituents at concentrations exceeding UTS.

Unfortunately, no single data source contained all the information required to assess these three criterion for all industries. Therefore, we relied on various sources to provide data, as well as support development of reasonable assumptions in developing estimates of the number of facilities and quantity of waste affected.

In particular, for the inorganic chemicals industry, we principally relied on the TRI database. We also collected information from the BRS, PCS and Industrial D Screener Survey. We combined TRI loadings data and industry-specific data on flow rates for wastewater discharges to estimate the concentrations of these constituents in facilities' wastestreams. We then compared these concentration levels to UTS levels to identify facilities and wastestreams potentially exceeding UTS. In addition, since TRI does not contain information on waste management practices, we considered data from other sources to evaluate facilities likely to manage ICRT wastewaters in surface impoundments. Below we outline the steps and assumptions used in the analysis in more detail.

Step 1: Using TRI data, identify facilities that report discharges of non-priority UTS pollutants to POTWs or to surface waters and collect data on the reported loadings for each facility by constituent.

Step 2: Evaluate the flow rate of wastewater discharges by facilities in the industry. Establish low-end and high-end estimates of flow rates.

Step 3: Apply low-end and high-end flow rate estimates to the TRI loadings data to identify facilities almost certain to have wastestreams with constituents concentrations exceeding UTS levels (i.e., UTS exceedances even at very high wastewater flows) and facilities that might have wastestreams exceeding UTS levels (i.e., exceedances at very low wastewater flows).

Step 4: Adjust the resulting estimates of the number of affected facilities to reflect the likelihood that facilities in the industry manage and treat their decharacterized ICRT wastes in surface impoundments.

This approach may understate the number of facilities affected by the rule primarily for two reasons. First, the TRI database only includes data on 48 of the 101 non-priority UTS constituents. Second, only those facilities generating more than 10,000 pounds of TRI constituents per year are required to report to TRI. Smaller facilities that manage ICRT wastewaters in surface impoundments also could be affected by the rule.

Results

Based on our analysis, we found that three facilities are almost certain to be affected and an additional nine facilities may be affected by the rule. Below we summarize how we calculated these estimates and provide additional information characterizing the industry.

In 1992, 685 inorganic chemical manufacturing facilities reported releases of TRI chemicals, with 250 reporting releases to water or to POTWs. These 685 facilities are likely to reflect most of the inorganic chemical facilities potentially affected by the rule. That is, 685 compares well to the estimate of about 802 facilities in the entire industry. It is reasonable to assume that the remaining facilities do not use TRI chemicals in large enough quantities to report to TRI. Also, these smaller facilities are unlikely to use surface impoundments for treatment of ICRT wastewaters and thus probably would not be affected by the rule.

Of the 250 facilities reporting releases to water or to POTWs, 72 reported a quantifiable discharge of at least one of the 101 non-priority UTS pollutants. Of these 72 facilities, 28 directly discharged wastewaters to surface waters, 32 discharged wastewaters to POTWs, and 12 did both. Wastewaters from these facilities contained 17 UTS non-priority pollutant, including barium, methanol and acetone.

To assess the number of affected facilities, we combined the TRI loadings data with low-end and high-end wastestream flow rates for facilities in this industry and compared the resulting concentration estimates to UTS levels. Based on this analysis, we found that 17 facilities are likely to be affected by the rule because they generate wastewaters containing non-priority UTS constituents exceeding UTS levels at high-end flow rates of one million gallons per day. This analysis also showed that an additional 16 facilities may be affected by the rule, based on a low-end

flow rate of 50,000 gallons per day. Table D-1 shows the loadings levels for the pollutants of concern for these 33 facilities.

We adjusted this estimated range of the affected number of facilities to reflect the number of facilities likely to manage wastewaters in surface impoundments. The PCS database shows that 331 inorganic chemical facilities have NPDES permits (affecting 1,532 outfalls) and 89 of these facilities reported treatment information (affecting 215 outfalls).[1] Based on an analysis of the treatment data, 32 facilities reported treatment types likely to occur in surface impoundments, affecting 36 outfalls. Comparing the number of outfalls and facilities with land-based units to the total number of outfalls and facilities for which treatment data were available, we estimated that 17 to 36 percent of facilities use surface impoundments.[2] The number of inorganic chemical facilities reporting use of surface impoundments based on the Screening Survey of Industrial Subtitle D establishments, 26 percent, falls within this range. Based on the survey, of the 1,302 inorganic chemical facilities managing Subtitle D waste in 1985, 345 facilities managed these wastes in surface impoundments.

Applying this range of 17 to 36 percent to the TRI analysis, we estimated that three to twelve facilities, or less than one percent of the 685 inorganic chemical manufacturing facilities reporting to TRI, may actually be affected by the rule.[3] In addition, we estimated the quantity of wastewater generated by these affected facilities at between 1.0 and 4.5 million tons per year. This is based on an average flow rate for facilities in the industry of 250,000 gallons per day (average flow rate based on the effluent guidelines).[4]

In our analysis, we assumed that all facilities manage decharacterized ICRT wastes in their surface impoundments. This assumption is reasonable because a large portion of the industry relies on production activities occurring at high or low pH (i.e., corrosive). As a check on this assumption, we analyzed data from the BRS to evaluate the quantity of ICRT waste managed in land-based units. Our analysis for the inorganic chemicals industry indicated that 7.5 million tons of ICRT wastes are managed in land-based units for this industry. This quantity is the same order of magnitude as our estimate of the quantity of waste affected, suggesting that our approach is sound.

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[1]Reporting of treatment information to PCS is voluntary.

[2]Seventeen percent equals 36 outfalls with treatment in surface impoundments divided by 215 outfalls for which facilities reported treatment information. Thirty-six percent equals 32 facilities with treatment in surface impoundments divided by 89 facilities reporting treatment information.

[3]Sixteen facilities x 17 percent = 2.7 facilities (rounds up to 3 facilities); 33 facilities x 36 percent = 11.9 (rounds up to 12 facilities).

[4]For the lower bound of this range, 250,000 gallons per day x 365 days per year x 0.004171 tons per gallon x 2.7 facilities = 1.0 million tons. The upper bound is calculated in a similar fashion based on 11.9 facilities.

As noted above, the analysis of the TRI data does not consider 53 non-priority UTS constituents and thus may underestimate the effects of the rule. Of the 53 pollutants not considered, six are dioxins and furans and 13 are pesticides, which are unlikely to be a concern for the inorganic chemicals industry. The impacts of the rule due to the remaining non-priority pollutants is unclear. If the non-priority UTS organic pollutants omitted from TRI are present in wastewaters at concentration levels that are similar to the levels for the pollutants considered in TRI, the additional number of affected facilities is likely to be small. The only two inorganic pollutants not included in the analysis, fluoride and sulfide, are likely to be present at a number of inorganic chemical manufacturers. However, CWA permitting authorities may set limits for these pollutants at facilities where they are present in appreciable quantities (i.e., above UTS). As such, the impact of the rule for these two pollutants may be minor.

Table D-1

SUMMARY OF TRI LOADINGS DATA FOR FACILITIES WITH WASTESTREAMS CONTAINING NON-PRIORITY UTS CONSTITUENTS AT LEVELS EXCEEDING UTS

Facility Number	Constituent	Release to Water (lbs/yr)	Release to POTW (lbs/yr)	Almost Certain to Exceed UTS[1]	May Exceed UTS[1]
1	Barium	0	3,114		✓
1	Methanol	0	1,257,129	✓	
2	Barium	1,534	0		✓
3	Phthalic Anhydride	0	250	✓	
4	Barium	0	2,000		✓
5	Barium	1,060	0		✓
6	Barium	0	4,500	✓	
7	Methyl Isobutyl Ketone	440	0	✓	
7	Methanol	4,000	0		✓
8	Barium	782			✓
9	Methanol	52,769	26,765	✓	
10	Methanol	0	1,600		✓
11	Barium	0	250		✓
12	Barium	0	5,010	✓	
13	Carbon Disulfide	1,453	0		✓
14	Barium	2	3,001		✓
14	Methanol	0	5,362		✓
14	Acetone	0	6,860	✓	
15	Barium	11,000	0	✓	
16	Acetone	0	2,115	✓	
16	Acetonitrile	0	250,131	✓	
16	Methanol	0	5,182		✓
16	Methyl Ethyl Ketone	0	948	✓	
16	Methyl Isobutyl Ketone	0	132		✓
16	Methyl Methacrylate	17,001	4,780	✓	
17	Barium	0	2,560		✓
18	Acetone	6,400	0	✓	

Table D-1

SUMMARY OF TRI LOADINGS DATA FOR FACILITIES WITH WASTESTREAMS CONTAINING NON-PRIORITY UTS CONSTITUENTS AT LEVELS EXCEEDING UTS

Facility Number	Constituent	Release to Water (lbs/yr)	Release to POTW (lbs/yr)	Almost Certain to Exceed UTS[1]	May Exceed UTS[1]
19	Freon 113	960	0	✓	
20	Barium	750	0		✓
21	Methanol	0	1,608	✓	
22	Barium	0	24,200	✓	
23	Methanol	2,032	0		✓
24	Acetone	250	0		✓
24	Methyl Methacrylate	250	0		✓
25	Acetone	0	265		✓
26	Methanol	1,522	0		✓
27	Methanol	2,512	0		✓
28	Barium	580	0		✓
28	Xylene	300	0		✓
28	Acetone	8,100	0	✓	
28	Methyl Ethyl Ketone	11,000	0	✓	
28	Methyl Isobutyl Ketone	770	0	✓	
29	Methanol	0	368,462	✓	
30	Acetone	3,100	0	✓	
30	Aniline	250	0		✓
31	Vanadium	750	0		✓
32	Ethylene Oxide	58	0		✓
32	Acetone	8,600	0	✓	
32	Methanol	13,000	0		✓
32	Dichlorofluoromethane	2,100	0	✓	
33	Methanol	0	7,060		✓

1. "Almost certain to exceed UTS" includes those wastestreams with constituent concentration exceeding UTS at high-end flow rates. "May exceed UTS" includes those wastestreams with constituents exceeding UTS at low-end flow rates. Note that those wastestreams exceeding UTS at high-end flow rates also exceed UTS at low-end flow rates, although we have not included a ✓ in the last column for these wastestreams.

Appendix E

RESULTS OF SCREENING ANALYSES OF THE IRON AND STEEL INDUSTRY

Appendix E

RESULTS OF SCREENING ANALYSES OF THE IRON AND STEEL INDUSTRY

The iron and steel industry includes facilities in SIC codes 3312 through 3325. For the purposes of the water effluent guidelines, this industry has been broken into twelve subparts: coke making, sintering, iron making, steel making, vacuum degreasing, continuous casting, hot forming, salt bath descaling, acid pickling, cold forming, alkaline cleaning, and hot coating. The effluent guidelines for this industry were finalized in 1982. The development document for these guidelines, reports a total of 1,020 active plants (as of July 1981), 903 of which directly or indirectly discharge wastewater. In 1992, 870 iron and steel facilities reported releases of TRI chemicals.

Approach for Identifying Facilities Affected by the Phase III LDR Rule

We identified facilities potentially affected by the rule based on facilities with wastestreams that met the following three criteria:

- Contained decharacterized ICRT wastewater;
- Managed in a land-based unit; and
- Contained non-priority UTS constituents at concentrations exceeding UTS.

Due to a lack of effluent guideline data on non-priority UTS constituents in wastestreams generated by the iron and steel industry, we relied largely on TRI data to assess which facilities might have wastestreams containing non-priority constituents exceeding UTS levels. In our analysis, we combined TRI loadings data and industry-specific data on flow rates for wastewater discharges to estimate the concentrations of non-priority UTS constituents in facilities' wastestreams. We then compared these concentration levels to UTS levels to identify facilities with wastestreams potentially exceeding UTS. In addition, since TRI does not contain information on waste management practices, we considered data from other sources to evaluate facilities likely to manage ICRT wastewaters in surface impoundments. Below we outline the steps and assumptions used in the analysis in more detail.

Step 1: Using TRI data, identify facilities that report discharges of a non-priority UTS pollutants to POTWs or to surface waters and collect data on the reported loadings for each facility by constituent.

Step 2: Evaluate the flow rate of wastewater discharges by facilities in the industry. Establish low-end and high-end estimates of flow rates.

Step 3: Applying the low-end and high-end flow rate estimates to the TRI loadings data, identify facilities almost certain to have wastestreams with constituent concentrations exceeding UTS levels (i.e., UTS exceedances even at very high wastewater flows) and facilities that might have wastestreams exceeding UTS levels (i.e., exceedances at very low wastewater flows).

This approach may understate the number of facilities affected by the rule primarily for two reasons. First, the TRI database only includes data on 48 of the 101 non-priority UTS constituents. Second, only those facilities generating more than 10,000 pounds of TRI constituents per year are required to report to TRI. Smaller facilities that manage ICRT wastewaters in surface impoundments also could be affected by the rule.

Results

Based on our analysis, we found that no facilities are almost certain to be affected and four facilities may be affected by the rule. Below we summarize how we calculated these estimates and provide additional information characterizing the industry.

In 1992, 870 iron and steel manufacturing facilities reported releases of TRI chemicals, with 360 reporting releases to water or to POTWs. Of these 360 facilities, 17 reported a quantifiable discharge of at least one of the 101 non-priority UTS pollutants. Ten of these facilities directly discharged wastewaters to surface waters, four discharged wastewaters to POTWs, and three did both. Wastewaters from these facilities contained at least one of six non-priority UTS pollutants including barium, cresol, acetone, methanol, vanadium, or xylene.

To assess the number of affected facilities, we combined the TRI loadings data with low-end and high-end wastestream flow rates for facilities in this industry and compared the resulting concentration estimates to UTS levels. Based on our analysis considering high-end flow rates of 10 million gallons per day, we found that no facilities are likely to be affected by the rule because no facilities generate wastewaters containing non-priority UTS constituents exceeding UTS levels at these assumed flow rates. Based on a low-end flow rate of 250,000 gallons per day, we estimated that four facilities may be affected by the rule. The flow rate estimates are based on data from the effluent guidelines development documents. In addition, we estimated that the quantity of affected wastewater generated by these facilities is 3.0 million tons per year, based on an average flow rate for this industry of 500,000 gallons per day.[1] Table E-1 shows the loadings levels for the pollutants of concern for these four facilities.

The above analysis shows that the Phase III LDR rule is unlikely to have a large effect on the iron and steel industry. The four facilities represent far less than one percent of facilities in the industry. Furthermore, the above analysis did not consider whether these facilities manage wastewaters in surface impoundments and whether the wastestreams are likely to contain decharacterized ICRT wastes. We collected additional data related to these two factors for this industry, although we did not use this information to adjust the TRI analysis.

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[1] This quantity is calculated as follows: 500,000 gallons per day x 365 days per year x 0.004171 tons per gallon x 4 facilities = 3.0 million gallons per year.

The PCS database shows that 329 iron and steel manufacturing facilities have NPDES permits and 106 of these facilities reported treatment information.[2] Based on an analysis of the treatment data, seven facilities reported treatment types likely to occur in surface impoundments.[3] Comparing the number of facilities with land-based units to the total number of facilities for which treatment data were available, we estimated that seven percent of facilities use surface impoundments.[4] Also the number of iron and steel facilities reporting use of surface impoundments based on the Screening Survey of Industrial Subtitle D establishments is a similar magnitude, nine percent. Based on that survey, of the 2,151 facilities managing Subtitle D waste in 1985, 185 facilities managed these wastes in surface impoundments.[5]

In addition, we reviewed the 1991 BRS to investigate the quantity of ICR waste generated and managed in surface impoundments by facilities in this industry. Based on this analysis, we found that 2.1 million tons of ICR wastes are managed in surface impoundments. The fact that our estimate is a similar order of magnitude suggests that our approach is reasonable. Note however that EPA believes that BRS data may understate the quantity of decharacterized ICR wastewaters managed in land-based units because many facilities did not report wastes that were diluted immediately upon generation as hazardous wastes.[6] Therefore, we did not rely on these data in our analysis.

The primary limitation of this analysis is that the TRI data does not consider 53 non-priority UTS constituents and thus may underestimate the effects of the rule. The impacts of the rule due to the remaining non-priority pollutants is unclear.

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[2] Reporting of treatment information to PCS is voluntary.

[3] Treatment types assumed to occur in land-based units included evaporation; sedimentation; equalization; neutralization; aerated, polishing, and sludge lagoons; oxidation, stabilization, and holding ponds; aerobic digestion; and extended aeration.

[4] Seven percent equals seven facilities with treatment in surface impoundments divided by 106 facilities reporting treatment information.

[5] It is not clear why the total number of iron and steel facilities for 1985 based on the Screening Survey (2,151) is about twice as much as EPA's estimate of the number of active plants as of July 1981 (1,020).

[6] In fact, such wastes should have been included in the BRS. however, EPA discussions with industry suggest that this requirement has been broadly misinterpreted in the past.

Table E-1

SUMMARY OF TRI LOADINGS DATA FOR FACILITIES WITH WASTESTREAMS CONTAINING NON-PRIORITY UTS CONSTITUENTS AT LEVELS EXCEEDING UTS

Facility Number	Constituent	Release to Water (lbs/yr)	Release to POTW (lbs/yr)	Almost Certain to exceed UTS[1]	May Exceed UTS[1]
1	Barium Compounds	12,314	0		✓
1	Xylene (Mixed Isomers	250	0		✓
2	Xylene (Mixed isomers)	250	1,500		✓
3	Acetone	0	250		✓
4	Barium	4,600	0		✓
4	Vanadium	3,500	0		✓

1. "Almost certain to exceed UTS" includes those wastestreams with constituent concentration exceeding UTS at high-end flow rates. "May exceed UTS" includes those wastestreams with constituents exceeding UTS at low-end rates.

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Appendix F

SUMMARY OF ANALYSES FOR STEAM ELECTRIC GENERATORS

Appendix F

SUMMARY OF ANALYSES FOR STEAM ELECTRIC GENERATORS

The electric power generation industry includes privately and publicly-owned facilities that generate, transmit and/or distribute electric power for sale.[1] This industry encompasses SIC codes 4911 (Electric Services) and 4931 (Electric Services and Other Services Combined).[2] EPA developed water effluent guidelines for a subsector of this industry, steam electric generating plants, in 1982. Steam electric plants include those facilities that use fossil or nuclear fuel to produce steam which is used to power a turbine and generate electricity. Based on the development documents for these effluent guidelines, there were 842 steam electric generation facilities in 1978. EPA currently is conducting a preliminary study to determine whether to revise the guidelines for this industry subcategory and plans to complete this study in 1995.

Steam electric facilities generate a variety of wastewaters both on a continuous and intermittent basis. Wastewaters generated on a continuous basis include once-through cooling water, recirculating cooling system blowdown, fly ash and bottom ash, boiler blowdown and wet flue gas blowdown. In addition, these facilities generate several other types of wastes on a regular basis including ion exchange and demineralizer regeneration wastes, evaporator blowdown, reverse osmosis brine, and water softening wastes. Finally there are many wastes generated periodically from cleaning of boiler and generating units.

In August 1993, EPA promulgated a final regulatory determination exempting four high-volume wastes generated at coal-fired electric generating plants from Subtitle C regulations -- fly ash, bottom ash, boiler ash and flue gas emission control wastes.[3] This final rule, however, did not permanently exempt these wastes if they are co-managed with other low-volume wastes generated at these facilities. If these four wastes are co-managed with other wastes, EPA classifies them as "remaining" wastes; "remaining wastes" also include wastes generated by electric utility facilities that use other types of fossil fuel (e.g., oil) to generate power. EPA plans to consider whether to exempt remaining wastes from Subtitle C regulation by April 1, 1998. In the mean time, remaining wastes

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[1] This introductory section largely was taken from a draft of the capacity analysis for this industry prepared for EPA by ICF Incorporated and a letter from James Roewer, Utility Solid Waste Activities Group to Kristine Cornils, ICF, Inc., Re: Information on Steam Electric Utilities Regarding the Applicability of Phase III Land Disposal Restrictions, October 7, 1994.

[2] Electric Services and other Services combined includes establishments primarily providing electric services in combination with other services, with electric services a major part, but less than 95 percent of the total.

[3] Environmental Protection Agency, Final Regulatory Determination on Four Large-Volume Wastes from the Combustion of Coal by Electric Utility Power Plants, 40 CFR Part 261, 58 FR 42466, August 9, 1993.

are temporarily exempt from Subtitle C regulation.[4] This exemption is important to our analysis of the Phase III LDR rule since potentially affected wastes that are co-managed with these other exempt wastes would not be affected under the rule until EPA determines how to regulate these wastes.

Based on information provided by the Edison Electric Institute (EEI), utilities produce two types of wastes that they believe may be subject to further treatment under the Phase III LDR rule: (1) demineralizer regenerate (i.e., wastewater produced in ion exchange processes applied to boiler influent), and (2) chemical cleaning wastes that are produced when boilers are cleaned. These wastes are corrosive wastewaters that may contain the non-priority UTS metals barium and vanadium at concentrations exceeding UTS levels. In particular, boiler chemical cleaning wastes are generated infrequently -- boiler cleaning occurs at a facility every two to five years. EEI estimates that 375,000 tons of this waste is generated annually. Facilities usually ship these wastes off-site for treatment and disposal. The BRS data did not identify any facilities that managed boiler cleaning wastes in RCRA-exempt surface impoundments. Regeneration of deionizing units is performed on a more regular basis (every one to four days). EEI estimates that 25 million to 1.7 billion tons of these wastewaters are generated annually. Ion exchange regenerant wastes frequently are mixed and managed with RCRA-exempt wastes, but may be handled independently at some facilities; these facilities potentially would be affected by the rule. In addition, EEI identified two additional wastes, boiler and cooling tower blowdown and coal pile run-off, that could exhibit the corrosivity characteristic under unusual circumstances and thus could be affected by the rule.

Approach for Identifying Facilities Affected by the Phase III LDR Rule

We identified facilities potentially affected by the rule based on facilities with wastestreams that met the following three criteria:

- Contained decharacterized ICRT wastewater;
- Managed in a land-based unit; and
- Contained non-priority UTS constituents at concentrations exceeding UTS.

In addition, for this industry, we considered whether these wastes were co-managed with RCRA-exempt wastes and thus would not be affected by the rule.

Unfortunately, no single data source contained all the information required to assess these criteria for this industry. Therefore, we relied on various sources to provide data, as well as support development of reasonable assumptions and judgements in developing estimates of the number of facilities affected by the rule. These sources include the BRS, TRI, and PCS, as well as information

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[4] Note that recently in the Mobil decision (*Mobil Oil Corp v. EPA*, CA DC, No. 92-1211, 9/23/94), the federal appeals court vacated EPA regulations promulgated in 1989 related to mixtures of mining wastes and characteristic wastes. Apparently this court decision only affects mining wastes and does not directly effect mixtures of other exempt wastes and characteristic wastes.

collected in discussions with the EEI. To evaluate the number of facilities and quantity of waste affected by the rule, we largely relied on available information related to the first two criteria due to lack of concentration data for non-priority UTS constituents in wastewaters managed at these facilities.

Results

Based on our analysis, we estimated that the rule may have minor effects on this industry. This finding largely relied on an analysis of the BRS database. This analysis of BRS showed that four facilities generate ICR wastes managed in surface impoundments and thus may be affected by the rule. Note, however, that there is significant uncertainty associated with this estimate. First, there are limited data available on whether the wastewaters contain non-priority pollutants at concentrations exceeding UTS levels, and thus the BRS estimates may overstate the effects of the rule. Second, there is uncertainty over the extent to which facilities manage their ICR wastewaters in non-exempt surface impoundments. Finally, EPA believes that BRS data may underestimate the quantity of decharacterized ICR wastewaters managed in land-based units because many facilities may not have reported wastes that were diluted immediately upon generation as hazardous wastes.[5] Also there is some uncertainty in interpreting BRS survey responses as to what constitutes a surface impoundment and which units are regulated under RCRA. Analyses of the various data sources and discussions with EEI generally conform with our BRS findings, but none of the databases allow us to consider all of the factors concurrently. Further analysis of the impacts of the rule on this industry may be warranted. Below we discuss the results of our analyses and provide additional information characterizing the industry.

Based on the BRS data, EPA identified 33 facilities that managed ICR wastewaters on-site. Data on the type of waste management units used at the facility were available for 21 of these 33 facilities, accounting for 94 percent (689,000 tons) of the reported waste managed on-site by these facilities. Based on analyses of this treatment data, EPA found that four facilities managed 60,000 tons of potentially affected ICR wastes in surface impoundments regulated under RCRA.[6]

In our analysis, we assumed that the wastewaters at these facilities contained non-priority UTS pollutants at concentrations exceeding UTS. To evaluate the reasonableness of this assumption, we reviewed the TRI data to estimate constituent concentrations in wastewaters managed by electric utilities. This database, however, is of limited value since electric utilities are not required to report to TRI (since TRI covers manufacturing establishments in SIC codes 20 to 39). Based on the available data, only eight facilities in this industry (SIC codes 4911 and 4931) reported releases of TRI chemicals in 1992 and only one reported releases to water or POTWs.[7] This one facility did not report releases of any of the non-priority UTS constituents.

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[5] In fact, such wastes should have been included in BRS; however, EPA discussions with industry suggest that this requirement has been broadly misinterpreted in the past.

[6] Note that this analysis of the BRS was run independently of the analysis reported in Appendix P. The values reported in this analysis are different from those presented in Appendix P because they include consideration of the regulatory status of the units.

[7] We assume that these facilities reported to TRI because they also have operations under one of the SIC codes covered by TRI.

Other sources of data suggest that the number of facilities affected by the rule may be higher, particularly given the potentially large number of facilities that use surface impoundments. First, EPA reviewed data available in the TC RIA. This data source showed that 37 percent of steam-electric generating facilities manage their wastes in surface impoundments, suggesting that a larger number of facilities may be affected than estimated based on the BRS analysis. This data source, however, did not contain information on concentration levels of any of the non-priority UTS constituents for facilities in this industry and did not indicate whether these units also managed RCRA-exempt wastes. Thus, we could not estimate the number of facilities affected by the rule using this data source.[8]

Second, we reviewed the PCS database to obtain data on the number of facilities in the industry using surface impoundments. The PCS database shows that 1,450 facilities in the electric utility industry have NPDES permits. Of the 344 facilities that provided treatment information, 56 (16 percent) reported treatment types likely to occur in land-based units.[9] Note that the number of facilities (1,450) in this database exceeds the number of facilities based on the effluent development documents reported earlier (842) because the development documents only address steam-electric plants. Again, this data source suggests that a larger number of facilities potentially could be affected by the rule than estimated based on the BRS analysis. However, PCS did not provide the data needed to evaluate the effects of the rule considering all the applicable criteria. PCS did not provide data on constituent concentration levels, did not indicate whether wastewaters in these surface impoundments contain decharacterized ICRT wastes, and did not indicate whether the surface impoundments are RCRA-exempt.

Finally, as indicated above, we obtained information from discussions with EEI. Based on these conversations, EEI indicated that most of the waste generated by electric utilities that it believes may be ICR (demineralizer regenerate and chemical cleaning wastes) is managed in nonhazardous surface impoundments, which compare the majority of the estimated 540 surface impoundments in use in the industry. EEI also indicated that many facilities may co-manage these wastewaters with exempt wastes, but that this practice is declining. While, this information suggests that many facilities potentially would be affected by the rule, additional data on the concentrations of constituents in these wastes and the number of facilities actually managing ICR wastes in non-exempt surface impoundments is required to determine the impacts of the rule on this industry.

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[8] Note that the capacity analysis included information on concentration levels of several priority pollutants that are TC characteristic (i.e., D004 through D043). These data show concentrations of TC constituents in wastes on an as-generated basis (i.e., prior to treatment) and usually do not show concentrations for other constituents in these wastes; thus we were unable to use this information in this analysis.

[9] Reporting of treatment information is optional in PCS.

Appendix G

RESULTS OF SCREENING ANALYSES OF THE ELECTRONICS AND ELECTRICAL COMPONENTS INDUSTRY

Appendix G

RESULTS OF SCREENING ANALYSES OF THE ELECTRONICS AND ELECTRICAL COMPONENTS INDUSTRY

The electronics and electrical components industry includes facilities in the following SIC Industry Groups: 357 (Computer and Office Equipment), 361 (Electric Transmission and Distribution Equipment), 362 (Electrical Industrial Apparatus), 363 (Household Appliances), 364 (Electric Lighting and Wiring Equipment), 365 (Household Audio and Video Equipment, and Audio Recordings), 366 (Telecommunications Equipment), 367 (Electronic Components and Accessories), and 369 (Miscellaneous Electrical Machinery, Equipment, and Supplies). According to the 1987 Census of Manufactures, there were about 16,000 establishments in SIC code 36, covering the seven three-digit subcategories in this SIC group listed above, plus about 2,100 establishments in SIC code 357.

Effluent guidelines for this industry were finalized in 1983. No information on non-priority UTS constituents of concern for the Phase III LDR rule were available from these effluent guidelines documents.

Approach for Identifying Facilities Affected by the Phase III LDR Rule

We identified facilities potentially affected by the rule based on facilities with wastestreams that met the following three criteria:

- Contained decharacterized ICRT wastes;
- Managed in a land-based unit; and
- Contained non-priority UTS constituents of concentrations exceeding UTS.

Due to a lack of effluent guidelines data on non-priority UTS constituents in wastestreams generated by facilities in the electronics and electrical components industry, we relied largely on TRI data to assess which facilities might have wastestreams containing non-priority constituents exceeding UTS levels. We combined TRI loadings data and industry-specific data on flow rates for wastewater discharges to estimate the concentrations of these constituents in facilities' wastestreams. We then compared these concentration levels to UTS levels to identify facilities and wastestreams potentially exceeding UTS. In addition, since TRI does not contain information on waste management practices, we considered data from other sources to evaluate facilities likely to manage ICRT wastewaters in surface impoundments. Below we outline the steps and assumptions used in the analysis in more detail.

Step 1: Using TRI data, identify facilities that report discharges of a non-priority UTS pollutants to POTWs or to surface waters and collect data on the reported loadings for each facility by constituent.

Step 2: Evaluate the flow rate of wastewater discharges by facilities in the industry. Establish low-end and high-end estimates of flow rates.

Step 3: Applying the low-end and high-end flow rate estimates to the TRI loadings data, identify facilities almost certain to have wastestreams with constituents concentrations exceeding UTS levels (i.e., UTS exceedances even at very high wastewater flows) and facilities that might have wastestreams exceeding UTS levels (i.e., exceedances at very low wastewater flows).

Step 4: Adjust the resulting estimates of the number of affected facilities to reflect the likelihood that facilities in the industry manage and treat their ICRT wastes in surface impoundments.

This approach may understate the number of facilities affected by the rule primarily for two reasons. First, the TRI database only includes data on 48 of the 101 non-priority UTS constituents. Second, only those facilities generating more than 10,000 pounds of TRI constituents per year are required to report to TRI. Smaller facilities that manage ICRT wastewaters in surface impoundments also could be affected by the rule.

Results

Based on our analysis, we found that four to 12 facilities may be affected by the rule. Below we summarize how we calculated these estimates and provide additional information characterizing the industry.

In 1992, 1,898 electrical and electronic components manufacturing facilities reported releases of TRI chemicals, with 786 reporting releases to water or to POTWs. Of the 786 facilities reporting releases to water or to POTWs, 128 reported a quantifiable discharge of at least one of the 101 non-priority UTS pollutants. Of these 128 facilities, 15 directly discharged wastewaters to surface waters, 103 discharged wastewaters to POTWs, and 10 did both. Wastewaters from these facilities contained at least one of nine non-priority UTS pollutants, including barium, methanol, acetone, acetonitrile, freon 113, methyl ethyl ketone, methyl isobutyl latone, butanol, and xylene.

To assess the number of affected facilities, we combined the TRI loadings data with low-end and high-end wastestream flow rates for facilities in this industry and compared the resulting concentration estimates to UTS levels. Based on this analysis, we found that 29 facilities are likely to be affected by the rule because they generate wastewaters containing non-priority UTS constituents exceeding UTS levels at high-end flow rates of one million gallons per day. This analysis also showed that an additional 26 facilities may be affected by the rule, based on a low-end flow rate of 50,000 gallons per day. These flow rate data are based on data from the effluent guidelines. Table G-1 shows the loadings levels for the pollutants of concern for these 55 facilities.

We adjusted this estimated range of the affected number of facilities to reflect the number of facilities likely to manage wastewaters in surface impoundments. The PCS database shows that 309 electrical and electronic components manufacturing facilities have NPDES permits (affecting 918 outfalls) and 82 of these facilities reported treatment information (affecting 196 outfalls).[1] Based on an analysis of the treatment data, 17 facilities reported treatment types likely to occur in surface impoundments, affecting 25 outfalls.[2] Comparing the number of outfalls and facilities with land-based units to the total number of outfalls and facilities for which treatment data were available, we estimated that 13 to 21 percent of facilities use surface impoundments.[3]

Applying this range of 13 to 21 percent to the TRI analysis, we estimated that four to twelve facilities, or less than one percent of the 1,898 manufacturing facilities reporting to TRI, may actually be affected by the rule.[4] In addition, we estimated the quantity of wastewater generated by these affected facilities at between 579,000 and 2.6 million tons per year. This is based on an average flow rate for direct dischargers of one million gallons per day and indirect dischargers of 100,000 gallons per day (average flow rate based on BRS data).[5]

In our analysis, we assumed that all facilities with exceedances of UTS manage decharacterized ICRT wastes in their surface impoundments. As a check on this assumption, we analyzed data from the BRS to evaluate the quantity of ICR waste that is managed in land-based units. This analysis showed that 19.5 million tons of ICR wastes were managed in land-based units by this industry in 1991. This quantity is relatively large compared to our estimate of decharacterized ICR wastes with UTS exceedances, suggesting that a large portion of facilities in this industry may manage decharacterized ICR wastes with other wastewaters in surface impoundments and that our assumption is reasonable.

The primary limitation of our approach is that the analysis of the TRI data does not consider 53 non-priority UTS constituents and thus may underestimate the effects of the rule. The impacts of the rule due to the remaining non-priority pollutants is unclear.

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[1] PCS only contains data for direct dischargers, thus explaining the difference in the number of facilities in PCS and the number reporting to TRI. Also reporting of treatment information to PCS is voluntary.

[2] Treatment types assumed to occur in land-based units included evaporation; sedimentation; equalization; neutralization; aerated, polishing, and sludge lagoons; oxidation, stabilization, and holding ponds; aerobic digestion; and extended aeration.

[3] Thirteen percent equals 25 outfalls with treatment in surface impoundments divided by 196 outfalls for which facilities reported treatment information. Twenty-one percent equals 17 facilities with treatment in surface impoundments divided by 82 facilities reporting treatment information.

[4] Twenty-nine facilities x 13 percent = 3.8 facilities (rounds up to 4 facilities); 55 facilities x 21 percent = 11.6 (rounds up to 12 facilities).

[5] For the lower bound of this range, 100,000 gallons per day x 365 days per year x 0.004171 tons per gallon x 3.8 facilities = 579,000 tons. The upper bound is calculated as follows: 149,000 gallons per day x 365 days per year x 0.004171 tons per gallon x 11.6 facilities = 2.6 million tons. The 148,000 flow rate is the weighted average flow rate for direct and indirect dischargers where 52 of the 55 affected facilities are indirect dischargers and three are direct dischargers.

Table G-1

SUMMARY OF TRI LOADINGS DATA FOR FACILITIES WITH WASTESTREAMS CONTAINING NON-PRIORITY UTS CONSTITUENTS AT LEVELS EXCEEDING UTS

Facility Number	Constituent	Release to Water (lbs/yr)	Release to POTW (lbs/yr)	Almost Certain to Exceed UTS	May Exceed UTS
1	Methyl Ethyl Ketone	0	550		✓
2	Methyl Isobutyl Ketone	0	190		✓
2	Methyl Ethyl Ketone	0	4,800	✓	
3	Acetone	0	1,400	✓	
4	Xylene (Mixed Isomers)	250	0		✓
5	Acetone	0	750		✓
5	Freon 113	0	250	✓	
6	Acetone	0	327		✓
7	Methyl Ethyl Ketone	250	250		✓
8	Acetone	0	1,000	✓	
9	Methanol	0	58,159	✓	
10	Freon 113	0	124		✓
11	Acetone	0	2,175	✓	
11	Xylene (Mixed Isomers)	0	2,065	✓	
12	Barium Compounds	0	1,000		✓
13	Barium Compounds	0	3,100		✓
14	Acetone	0	120		✓
15	Acetone	0	250		✓
16	Freon 113	0	44		✓
16	Acetone	0	150		✓
17	Methanol	0	22,323	✓	
18	Acetone	0	5,334	✓	
19	Xylene (Mixed Isomers)	0	250		✓
19	Freon 113	0	250	✓	
20	Xylene (Mixed Isomers)	0	250		✓
21	Acetone	0	3,270	✓	
22	Acetone	0	3,989	✓	
22	Xylene (Mixed Isomers)	0	1,009	✓	
23	Acetone	0	526		✓
24	Methanol	0	5,500		✓
25	Acetone	0	1,800	✓	

Table G-1

SUMMARY OF TRI LOADINGS DATA FOR FACILITIES WITH WASTESTREAMS CONTAINING NON-PRIORITY UTS CONSTITUENTS AT LEVELS EXCEEDING UTS

Facility Number	Constituent	Release to Water (lbs/yr)	Release to POTW (lbs/yr)	Almost Certain to Exceed UTS	May Exceed UTS
26	Methanol	0	2,200		✓
26	Acetone	0	2,200	✓	
27	Acetone	250	21,412	✓	
28	Acetone	0	250		✓
29	Acetone	250	1,100	✓	
30	Freon 113	0	250	✓	
30	Acetone	0	250		✓
31	Methanol	0	33,000	✓	
31	Methanol	0	3,600		✓
31	Acetone	0	630		✓
32	Acetone	0	430		✓
33	Xylene (Mixed Isomers)	0	2,100	✓	
33	Acetone	0	890	✓	
34	Acetone	0	1,800	✓	
35	Acetone	0	31,000	✓	
36	Xylene (Mixed Isomers)	0	350		✓
36	Acetone	0	7,100	✓	
37	Xylene (Mixed Isomers)	0	340		✓
37	Acetone	0	11,000	✓	
38	Methanol	0	6,190		✓
38	Acetone	0	46,450	✓	
39	Acetone	0	550		✓
40	Acetone	0	5,000	✓	
41	Acetone	0	250		✓
42	Xylene (Mixed Isomers)	0	250		✓
43	Methanol	0	190,000	✓	
44	Methanol	0	2,300		✓
45	Acetone	0	250		✓
46	Acetone	0	4,248	✓	
47	Methyl Ethyl Ketone	0	8,030	✓	
48	Xylene (Mixed Isomers)	0	250		✓

Table G-1

SUMMARY OF TRI LOADINGS DATA FOR FACILITIES WITH WASTESTREAMS CONTAINING NON-PRIORITY UTS CONSTITUENTS AT LEVELS EXCEEDING UTS

Facility Number	Constituent	Release to Water (lbs/yr)	Release to POTW (lbs/yr)	Almost Certain to Exceed UTS	May Exceed UTS
49	Acetone	0	12,507	✓	
50	Methanol	2,006	0		✓
51	Xylene (Mixed Isomers)	0	250		✓
52	Acetone	0	250		✓
53	N-Butyl Alcohol	0	22,000	✓	
54	Xylene (Mixed Isomers)	0	250		✓
54	Methyl Ethyl Ketone		250		✓
55	Acetone		689		✓

Appendix H

RESULTS OF SCREENING ANALYSES OF THE FOOD INDUSTRY

Appendix H

RESULTS OF SCREENING ANALYSES OF THE FOOD INDUSTRY

The food industry includes a wide array of facilities involved in food processing. For the purposes of this analysis, we considered the potential impacts of the rule on the following six subsectors of the industry: dairy products (2021-2026); fruits and vegetables (2032-2035, 2037-2038); grain mill products (2041, 2043-2048); meat products (2011, 2013, 2015); sugar processing (2061-2063); and seafood processing (2091-2092). These subsectors include those for which EPA has promulgated effluent guidelines; EPA issued guidelines for the meat products subsector in 1976 and for the five other subsectors in 1974 with revisions in 1986. According to the 1987 Census of Manufactures, there are 8,965 establishments in this industry.

Approach for Identifying Facilities Affected by the Phase III LDR Rule

We identified facilities potentially affected by the rule based on facilities with wastestreams that met the following three criteria:

- Contained decharacterized ICRT wastewater;
- Managed in a land-based unit; and
- Contained non-priority UTS constituents at concentrations exceeding UTS.

Due to a lack of data on non-priority UTS constituents in wastestreams generated by the food industry in the effluent guidelines development documents, we relied largely on TRI data to assess which facilities might have wastestreams containing these constituents at concentrations exceeding UTS levels. For this analysis, we combined TRI loadings data and industry-specific data on flow rates for wastewater discharges to estimate the concentrations of these constituents in facilities' wastestreams. We then compared these concentration levels to UTS levels to identify facilities and wastestreams potentially exceeding UTS. In addition, since TRI does not contain information on waste management practices, we considered data from other sources to evaluate facilities likely to manage ICRT wastewaters in surface impoundments. Below we outline the steps and assumptions used in the analysis in more detail.

Step 1: Using TRI data, identify facilities that report discharges of non-priority UTS pollutants to POTWs or to surface waters and collect data on the reported loadings for each facility by constituent.

Step 2: Evaluate the flow rates of wastewater discharges by facilities in the industry.

Step 3: Applying the flow rate estimates to the TRI loadings data, identify facilities that may have wastestreams with constituents exceeding UTS levels.

This approach may understate the number of facilities affected by the rule for two reasons. First, the TRI database only includes data on 48 of the 101 non-priority UTS constituents. Second, only those facilities generating more than 10,000 pounds of TRI constituents per year are required to report to TRI. Smaller facilities that manage ICRT wastewaters in surface impoundments also could be affected by the rule.

Results

Based on our analysis, we found that 11 facilities may be affected by the rule. These facilities represent less than one percent of the industry and thus we do not expect the rule to have a significant impact on this industry. Below we summarize how we calculated this estimate and provide additional information characterizing the industry.

In 1992, 2,100 food facilities reported releases of TRI chemicals, with 731 reporting releases to water or to POTWs. Of these 731 facilities, 17 reported a quantifiable discharge of at least one of the 101 non-priority UTS pollutants. Of these 17 facilities, one discharged wastewaters to surface waters, fifteen discharged wastewaters to POTWs, and one did both. Wastewaters from these facilities contained at least one of five non-priority UTS pollutants, including acetone, methanol, butanol, ethylene oxide, and cresol.

To assess the number of affected facilities, we combined the TRI loadings data with the average wastewater flow rate for facilities in this industry and compared the resulting concentration estimates to UTS levels. Based on this analysis, we found that 11 facilities are likely to be affected by the rule because they generate wastewaters containing non-priority UTS constituents exceeding UTS levels at an average wastewater flow rate of 570,000 gallons per day.[1] All of these 11 facilities are indirect dischargers. In addition, we estimated the quantity of wastewater generated by these affected facilities at 9.5 million tons per year.[2] Table H-1 shows the loadings levels for the pollutants of concern for these 11 facilities.

In our analysis, we assumed that all facilities with wastewaters containing non-priority UTS constituents at concentrations exceeding UTS levels manage these wastewaters in land-based units. To evaluate the reasonableness of this assumption, we analyzed the PCS database. The PCS database showed that 1,474 food facilities have NPDES permits and 339 of these facilities reported

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[1] The estimated average flow rate was taken from van der Leeden, Frits, Fred L. Troise and David Keith Todd, *The Water Encyclopedia*, Lewis Publisher, 1990. See Table 5-39 for data on water use in the food industry. We were unable to obtain flow rate data from the effluent guidelines development documents that could be used to estimate a lower bound flow rate.

[2] Calculated as follows: 570,000 gallons per day x 365 days per year x 0.004171 tons per gallon x 11 facilities = 9.5 million tons.

treatment information.[3] Based on an analysis of the treatment data, 147 facilities reported treatment types likely to occur in surface impoundments.[4] Comparing the number of facilities with land-based units to the total number of facilities for which treatment data were available, we estimated that 43 percent of direct dischargers use surface impoundments. If the percentage of indirect dischargers that use land-based units is similar to the percentage for direct dischargers, our analysis would overstate the number of affected facilities and the quantity of waste generated by them.

In our analysis, we also assumed that all facilities with exceedances of UTS manage decharacterized ICRT wastes in their surface impoundments. As a check on this assumption, we analyzed data from BRS to evaluate the quantity of ICR waste that is managed in land-based units by the food industry. This analysis showed that only 85,000 tons of ICR wastes were managed in land-based units by this industry in 1991. However, EPA believes that BRS data may underestimate the quantity of decharacterized ICR wastewaters managed in land-based units because many facilities did not report wastes that were diluted immediately upon generation as hazardous wastes.[5] This may explain why our estimated quantity of wastewaters affected by the rule exceeds the quantity of ICR managed in land-based units reported in BRS. Thus, it is difficult to use these data to evaluate the reasonableness of our assumption.

The primary limitation of our approach is that the analysis of the TRI data does not consider 53 non-priority UTS constituents and thus may underestimate the effects of the rule. The impacts of the rule due to the remaining non-priority pollutants are unclear.

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[3] PCS only contains data for direct dischargers, thus explaining the difference in the number of facilities in PCS and the number reporting to TRI. Also reporting of treatment information to PCS is voluntary.

[4] Treatment types assumed to occur in land-based units included evaporation; sedimentation; equalization; neutralization; aerated, polishing, and sludge lagoons; oxidation, stabilization, and holding ponds; aerobic digestion; and extended aeration.

[5] In fact, such wastes should have been included in BRS; however, EPA discussions with industry suggest that this requirement has been broadly misinterpreted in the past.

Table H-1

SUMMARY OF TRI LOADINGS DATA FOR FACILITIES WITH WASTESTREAMS CONTAINING NON-PRIORITY UTS CONSTITUENTS AT LEVELS EXCEEDING UTS

Facility Number	Constituent	Release to Water (lbs/yr)	Release to POTW (lbs/yr)	May Exceed UTS[1]
1	Acetone		29,134	✓
1	Methanol		174,122	✓
2	Methanol		15,000	✓
3	Methanol		26,000	✓
4	Acetone		47,000	✓
4	Methanol		50,000	✓
5	Ethylene Oxide		3,700	✓
6	Methanol		1,800,000	✓
7	Ethylene Oxide		24,172	✓
8	Acetone		750	✓
9	Methanol		191,475	✓
10	Methanol		87,000	✓
11	Acetone		9,040	✓

1. Based on an average flow rate of 570,000 million gallons per day.

Appendix I

RESULTS OF SCREENING ANALYSES OF METAL PRODUCTS AND MACHINERY AND ELECTROPLATING/METAL FINISHING

Appendix I

RESULTS OF SCREENING ANALYSES OF METAL PRODUCTS AND MACHINERY AND ELECTROPLATING/METAL FINISHING

We discuss the Metal Products and Machinery industry category and the Electroplating/ Metal Finishing category together because their processes and wastestreams are quite similar and our analyses of these industries rely on the same data sources.[1]

Industry Overview

Metal Products and Machinery Category

The Metal Products and Machinery (MP&M) category, formerly the Machinery Manufacturing and Rebuilding (MM&R) category, includes facilities that generate wastewater while processing metal parts, metal products, and machinery, including manufacture and assembly, rebuilding, repair, and maintenance operations (covers a range of facilities, principally in SIC codes 34 through 39). The MP&M category includes 15 major industrial groups, shown below, which have been divided into two groups, reflecting the groupings for the two-phased development of the effluent guidelines. EPA selected seven subcategories for Phase I based on an analysis of the types of wastewaters created, the likely regulatory impact of new effluent standards, and the extent to which facilities in the different groups are not currently affected by existing wastewater discharge guidelines and standards. MP&M Phase II represents the remaining industrial groups in the MP&M category.

MP&M Phase I Industrial Groups	MP&M Phase II Industrial Groups
Aircraft	Motor Vehicles (i.e., automobiles)
Aerospace Vehicles;	Bus and Truck
Hardware (Machine Tools, Screw Machines, Metal Forging and Stamping, Metal Springs, Heating Equipment, Fabricated Structural Metal)	Railroad
Ordinance	Ships and Boats
Stationary Industrial Equipment (including Electrical Equipment)	Office Machines
Mobile Industrial Equipment	Household Equipment
Electronic Equipment (including Communications Equipment)	Instruments (Measurement and Control Instruments and Specialty Equipment)
	Precious and Nonprecious Metals and Instruments

[1] This appendix is based largely on analyses conducted for the capacity assessment (see the appendices to the development document for the capacity analysis).

According to Dun and Bradstreet (D&B), there are approximately 970,000 facilities covered by these designations. The seven major industrial groups in MP&M Phase I represented approximately 270,000 of these facilities (or over 25 percent of all MP&M facilities). EPA's data collection efforts for the MP&M Phase I category indicated that the number of facilities in this industry category is significantly smaller than the D&B data, at about 10,600 facilities. Responses to EPA's screener surveys indicated that less than half of the original 270,000 facilities used the identified metal processes (i.e., many facilities were wood, warehouse or nonmanufacturing facilities) and less than half of the remaining facilities used process water. Assuming a similar revision to the number of facilities in the MP&M Phase II subcategory as in Phase I (i.e., four percent of D&B estimated number of facilities), the estimated number of facilities in the MP&M Phase II category is 28,000.

The MP&M category has been included in the effluent guidelines program because many of the facilities identified in this category use processes that generate large quantities of corrosive (i.e., high or low pH that would meed the RCRA hazardous waste characteristic for corrosivity) wastewaters. These wastewaters include both acidic and alkaline streams and include both concentrated solutions (i.e., process baths) and rinsewaters. Common practice in the MP&M industry category is to collect acidic wastewaters in one tank and alkaline wastewaters in a separate tank. Wastewaters are then used for pH adjustments and to precipitate metals.

Effluent guidelines for MP&M Phase I are scheduled for proposal in November 1994, with promulgation of final regulations planned for June 1996. MP&M Phase II effluent guideline efforts are scheduled to begin in 1995.

Electroplating/Metal Finishing Category

The E/MF category covers a range of facilities in SIC codes 34 through 39 that conduct any one of the following six operations: electroplating, electroless plating, anodizing, conversion coating, chemical etching, or printed circuit board manufacturing. If a facility uses one of these six core unit operations, an additional 40 metal finishing operations that discharge wastewater are covered under the effluent guidelines (e.g., cleaning, machining, polishing).

EPA promulgated effluent guidelines for the electroplating industry in January 1981 and for the metal finishing industry in July 1983. During the development of these guidelines, EPA identified approximately 13,500 facilities in the electroplating/metal finishing industry. EPA currently is collecting preliminary information on the metal finishing category, investigating the overlap with the MP&M category, and considering this category for a future rulemaking. Data collected for the MP&M category showed that about 3,600 facilities in the MP&M Phase I category currently are subject to electroplating/metal finishing effluent guidelines.

Approach for Identifying Facilities Affected by Phase III LDR Rule

We identified facilities potentially affected by the rule based on facilities with wastestreams that met the following three criteria:

- Contained decharacterized ICRT wastewater;
- Managed in a land-based unit; and
- Contained non-priority UTS constituents at concentrations exceeding UTS.

For these two industry categories, we were able to rely principally on one data source -- data collected under Section 308 of the CWA for use in developing effluent guidelines for the MP&M Phase I industry category. The Office of Water collected data on unit operations and treatment trains, wastewater generation and flow rates, and contaminants in the wastestreams, using screener questionnaires, detailed questionnaires, and sampling programs. These surveys addressed over 300 pollutants, covering most of the non-priority UTS constituents. Due to the size of the industry, a total of 446 statistically representative facilities were selected to serve as model plants representing the entire MP&M Phase I subcategory. Scaling factors for each facility were developed to expand the 446 model facilities to the 10,600 facilities identified in the MP&M Phase I subcategory. Due to similarities between MP&M Phase I facilities and MP&M Phase II and E/MF facilities, we relied on these Section 308 data for all three industry categories. Below we outline the steps and assumptions used in our analysis for the three industry groups.

MP&M Phase I Facilities

The approach for identifying facilities in the MP&M Phase I category that are likely to be affected by the Phase III LDR rule was developed as a result of numerous discussions with the effluent guidelines development project teams regarding the data that were collected for that effort. The discussions resulted in an approach consisting of a series of queries and assumptions based on expert knowledge of the industry that are designed to identify facilities in the affected universe. The queries and assumptions used are described below.

Step 1: Query the database to identify those processes that generate corrosive wastewaters (based on pH levels);

Step 2: Query the database to identify model facilities that perform the identified processes and generate corrosive wastewaters. (Identifying facilities likely to generate corrosive wastewaters was conducted in this two step process due to the way that pH data was collected and incorporated into the database.)

Step 3: Query the database to identify facilities with a TC organic constituent in their wastewaters at the point of generation.

Assumption: Ignitable, reactive, or TC pesticide wastewaters are not generated by the MP&M industry.

Assumption: All wastewaters that contain at least one of the TC organic constituents at the point of generation are considered as TC organic wastewaters, to be conservative.

Step 4: For those model facilities and wastestreams identified in Steps 2 and 3, query the database to identify those facilities that are likely to have land-based units, based on facilities with flow rates through their treatment system of at least 100,000 gallons per day (gpd).

Assumption: Only a small percentage of the largest facilities in the industry are likely to use land-based units in their treatment trains. A flow rate of 100,000 gpd through a treatment system was estimated as representative of these large facilities. Facilities with flows below these levels are unlikely to need the capacity of a land-based unit and may use tanks. This assumption was tested/verified in Step 7.

Step 5: For those large model facilities identified in Step 4, identify facilities likely to be affected by the rule by comparing end-of-pipe constituent concentrations to UTS levels.

Step 6: Apply the scaling factors to the identified model facilities to estimate the total number of facilities likely to be affected.

Step 7: Test/validate our earlier assumption that only large facilities are likely to use land-based units by identifying smaller facilities (i.e., facilities with flow rates less than 100,000 gpd) that use treatment types that may occur in land-based units.

Assumption: In the detailed questionnaire, EPA collected data on the type of treatment performed, but not on the unit in which the treatment is performed. The list of treatment codes in the Data Collection Portfolio Dictionary was reviewed to identify the treatments that may occur in a land-based unit.

Step 8: For facilities identified in Step 7, identify those facilities likely to be affected by the rule by comparing end-of-pipe constituent concentrations to UTS levels.

MP&M Phase II Facilities

To identify affected facilities for this industry subcategory, we relied on the available data for the Phase I MP&M facilities. Our approach applied the estimated percentage of MP&M Phase I facilities affected by the rule to the total number of MP&M Phase II facilities. We developed this approach after discussions with the MP&M project team that indicated that MP&M Phase I and MP&M Phase II facilities generate similar wastewaters from similar processes.

E/MF Facilities

For this industry category, our approach for estimating the number of affected facilities also relied on data for the MP&M Phase I industry category, as well as available data on the number of facilities in the E/MF and MP&M industry categories. As outlined below, the approach essentially involved removing from the total number of E/MF facilities, those facilities already addressed by the MP&M category, and for the remaining E/MF facilities estimating the number affected based on MP&M Phase I category data.

Step 1: Remove from the scope of E/MF, all Phase I MP&M facilities that use one of the six identified E/MF unit operations.

Step 2: Remove from the scope of E/MF, all Phase II MP&M facilities that use one of the six unit operations.

Assumption: Because MP&M Phase I and Phase II facilities are similar, our analysis assumed that the percentage of MP&M Phase I facilities that use one of the six E/MF unit operations (33 percent) also applies for Phase II facilities.

Step 3: Of the remaining facilities, identify those likely to be affected by the rule based on the percentage of MP&M Phase I facilities estimated to be affected by the rule.

Assumption: The MP&M and E/MF industries are similar, as illustrated by the significant overlap in operations covered by each category. Based on these similarities, we assumed that the affected wastewaters for the E/MF facilities are similar in terms of constituents and concentrations above UTS levels to those affected wastewaters identified for MP&M Phase I facilities.

Results

Based on our analysis of the 308 data, we found that no facilities are likely to be affected by the Phase III LDR rule for the MP&M and E/MF industries. Below we summarize these results.

MP&M Phase I Facilities

The analysis of the largest facilities (i.e., those facilities with flow rates of at least 100,000 gpd) yielded two facilities that generate ICRT wastewaters with hazardous constituents above UTS levels at the point of discharge (i.e., end-of-pipe) and managed in a land-based unit. However, the three constituents contained in the wastestreams at these two facilities (phenol, 2-chlorophenol, and trichloroethane) are priority pollutants. Thus, we found that no MP&M Phase I facilities managed ICRT containing non-priority UTS pollutants exceeding UTS levels in land-based units, and thus no facilities are likely to be affected by the rule.

The analysis of the facilities that have wastewater flows below 100,000 gpd found one additional facility that met all of the criteria (i.e., ICRT wastewater containing UTS constituents exceeding UTS and managed in a land-based unit). Again, however, the two UTS constituents present in this facility's wastestream (phenol and 2-chlorophenol) are priority pollutants, and thus the facility is not expected to be affected by the rule.

MP&M Phase II Facilities and E/MF Facilities

Our approaches for identifying facilities in the MP&M Phase II category and the E/MF category that are likely to be affected by the rule both are based on the data for the Phase I MP&M category. Because we found that no facilities in the Phase I MP&M category are likely to be affected by the Phase III LDR rule, we estimated that no facilities in the MP&M Phase II and the E/MF categories will be affected by the rule.

Appendix J

RESULTS OF SCREENING ANALYSES OF THE PULP AND PAPER INDUSTRY

Appendix J

RESULTS OF SCREENING ANALYSES OF THE PULP AND PAPER INDUSTRY

The pulp and paper industry consists of companies that are engaged in the manufacture of pulp, paper, paperboard, and converted paper products.[1] These facilities are classified in the paper and allied products category (major SIC group 26), principally under the following three SIC codes: 2611 (pulp mills), 2621 (paper mills), and 2631 (paperboard mills). Based on data collected by EPA in developing revised effluent guidelines for this industry, there are 565 pulp and paper manufacturing facilities in the United States. Effluent guidelines for this industry were initially established in 1974, with revisions in 1986. EPA proposed revised guidelines for this industry in December 1993 and expects to finalize these guidelines in 1995.

The pulp and paper industry includes integrated pulp and paper facilities (290 facilities) and non-integrated facilities (275 facilities). Integrated facilities manufacture pulp on site from virgin wood fiber, secondary fiber, or non-wood fiber. Non-integrated mills manufacture paper or paperboard from purchased pulp or paper produced elsewhere. Integrated pulp and paper mills can be classified further according to their pulping process: (1) chemical pulp mills; (2) semi-chemical pulp mills; (3) mechanical pulp mills; and (4) secondary fiber mills.

Mills with chemical pulping processes mix concentrated chemical solutions with raw materials at high temperature and under pressure to produce a variety of pulps with unique properties. This "cooking" process dissolves the lignin that binds cellulose fibers together. The different types of chemical pulping primarily differ according to the types of chemicals and chemical recovery processes used. There are three types of chemical pulping: (1) kraft pulping - which uses an alkaline solution of sodium sulfide and sodium hydroxide; (2) sulfite pulping - which uses an acid solution of sulfurous acid and busulfite ion; and (3) soda pulping - which uses an alkaline solution of only sodium hydroxide.

Mills with semi-chemical pulping processes use a combination of chemical and mechanical treatments. Wood chips are mixed in a relatively mild chemical solution prior to mechanical refining for fiber separation. The resulting pulp can have a wide range of properties depending upon the degree of mechanical and chemical methods that are used.

Mills with mechanical pulping processes use little or no chemicals and moderate or no heat. There are five types of mechanical pulping: (1) stone groundwood - which uses mechanical pressure to force logs against a stone grindstone and washes fibers and fiber fragments torn away from the wood with water; (2) refiner mechanical - which passes wood chips between pairs of rotating grooved steel plates to separate the fibers; (3) thermo-mechanical - which preheats wood chips with steam prior to refining in double-disc refiners; (4) chemi-mechanical - which treats wood chips with caustic soda solution prior to refining in double-disc refiners; and (5) chemi-thermo-mechanical - which pretreats wood chips with caustic soda to allow separation of nearly intact fibers with minimum energy requirements for mechanical refining.

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[1] This industry background section largely was taken from the capacity analysis.

Mills with secondary fiber pulping processes use a ragger and a junker to repulp secondary fiber to remove contaminants (such as ink, adhesives and coatings, and plastic films). The ragger uses a wire to remove strings, wires, and rags, and the junker uses centrifugal force to remove heavy contaminants. Other systems are sometimes used to remove contaminants, depending upon the grade of the waste paper and the desired final product. These processes commonly use caustic soda, soda ash, and sodium silicate for repulping. When the contaminant to be removed is ink, a mill uses surfactants, including detergents and dispersants, and heat to remove ink particles from the fiber. Ink particles are removed from the stock by washing, which uses screens or thickeners, and/or flotation, which uses air bubbles. Mills with secondary fiber pulping processes can be classified as either deink mills or non-deink mills.

Pulp and paper facilities can either produce unbleached or bleached final products. Bleaching is used at 30 percent of pulp and paper facilities to whiten the pulp by chemically altering the coloring matter to brighten the product. The type and degree of pulp bleaching required is dependent upon the wood type, the pulping process used, and the desired qualities of the final product. Chlorine and chlorine-containing chemicals frequently are used for pulp bleaching; however, the industry has recently been reducing the amount of such chemicals used by substituting chlorine dioxide for chlorine in the first stage of bleaching, reducing the use of hypochlorite, and improving delignification prior to bleaching.

The use of water varies in each of the processes and the resulting wastewaters may contain a range of chemicals. Pulp mills that use logs as raw material may use water for log conveyance, log washing, and wet debarking. Mechanical pulping uses water in several different ways: as a coolant, a carrier to sluice pulp from the grinder, a diluent for subsequent pulp screening and cleaning steps, and a material used in washing or pretreating chips. Water is used in chemical pulping in several different ways: as a solvent for cooking chemicals, a pulp cooking medium, a pulp wash water, and a diluent for screening, cleaning, and subsequent pulp processing. In the chemical recovery cycle, water initially containing weak black liquor from the pulp mill is separated from this black liquor in multi-stage evaporators and then recondensed. The evaporator condensate is either discharged as wastewater or recycled to the pulp mill. Water also is used to wash the solid precipitates formed in the recovery cycle of kraft pulping chemical processes. In the wastepaper processing (deinking or non-deinking), water is mixed with wastepaper to remove pulp particles. Bleaching is a staged process that uses water to perform washes between stages to remove bleaching chemicals and wood components extracted during bleaching. As a result, bleaching wastewater has a high chlorine content. Finally, water is used in pulp handling and papermaking processes to suspend, dilute, and transport the pulp to the paper machine. Water that drains from the wet end of the paper machine is called white water and is normally captured and reused in other parts of the mill or discharged.

Wastes from the various processes typically are aggregated into one wastestream. Primary wastewater treatment at pulp and paper facilities includes screening, gravity sedimentation, and dissolved-air flotation. Common secondary wastewater treatment processes include oxidation and aeration lagoons, activated sludge system, and biological filter system. Most facilities use surface impoundments in treating their wastewaters. These surface impoundments are used for either activated sludge or aerated stabilization treatment.

For the purposes of developing effluent guidelines for this industry, EPA divided the industry into 12 subcategories. Table J-1 lists these subcategories and indicates the number of mills in each.

Table J-1 NUMBER OF MILLS IN THE PULP AND PAPER INDUSTRY BY SUBCATEGORY[1]	
Subcategory	**Number of Mills[2]**
Dissolving Kraft	3
Bleached Papergrade Kraft and Soda	88
Unbleached Kraft	58
Dissolving Sulfite	5
Papergrade Sulfite	11
Semi-Chemical	21
Mechanical Pulp	57
Non-wood Chemical Pulp	12
Secondary Fiber Deink	43
Secondary Fiber Non-deink	342
Fine and Lightweight Papers from Purchased Pulp	115
Tissue, Filter, Non-Woven, and Paperboard from Purchased Pulp	169
Total	565

[1] Counts were from U.S. Environmental Protection Agency, "Development Document for Proposed Effluent Limitations, Guidelines, and Standards for the Pulp, Paper and Paperboard Point Source Category," Office of Water, Effluent Guidelines Division, October, 1993.

[2] Mills are counted in every subcategory in which they have production.

Approach for Identifying Facilities Affected by the Phase III LDR Rule

We identified facilities potentially affected by the rule based on facilities with wastestreams that met the following three criteria:

- Contained decharacterized ICRT wastewater;
- Managed in a land-based unit; and
- Contained non-priority UTS constituents at concentrations exceeding UTS.

For the pulp and paper industry, we largely relied on data collected by EPA to support the development of revised effluent guidelines for the industry (Section 308 data).[2] As part of that effort, EPA focused on collecting data for four of the pulp and paper industry subcategories: bleached papergrade kraft and soda, papergrade sulfite, dissolving kraft, and dissolving sulfite mills. EPA collected detailed data at 20 facilities, representing the 107 mills in these four subcategories. EPA collected data on the pulp making, paper making, bleaching, and chemical recovery processes. EPA focused on these four subcategories because it was concerned by the constituents likely to be present in wastewaters generated by these types of facilities because of the processes used at the facilities (e.g., bleaching).

Our analytic approach was developed as a result of numerous discussions with effluent guidelines development project teams about the data collected by EPA. Our analysis focused on the first and third criteria listed above; we assumed that all pulp and paper facilities use land-based units in managing the potentially affected wastes. Below we outline the steps and assumptions used in the analysis in more detail.

Step 1: Using Section 308 data, identify facilities using processes that generated wastewaters containing ICRT wastes.

Step 2: Determine if the end-of-pipe discharges of wastewaters from these processes contain non-priority UTS constituents at concentrations exceeding UTS.

Step 3: For those facilities identified in based on Steps 1 and 2, collect end-of-pipe flow rate information to be used in estimating the quantity of waste likely to be affected by the rule.

Step 4: Extrapolate results of the analysis for the 20 mills for which there were effluent guidelines data to the 107 pulp and paper mills represented by these 20 facilities.

There are several limitations to this approach. First, the effluent guidelines did not include data on some underlying hazardous constituents, including some metals and semi-volatiles. Second, this analysis did not address the 461 facilities in the other eight industry subcategories, and thus may understate the impacts of the rule.

Results

Based on our analysis, we found that no facilities are likely to be affected by the rule. EPA's analysis of the effluent guidelines data for the 20 facilities found that 17 of the 20 facilities had wastestreams containing ICRT wastes. In addition, this analysis identified five non-priority UTS

[2] U.S. Environmental Protection Agency, *Development Document for Proposed Effluent Limitations, Guidelines, and Standards for the Pulp, Paper, and Paperboard Point Source Category,* October, 1993.

constituents in wastewaters at these 20 facilities. In its recent rule, EPA proposed CWA effluent standards for two of these constituents (acetone and 2,3,7,8 tetrachlorodibenzofuran) and thus wastestreams containing these constituents would not be affected by the rule. Nine of the 20 facilities generated wastewaters containing at least one of the other three UTS constituents (barium, vanadium and carbon disulfide). Finally, the analysis showed that the concentrations of these constituents were below UTS levels at these nine facilities. Thus, EPA found that none of the facilities are likely to be affected by the rule because they do not generate wastewaters containing non-priority UTS constituents at concentrations exceeding UTS levels. Extrapolating these results to the 107 pulp and paper mills represented by these 20 facilities, EPA concludes that none of these mills are likely to be affected by the rule.

Note that although the assumption that all facilities use land-based units in managing their wastewaters did not affect our findings, this assumption may be conservative. The PCS database shows that 457 pulp and paper manufacturing facilities have NPDES permits (affecting 1,745 outfalls) and 172 of these facilities reported treatment information (affecting 435 outfalls).[3] Based on an analysis of the treatment data, 95 facilities reported treatment types likely to occur in surface impoundments.[4] Comparing the number of facilities with land-based units to the total number of facilities for which treatment data were available, EPA estimates that 55 percent of facilities use surface impoundments.[5]

The primary limitation of this analysis is that EPA did not consider the potential effects of the rule on facilities in the other eight industry subcategories due to a lack of data on these facilities. If these facilities, generate similar wastestreams to the 20 facilities analyzed above (i.e., wastewaters containing similar constituents at similar concentration levels), then the rule may not affect these other 461 facilities.

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[3] Reporting of treatment information to PCS is voluntary.

[4] Treatment types assumed to occur in land-based units included evaporation; sedimentation; equalization; neutralization; aerated, polishing, and sludge lagoons; oxidation, stabilization, and holding ponds; aerobic digestion; and extended aeration.

[5] Fifty-five percent equals 95 facilities with treatment in surface impoundments divided by 172 facilities reporting treatment information.

Appendix K

RESULTS OF SCREENING ANALYSES OF THE PHARMACEUTICAL INDUSTRY

Appendix K

RESULTS OF SCREENING ANALYSES OF THE PHARMACEUTICAL INDUSTRY[1]

Industry Overview

The Pharmaceutical industry includes facilities involved in the manufacture, extraction, processing, purification, and packaging of chemical products to be used as medication for humans and animals. These facilities typically are classified under SIC Codes 2833 through 2836 and part of SIC Code 2844.[2] In particular for these analyses, the pharmaceutical industry includes the manufacture of any of the following products:

- Biological products except diagnostic substances (SIC Code 2836), medicinal chemicals and botanical products (SIC Code 2833), and pharmaceutical products (SIC Code 2834);
- All fermentation, biological and natural extraction, chemical synthesis, and formulation products considered as pharmaceutically active ingredients by the Food and Drug Administration that are not covered by SIC Codes 2833, 2834, or 2836;
- Products with multiple end uses which are attributable pharmaceutical product, component of a pharmaceutical formulation, or pharmaceutical intermediate. Products which have nonpharmaceutical uses may also apply provided that the product was primarily intended for use as a pharmaceutical;
- Products not covered by SIC Codes 2833, 2834, and 2836 if they are manufactured by a pharmaceutical manufacturer by processes which generate wastewaters which closely correspond to those of pharmaceutical products; and
- Cosmetic preparations (SIC Code 2844) which function as a skin treatment.

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[1] This appendix is largely taken from an analysis of the Section 308 data for this industry, conducted by Radian Corporation.

[2] In the analysis, we principally relied on data recently collected to support development of revised effluent guidelines for this industry. These survey data cover all pharmaceutical facilities identified by EPA and do not specifically focus on SIC codes. The SIC codes mentioned here reflect the major ones. Note that in the analysis of the BRS and PCS databases, EPA did not include SIC 2844 (perfumes, cosmetics, and other toilet preparations) because it is likely to cover many facilities not in the industry.

EPA finalized effluent guidelines for this industry category in 1983. EPA currently is revising these effluent guidelines and planned to publish the proposed rule in February 1995. The final rule is scheduled for promulgation in February 1996.

In collecting data for development of revised effluent guidelines, EPA distributed a screening survey to 1,163 known or suspected pharmaceutical manufacturing facilities in 1989. EPA identified 560 manufacturers based on responses to the survey. In 1991, the Agency sent a more detailed questionnaire to 280 of these facilities and received responses from 244 of them (35 of the facilities that received questionnaires either were closed or no longer manufactured pharmaceutical products and thus did not respond to the survey, and one facility did not respond). For its detailed questionnaire EPA did not survey all 560 of the identified facilities because it determined that it was unnecessary to survey stand-alone research facilities, facilities that do not discharge wastewater, or facilities that do not use solvents and whose only source of wastewater is from formulation and mixing.

Industry Processes

For the revised effluent guidelines, EPA has divided the pharmaceutical manufacturing industry into four subcategories, based on the manufacturing operations conducted:

- Fermentation,
- Biological and natural extraction,
- Chemical synthesis, and
- Formulation and mixing/compounding.

Pharmaceutical research is a fifth subcategory, but EPA is not planning to regulate this subcategory under the revised effluent guidelines.

Fermentation is commonly used in the manufacture of antibiotics and steroids. It is often a large-scale batch process, consisting of three basic steps: inoculum and seed preparation, fermentation, and product recovery. Most wastewater is generated during the fermentation and product recovery steps. During the product recovery steps, solvents are used in solvent extraction and ion exchange or adsorption. The most commonly used solvents in solvent extraction are acetone, methanol, isopropanol, ethanol, amyl alcohol, and methyl isobutyl ketone. In addition, recovery by direct precipitation using heavy metal precipitating agents generates wastewaters contaminated with metals. Responses to EPA's effluent guidelines survey showed that, in general, fermentation plants produce wastewaters with high BOD_5, COD, and TSS concentrations, relatively large flows, and a pH ranging between 4.0 and 8.0.

Biological and/or natural extraction involves the extraction of products from natural materials such as plant tissue, animal glands, and parasitic fungi. These processes typically use small-scale, assembly-line batch methods. Wastewaters come principally from spent raw materials and solvents used for extraction. In addition, wastewaters contain detergents and disinfectants used in washing floors and equipment. Generally, wastewater from biological/natural extraction facilities are

characterized by low BOD_5, COD, and TSS concentrations, small flows, and a pH range of approximately 6.0 to 8.0.

Most active ingredients in drugs are produced through chemical synthesis. Chemical synthesis is the production of drug compounds through the use of organic and inorganic reactions. Typically, these are batch reactions which involve alkylations, carboxylations, esterifications, halogenations, and sulfonations. Wastewaters primarily are generated from process steps which require the emptying and filling of batch vessels. They are generally characterized as having high BOD_5, COD, and TSS concentrations, large flows, and highly variable pH values, ranging from 1.1 to 11.0.

Finally, mixing, compounding, and formulating operations convert the bulk product into a final dosage for consumption (tablets, liquids, capsules, ointments, etc.). Floor and equipment wash water, wet scrubbers, and spills account for the majority of wastewaters generated by this process. Wastewaters from these operations generally have low BOD_5, COD, and TSS concentrations, relatively small flows, and pH values between 6.0 and 8.0.

A wide variety of treatment technologies are used by pharmaceutical manufacturing facilities to treat their wastewaters. Since 1986, the use of neutralization, equalization, activated sludge, primary clarification, multimedia filtration, steam stripping, secondary clarification, granular activated carbon, and oxidation have all increased, while the use of aerated lagoons, chlorination, waste stabilization ponds, and trickling filters have slightly decreased. Other treatment technologies used by the industry include: settleable solids removal, primary sedimentation, polishing ponds, evaporation, dissolved air flotation, pH adjustment, or phase separation.

Variability of Wastewater Flows

The flow and composition of wastewaters discharged from a pharmaceutical facility can be highly variable as a result of three common practices found in the pharmaceutical industry: campaigning, batch processing, and wastewater commingling. A facility typically manufactures many different pharmaceutical products during different campaigns (i.e., limited production efforts in which specific products are manufactured). Between campaigns, the process equipment must be cleaned to avoid contamination between processes. Thus, changeovers produce wastewaters whose composition depends on the product manufactured on that process line. Batch-type production is the most common manufacturing operation used by the industry. Often, many different batch operations are running simultaneously in separate vessels. The timing, composition, and concentrations of wastewater discharges vary between individual batches, contributing to the variability of wastewaters produced by a facility. In addition, pharmaceutical manufacturing facilities typically commingle their wastes, adding to the variability of wastewaters. Often, organic-contaminated wastes from different processes will be mixed in order to accumulate a sufficient amount for the economical operation of a treatment unit.

Approach for Identifying Facilities Affected by Phase III LDR Rule

EPA identified facilities potentially affected by the rule based on facilities with wastestreams that met the following three criteria:

- Contained decharacterized ICRT wastewater;
- Managed in a land-based unit; and
- Contained non-priority UTS constituents at concentrations exceeding UTS.

For the analysis of the pharmaceuticals industry, EPA relied on data collected under Section 308 of the CWA and used in developing effluent guidelines. This approach for identifying facilities in the pharmaceutical category that are likely to be affected by the Phase III LDR rule was developed as a result of numerous discussions with the effluent guidelines development project teams regarding these data and how they are currently managed in the CBI and non-CBI versions of the pharmaceuticals database. The non-CBI version was provided in its entirety for this Phase III effort.

The analysis to identify facilities affected by the rule focused on the latter two criteria listed above -- on the use of land-based units to manage wastewaters and the presence of non-priority UTS constituents in wastewaters at concentrations exceeding UTS -- and EPA did not consider whether these wastewaters were likely to contain decharacterized ICRT wastes (due to lack of data).[3]

Step 1: Identify the treatment types that are likely to occur in a land-based unit and identify those facilities that use those treatment types.

Assumption: Aerated stabilization basins and wastewater stabilization ponds are the treatment types likely to occur in a land-based unit.

Step 2: For the facilities identified in Step 1, identify wastestreams containing non-priority UTS pollutants and calculate end-of-pipe concentrations and flow rates.

Assumption: All priority pollutants will be addressed under the CWA through the effluent guidelines program.

Step 3: Compare end-of-pipe concentrations to UTS levels to estimate the facilities and wastestreams likely to be affected by the rule.

[3] Given the results of our analysis discussed below, it was not necessary to refer to other data sources to address this criterion.

Note that the data collected to support the effluent guidelines is likely to cover most of the non-priority UTS constituents found in wastewaters generated by pharmaceutical facilities. This is the case because the current sampling and survey procedures for the effluent guidelines involve data collection for a long list of pollutants including priority and non-priority pollutants.[4]

Results

In this analysis, EPA found that the Phase III LDR rule is unlikely to affect any facilities in the pharmaceutical industry. The results of this analysis are presented below.

Based on this analysis of the effluent guidelines data, EPA identified 15 out of 244 pharmaceutical facilities that use aerated stabilization basins and/or wastewater stabilization ponds (i.e., land-based units). Based on the available end-of-pipe discharge data, wastewaters managed at these facilities contained only three non-priority UTS constituents: isobutyl alcohol, methanol and acetone (2-propanol). Only one of these three constituents, acetone, exceeded UTS levels at two facilities. However, acetone is among the constituents that EPA plans to propose for regulation under the pharmaceutical industry's revised effluent guidelines. This rule is expected to be proposed in February 1995, and will be finalized in February 1996. As written in the Phase III LDR rule, constituents which are controlled to BAT by the Clean Water Act will not be subject to UTS standards under RCRA. Thus, based on this regulatory schedule, these two facilities will not be affected by the rule.

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[4] EPA's initial sampling program for this industry analyzed for the presence and concentration of all pollutants on the "Industrial Technology Division List of Analytes." In its detailed questionnaire from 1990, EPA considered 109 non-priority pollutants likely to be present in pharmaceutical facilities' wastewaters, based on data from the sampling program.

Appendix L

RESULTS OF SCREENING ANALYSES OF INDUSTRIAL LAUNDRIES

Appendix L

RESULTS OF SCREENING ANALYSES OF INDUSTRIAL LAUNDRIES[1]

Industry Overview

Industrial Laundry facilities (SIC code 7218) are primarily engaged in supplying laundered or, to a limited extent, dry-cleaned work uniforms, wiping towels, safety equipment (e.g., gloves, flame-resistant clothing), dust covers and cloths, and similar items to industrial or commercial users. These items may belong to the industrial laundry and supplied to users on a rental basis, or they may be the customer's own goods.

Estimates of the number of facilities in this industry range between about 1,000 and 1,500. There are 1,379 operating industrial laundries according to the 1987 Census of Service Industries, up from 1,288 based on the 1982 Census. According to the 1982 Census, approximately 1,000 of these facilities operate their own laundry facilities; the remainder are mostly sales establishments, administrative centers, or distribution centers. The Agency currently is collecting additional data and refining estimates of the number of facilities in the industry based on screener questionnaire responses. EPA is developing new effluent guidelines for this industry (no standards are currently in existence). It plans to propose guidelines in December 1996 and to finalize them in 1998.

The laundries industry is extremely labor intensive and conservative in equipment usage. Equipment usage has not changed greatly in recent years. Basic laundry equipment is durable and there is a strong tendency in this industry to purchase used or rebuilt machinery when replacing equipment. The major customers of industrial laundries are chemical and manufacturing plants, automotive repair shops and service stations, machine shops, printing establishments, and janitorial services.

The three basic processes used at industrial laundries are laundering, dry cleaning, and dual-phase processing. In the laundering process, soiled materials are first sorted by color and then by the need for stain treatment. Each laundry load is placed in a washing machine that progresses through various washing stages, including a bleach or brightening cycle for many items. In the dry-cleaning process, fabrics are cleaned using an organic solvent. Dual-phase or dual-stage processing uses a cleaning method that employs a water/detergent wash and a separate solvent wash to clean items that contain large amounts of both water-soluble solids and oil and grease. Relatively large quantities of dry-cleaning solvent may enter the wastewater stream as a result of dual-phase processing; however, this method is being phased out as a laundry process.

[1] This appendix is largely based on the analysis conducted for the capacity assessment (see the appendices to the capacity analysis development document).

In typical laundries, there are three principal sources of wastewater: water washing laundering processes, plant and equipment cleaning, and sanitary water. Dual-phase laundering and dry cleaning are minor sources of process wastewater because dual-phase is rarely used and dry-cleaning utilizes only small quantities of process water. The total volume of wastewater ranges from 8,600 to 290,000 gallons per day (gpd) and averages 68,000 gpd per facility. The quantity discharged depends on the efficiency of the equipment, water conservation methods employed, types of items laundered, and types and loadings of soils on items. The characteristics of the wastewaters depend on the general type of cleaning, types and quantities of soils, and composition of the various laundering chemicals used. All known industrial laundries discharge to POTWs; there are no direct dischargers. As a result, many facilities do not treat their wastes prior to discharge.

Approach for Identifying Facilities Affected by the Phase III LDR Rule

We identified facilities potentially affected by the rule based on facilities with wastestreams that met the following three criteria:

- Contained decharacterized ICRT wastewater;
- Managed in a land-based unit; and
- Contained non-priority UTS constituents at concentrations exceeding UTS.

For the industrial laundries category, we relied on information from PCS and BRS, as well as on professional judgment to evaluate the number of affected facilities. Limited data are available from the effluent guidelines program because effluent guidelines currently do not exist for this industry category; the available data includes data collected to date to support development of new effluent guidelines. In addition, TRI data are not available because TRI only covers manufacturing facilities (i.e., SIC codes 20 through 39).

Results

We estimated that no industrial laundry facilities will be affected by the Phase III LDR rule because these facilities typically do no use land-based units to manage their wastewaters. First, most industrial laundries do not conduct on-site treatment of wastewaters prior to discharging to a POTW. In addition, if treatment is performed on-site, it is not biological treatment nor other treatment activities that routinely occur in land-based units. Rather, conventional treatment methods in this industry include lint screens, oil skimmers, and heat reclaimers. Furthermore, industrial laundry facilities do not generate wastewater at a rate that would warrant the use of a land-based unit in a treatment system if treatment were performed.

Data collected to date from the effluent guideline screener questionnaires and limited sampling efforts support this characterization of the industry. EPA anticipates that data collected in the 200 additional screener questionnaires, the outstanding detailed questionnaires, or future sampling efforts will not yield new or different information regarding on-site treatment or the use of land-based units. Our analysis of BRS data, which focused on ICRT wastewaters managed in land-based units, supported this expectation, as it did not yield any quantity data on industrial laundries. Also, PCS data showed only four land-based units under the entire Personal Services SIC code (SIC 72) and no units under SIC Code 7218.

Appendix M

RESULTS OF SCREENING ANALYSES OF THE LEATHER TREATING INDUSTRY

Appendix M

RESULTS OF SCREENING ANALYSES OF THE LEATHER TREATING INDUSTRY

The leather tanning industry includes facilities in SIC code 3111.[1] Establishments in this industry engage in tanning, currying, and finishing raw or cured hides and skins. Tanning is the reaction of collagen fibers with tannins, chromium, alum, or other tanning agents that help preserve the skin. In addition, the industry includes converters and dealers that buy hides and skins or leather and contract with tanners or finishers to process these products. The effluent guidelines for this industry were finalized in 1982. According to the 1987 Census of Manufactures, there are 319 establishments in the leather treating industry, 258 tanneries, 16 converters, and 45 contract tanneries.

The three major types of manufacturing processes in the leather treating industry include beamhouse operations, tanyard processes, and retanning and wetfinishing processes. Beamhouse operations include washing and soaking hides or skins and removing the attached hair. Tanyard processes involve reactions of tanning agents with the skins or hides and stabilization of the proteinaceous matter in these skins and hides. Further tanning is performed as part of the retanning and wet finishing processes, using chemical agents such as syntans, dyes, lubricants and various finishes. In general, leather treating processes generate acidic wastewaters principally containing sulfides and chromium, as well as ammonia, biocides, chlorides, and surfactants. Tanners tend to discharge their wastewaters to POTWs.

Approach for Identifying Facilities Affected by the Phase III LDR Rule

We identified facilities potentially affected by the rule based on facilities with wastestreams that met the following three criteria:

- Contained decharacterized ICRT wastewater;
- Managed in a land-based unit; and
- Contained non-priority UTS constituents at concentrations exceeding UTS.

Due to a lack of effluent guideline data on non-priority UTS constituents in wastestreams generated by the leather tanning industry, we relied largely on TRI data to assess which facilities might have wastestreams containing non-priority constituents exceeding UTS levels. In our analysis, we combined TRI loadings data and industry-specific data on flow rates for wastewater discharges to estimate the concentrations of non-priority UTS constituents in facilities' wastestreams. We then compared these concentration levels to UTS levels to identify facilities with wastestreams potentially

[1] This overview of the industry was taken from a draft of the capacity analysis for this industry (see the appendix for this industry in the capacity analysis development documents).

exceeding UTS. In addition, since TRI does not contain information on waste management practices, we considered data from other sources to evaluate facilities likely to manage ICRT wastewaters in surface impoundments. Below we outline the steps and assumptions used in the analysis in more detail.

Step 1: Using TRI data, identify facilities that report discharges of a non-priority UTS pollutants to POTWs or to surface waters and collect data on the reported loadings for each facility by constituent.

Step 2: Evaluate the average flow rate of wastewater discharges by facilities in the industry.

Step 3: Applying the estimated average flow rate to the TRI loadings data, identify facilities that may be affected by the rule because they have wastestreams with non-priority UTS constituents with concentrations exceeding UTS levels.

This approach may understate the number of facilities affected by the rule for two reasons. First, the TRI database only includes data on 48 of the 101 non-priority UTS constituents. Second, only those facilities generating more than 10,000 pounds of TRI constituents per year are required to report to TRI. Smaller facilities that manage ICRT wastewaters in surface impoundments also could be affected by the rule.

Results

Based on our analysis, we found that no facilities are likely to be affected by the rule. In 1992, 74 leather treating facilities reported releases of TRI chemicals, with 61 reporting releases to water or to POTWs; seven are direct dischargers, 44 are indirect dischargers, and 10 are both. Of these 61 facilities, 8 reported a quantifiable discharge of at least one of the 101 non-priority UTS pollutants. All eight of these facilities discharged wastewaters to POTWs. Wastewaters from these facilities contained at least one of six non-priority UTS pollutants, either methanol, butanol, xylene, methyl ethyl ketone, methyl isobutyl ketone, or acetone.

To assess the number of affected facilities, we combined the TRI loadings data with the estimated average wastestream flow rates for facilities in this industry and compared the resulting concentration estimates to UTS levels. Based on our analysis, we found that no facilities are likely to be affected by the rule because no facilities generate wastewaters containing non-priority UTS constituents exceeding UTS levels, assuming an average flow rate of 226,000 gallons per day.[2]

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[2] This average flow rate was taken from van der Leeden, Frits, Fred L. Troise and David Keith Todd, *The Water Encyclopedia*, Lewis Publishers, 1990. See Table 5-39 for data on water use in the leather treating industry. We were unable to obtain flow rate data from the effluent guidelines development documents that could be used to estimate a lower bound flow rate.

The above analysis shows that the Phase III LDR rule is unlikely to have a significant effect on the leather treating industry. However, our analysis of the TRI data does not address 53 non-priority UTS constituents since these pollutants are not considered in TRI, and thus may underestimate the effects of the rule. Therefore we also conducted analyses of the BRS and PCS databases to evaluate the extent to which facilities in this industry manage ICRT wastes in land-based units.

The results of our analyses of the BRS and PCS databases supported our findings from the TRI analyses -- that is that the rule is likely to have no effects on this industry. Our analysis of BRS did not identify any ICR wastes managed in land-based units by facilities in this industry. Furthermore, our analysis of PCS did not yield any facilities in the industry that reported to PCS (i.e., there are no leather treating facilities that are direct dischargers with NPDES permits in the database). This finding is not surprising since PCS only addresses direct dischargers, and most facilities in the industry apparently discharge to POTWs. Unfortunately, the PCS data did not allow us to evaluate the extent to which indirect discharges manage wastewaters in land-based units prior to discharging them to POTWs.

Appendix N

RESULTS OF SCREENING ANALYSES OF FEDERAL FACILITIES

Appendix N

RESULTS OF SCREENING ANALYSES OF FEDERAL FACILITIES[1]

Federal facilities include all operations and facilities managed by the U.S. federal government and cover a wide range of services and processes. In the SIC code system, these facilities are classified according to the operations of the facility and do not have a separate code. For example, steam electric plants that are operated by the federal government are classified under the same SIC code as privately-owned facilities -- SIC 4911. Operations likely to occur at federal facilities include electroplating and metal finishing, manufacturing of electrical and electronic components, manufacturing of metal products and machinery, and transportation equipment cleaning.

Since federal facilities are classified according to the manufacturing processes and products manufactured at the facility, many of these facilities are likely to be addressed in the analyses of other industries. However, EPA did investigate the availability of data for conducting a stand-alone analysis of federal facilities. EPA identified and used the Federal Facility Inventory for 1992 in an analysis of these facilities. As required under RCRA Section 3016, every two years EPA compiles this database from data submitted by federal agencies on treatment, storage, and disposal units at the facilities. The database contains general information on the facility, as well as data on environmental monitoring, contamination and response actions, RCRA treatment, storage and disposal units, and releases of hazardous wastes.

EPA's review of these data showed that of the 914 federal facilities in the database, 69 (eight percent) manage wastewaters in nonhazardous land-based units (i.e., land treatment units or surface impoundments).[2] This finding indicates that a small percentage of federal facilities are potentially affected by the rule. Unfortunately, the database did not support a more complete analysis since information on constituents and constituent concentrations in the wastes managed in these land-based units is not available from this source. EPA did not conduct any additional analysis for these facilities, assuming that those facilities potentially affected were addressed under the analyses conducted for other industries.

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[1] This appendix largely draws from a draft version of the analysis of this industry conducted for the capacity assessment.

[2] Note that this estimate does not include facilities that mange wastes in underground injection wells.

Appendix O

RESULTS OF SCREENING ANALYSES OF THE TRANSPORTATION EQUIPMENT CLEANING INDUSTRY

Appendix O

RESULTS OF SCREENING ANALYSES OF THE TRANSPORTATION EQUIPMENT CLEANING INDUSTRY

The transportation and equipment cleaning (TEC) industry includes firms that clean the interiors and exteriors of transport vehicles for the transportation industry. For the purposes of the water effluent guidelines, EPA has divided this industry category into two subcategories: (1) tank truck, rail tank car, barge tank, and ocean/sea tanker cleaning, and (2) aviation equipment cleaning. The first subcategory is a service-oriented industry, whereas the cleaning of aircraft is believed to be a vertically integrated function of fleet maintenance operations at airline companies. EPA has found that facilities in this industry are classified under a range of SIC codes, thus making it difficult to identify facilities based on these codes.

Unfortunately, limited data are available to evaluate the extent to which facilities in this industry are likely to be affected by the Phase III LDR rule. We principally relied on the available data currently being collected by EPA to support development of these effluent guidelines for this industry. The TEC industry currently is not regulated under the water effluent guidelines program. However, EPA currently is developing guidelines for this industry. The Agency plans to propose these guidelines by the end of 1996 and to finalize regulations in 1998.

EPA initially included 11,900 facilities in the TEC database of known or potential facilities in the industry, including facilities in both the tank cleaning and aviation equipment cleaning subcategories. EPA distributed screener surveys to 3,240 tank cleaning facilities and 760 airplane cleaning facilities to more accurately determine the scope of and identify facilities in the industry. Based on the preliminary results of this survey, EPA identified 734 facilities in the rail, truck and barge tank cleaning subcategory. Scaling the results of this survey sample to the entire population, EPA estimated that there are 2,400 to 2,800 facilities in this subcategory.

Based on an analysis of the waste management practices at the 734 facilities identified in the screener survey, EPA estimated that 98 of these facilities (13 percent) use land-based units in managing their wastewaters (evaporation ponds, lagoons, or settling ponds). Unfortunately, additional information on constituents contained in wastewaters managed in these land-based units by these facilities is not available.[1] In reviewing existing data, EPA generally found that a wide array of constituents can be found at these facilities because hundreds of different chemicals are shipped in tanks. Thus these facilities potentially could be affected by the rule.

Preliminary screener survey data for the aircraft cleaning subcategory will not be available until the spring of 1995. EPA believes that some of these facilities may use land-based units in managing their wastes and thus may be affected by the rule.

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[1] Data on constituents and concentration levels will be available when EPA completes the detailed questionnaire, which EPA plans to distribute to a subset of the facilities in the industry in 1995.

Appendix P

APPROACH AND RESULTS OF THE SCREENING ANALYSES OF THE BIENNIAL REPORT SURVEY (BRS)

Appendix P

APPROACH AND RESULTS OF THE SCREENING ANALYSES OF THE BIENNIAL REPORT SURVEY (BRS)

EPA conducted screening analyses of the BRS database to estimate the quantity of ICR waste generated and managed in land-based units by industries. The 1991 BRS provides the most recent data available on the generation and management of hazardous wastes by facilities. However, the BRS does not include data on constituent concentrations in wastes, and thus EPA could not rely solely on this data source in evaluating the number of facilities and quantity of waste likely to be affected by the Phase III LDR rule. Furthermore, EPA believes that BRS data may understate the quantity of decharacterized ICR wastewaters managed in land-based units because many facilities may not have reported wastes that were diluted immediately upon generation as hazardous wastes.[1] However, the BRS does provide an indication of the industries that manage these wastewaters in surface impoundments, and EPA thus used the BRS in determining which industries to include in the analysis. The results also served as reference points against which to evaluate estimates of the quantity of affected waste developed from other data sources.

This appendix outlines the approach used to estimate the quantity of ICR wastes managed in land-based units and summarizes the results of these analyses.

Analytic Approach

For each industry, the BRS analysis involved identifying facilities in the industry that generated ICR wastes and managed them in land-based units prior to discharge to POTWs or surface waters. To identify these facilities, the following screening criteria were applied:

Step 1: Screen for SIC codes of concern.

Step 2: Screen for ICR waste codes (D001 through D003).

Step 3: Screen for form codes representing wastewaters (to exclude non-wastewaters).

Step 4: Screen for facilities that managed their wastes on-site or discharged them to POTWs (exclude facilities that shipped wastes off-site and did not treat wastes on-site).

Step 5: Screen for waste management in land-based units and collect data on the quantity of ICR waste for these facilities.

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[1] In fact, such wastes should have been included in BRS. However, EPA discussions with industry suggest that this requirement has been broadly misinterpreted in the past.

EPA conducted analyses for 13 of the 16 industries considered in the RIA. Table P-1 summarizes the industries and corresponding SIC codes used in the analyses. Note that these industries in some cases have been defined somewhat more broadly than the definition ultimately used in the screening analyses of affected facilities (see Appendices B through P). Federal Facilities and Transportation Equipment Cleaning and Metal Finishing/Electroplating industries were not analyzed using BRS data because facilities in these industries could not be identified by SIC code; facilities in these industries are classified under a wide range of SIC codes, but do not include all facilities classified under these codes.

Table P-1

SUMMARY OF SIC CODES CONSIDERED FOR EACH INDUSTRY IN THE BRS ANALYSES

Organic Chemicals (OCPSF) SIC 2821-2824, 2865-2869	Petroleum Refining SIC 2900-2999
Inorganic Chemicals SIC 2812-2819	Pharmaceuticals SIC 2833-2836
Pulp and Paper SIC 2600-2699	MP&M SIC 3400-3499, 3500-3569, 3581-3599
Electrical and Electronic Components SIC 3612-3699, 3571-3579	Food SIC 2000-2099
Electric Power Generation SIC 4911	Pesticides SIC 2879
Iron and Steel SIC 3312-3325	Leather Treating SIC 3100-3199

Results

Based on this analysis, the 13 industries managed 79.5 million tons of ICR wastes in land-based units in 1991. The organic chemicals industry managed the largest share of these wastes -- 42 percent. Table P-2 summarizes the results of the analysis. Note that two of the industries, industrial laundries and leather treating, did not have any facilities in the BRS database that met all of the screening criteria and thus the estimated quantity of ICR waste managed in land-based units for these industries equals zero.

Table P-2

ESTIMATED QUANTITY OF ICR WASTE MANAGED IN LAND-BASED UNITS, BY INDUSTRY (1991 BRS Data)

Industry	Quantity (tons/yr)	Percent
Petroleum Refining	4,290,312	5.4%
Organic Chemicals	33,517,667	42.2%
Inorganic Chemicals	7,528,884	9.5%
Pesticides	417,959	0.5%
Food	85,988	0.1%
Electrical and Electronic Components	19,457,184	24.5%
Electric Power Generation	714,403	0.9%
Pharmaceuticals	262,939	0.3%
Pulp and Paper	2,119,004	2.7%
Metal Products & Machinery	8,995,349	11.3%
Iron and Steel	2,125,134	2.7%
Industrial Laundries	0	0.0%
Leather Treating	0	0.0%
Total:	79,514,823	100.0%

Appendix Q

COST METHODOLOGY FOR THE ORGANIC CHEMICAL AND PETROLEUM REFINING INDUSTRIES

Appendix Q

COST METHODOLOGY FOR THE ORGANIC CHEMICAL AND PETROLEUM REFINING INDUSTRIES

This appendix provides additional information on the data sources and methods used in developing estimates for the costs associated with on-going monitoring and with treatment of wastewater streams. Based on the affected industry analyses, we estimated that the Phase III LDR rule could have significant impacts on the organic chemicals and petroleum refining industries (i.e., the rule would affect more than one percent of the facilities in the industry). Cost estimates were calculated for these two industries; other industries were estimated to incur only minor or no effects, and were not considered in our cost analysis.

We first discuss in this appendix the costs associated with on-going monitoring. Facilities that comply with the Phase III LDR rule by either modification of their CWA permit or treatment of constituents to UTS levels will incur on-going monitoring costs. Second, we present our methodology for estimating the treatment costs incurred by facilities that achieve compliance by treating wastewater streams to UTS levels. We do not describe here other compliance costs, such as the costs related to re-opening CWA permits; the assumptions and methods for this category of costs is described in detail in Chapter 3.

Estimating On-Going Monitoring Costs

Approach

Under the Phase III rule, affected facilities will be required to perform on-going monitoring of their wastestreams. All facilities that have CWA permits must perform monitoring tests as required under the CWA. If affected facilities modify their CWA permits by adding additional constituents to the permit, these facilities will incur incremental on-going monitoring costs. Facilities that comply by treating their wastewaters must also perform on-going monitoring; the rule stipulates that these facilities must monitor their treated constituents on a quarterly basis. We estimated a range of on-going monitoring costs for facilities under each of two compliance options. This range reflects uncertainty and variability in several factors, including assumptions about the cost of testing an individual constituent and the number of constituents that will be tested (affected in part by the presence of high or low wastewater stream flows).

Permit Modification

Our calculation of incremental on-going monitoring costs for the permit modification compliance option was based on available data for the current costs of monitoring constituents already specified in CWA permits. For EPA's Discharge Monthly Report requirements for CWA permits, the Agency has collected information on the annual monitoring costs for sampling, analysis,

and reporting.[1] On average, this monitoring is performed 12 times a year. The constituent monitoring costs are stated in terms of annual costs per constituent per facility. For the category of "major industrial facilities," the average constituent monitoring costs are $2,230. We used this value in our calculations because we believe that this broad category encompasses the organic chemicals and petroleum refining facilities included in our analysis.

Estimation of on-going monitoring costs also required estimating the number of constituents at each facility that are expected to exceed UTS concentrations and would subsequently be included in the CWA permit specifying achievement of BAT levels. We estimated the average number of exceedences per facility by using the screening analyses described in Appendix A and Appendix B. Values reflecting both high-flow and low-flow were calculated. These values for both industries are shown below:

- Organic chemicals
  - under high-flow: 1.33 exceedences per facility
  - under low-flow: 1.69 exceedences per facility
- Petroleum refining
  - under high-flow: 1.25 exceedences per facility
  - under low-flow: 1.44 exceedences per facility

With these data, we calculated the per facility costs for on-going monitoring for facilities that modify their CWA permits. The results are presented in Table Q-1. For most of the calculations included in the RIA, we use a single value for on-going monitoring costs. Averaging over high- and low-flows, high and average constituent monitoring costs, and both organic chemicals and petroleum refining industries, we obtain a value of approximately $3,180 per facility per year.

Treatment to UTS

Facilities that treat their constituent concentrations to UTS levels will be required to perform quarterly monitoring of their wastestreams to ensure that adequate treatment is taking place. We assume that quarterly monitoring and CWA permit monitoring differ only in terms of frequency of testing. The costs for CWA permit monitoring are based on monthly monitoring performed to complete CWA Discharge Monthly Reports. We assumed that the cost for each of the monthly tests for CWA permits was equivalent to 1/12 the annual cost of CWA monitoring. We then multiplied this value by four to calculate the annual cost of quarterly testing of constituents treated to UTS. This yielded a value of $743 per constituent per year per facility.

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[1] Personal communication with Brian Bell, EPA Office of Water. Discharge Monthly Reports are submitted only by direct dischargers. We assume that the costs incurred by direct dischargers will be representative of those incurred by both direct and indirect dischargers considered in this analysis.

Table Q-1 ON-GOING MONITORING COSTS PER FACILITY FOR PERMIT MODIFICATION	
Industry	**Annual On-Going Monitoring Cost per Facility**
Organic Chemicals	
High-Flow	$2,966
Low-Flow	$3,769
Petroleum Refining	
High-Flow	$2,788
Low-Flow	$3,211

To calculate monitoring costs on a per facility basis, we required an estimate of the expected number of UTS exceedences per facility for both organic chemicals and petroleum refining industries. For these data, we used the results of the analysis performed for calculation of on-going monitoring costs for permit modification.

We combined the constituent monitoring costs with the number of constituents expected to exceed UTS levels to estimate the on-going monitoring costs for facilities that treat to UTS. The results of the analysis are presented in Table Q-2. For many calculations in the RIA, we use an average value for the range of costs shown in Table Q-2. For the organic chemicals industry, we use an average of $1,120; for the petroleum refining industries, we assumed a cost of $1,000.

Table Q-2 ON-GOING MONITORING COSTS PER FACILITY FOR TREATMENT TO UTS	
Industry	**Annual On-Going Monitoring Cost per Facility**
Organic Chemicals	
High-Flow	$989
Low-Flow	$1,256
Petroleum Refining	
High-Flow	$929
Low-Flow	$1,070

Estimating Treatment Costs

Approach

Developing estimates of the compliance costs associated with the treatment to UTS option involved three steps:

- Identify treatment type for reducing constituent concentrations in the affected wastestreams to below UTS levels;
- Develop per facility capital and operating and maintenance (O&M) cost estimates for these treatment technologies; and
- Apply these cost estimates to the estimated number of affected facilities, as developed in our affected facilities analyses.

EPA identified treatment options based on reviews of development documents for the effluent guidelines for these industries, as well as on engineering judgement. The Agency considered treatment technologies that would work within existing systems or could be installed at end-of-pipe. Note that for each industry, EPA analyzed direct and indirect dischargers separately and combined the resulting estimates to obtain an aggregate estimate for the industry.

There are several limitations associated with this approach. Most importantly, the analysis did not consider in-plant modifications or changes to current wastewater management techniques, such as segregation and separate treatment of ICRT wastes, that potentially could be implemented at a lower cost than the identified end-of-pipe treatment options. In addition, EPA did not consider the costs of shifting treatment to tanks, which might reduce the costs of complying with the rule. Thus, the resulting cost estimates provide an upper bound of the costs incurred by the facilities estimated to be affected by the rule.

Organic Chemicals

For the treatment to UTS option, EPA estimated that indirect dischargers in the organic chemicals industry would treat their wastes to meet UTS levels using activated sludge treatment followed by granular activated carbon treatment. Extended aeration activated sludge treatment was selected as the initial treatment process that facilities would install to reduce organic loadings in their wastewater since based on our affected facility analysis, wastewaters generated by indirect dischargers contained high levels of organics that are generally biodegradable, including acetone, methanol and other organics. EPA assumed that carbon treatment then would "polish" the remaining organics. In addition, for indirect dischargers whose affected wastewaters contain barium, EPA also estimated that facilities would add ferric sulfate feed to secondary clarifiers to precipitate the barium. In both cases, EPA assumed that the resulting sludge would be incinerated. The costs for each system are summarized in Table Q-3.

Table Q-3

PER FACILITY TREATMENT COSTS: ORGANIC CHEMICAL INDUSTRY

Technology	Capital Cost	Annual O&M Costs	Annualized Costs[1]
Indirect Dischargers			
Extended aeration activated sludge (including belt press)	$1,327,000	$61,000	
Granulated carbon system	$1,131,000	$255,000	
Ferric sulfate addition[2]	$9,000	$61,000	
Sludge incineration (fluidized bed)	$1,060,000	$240,000	
Sampling and testing[3]		$21,480	
On-going monitoring		$1,120	
Total: Indirect dischargers with barium exceedences	$3,527,000	$639,600	$972,524
Total: Indirect dischargers without barium exceedences	$3,518,000	$578,600	$910,674
Direct Dischargers			
Granulated carbon system	$5,089,000	$198,000	
Sampling and testing		$21,480	
On-going monitoring		$1,120	
Total		$220,600	$700,965

1 Based on a 20-year operating life for capital equipment and a discount rate of 7.0 percent.
2 This treatment is only for those facilities that have exceedences of barium.
3 Based on an average of the range of testing costs provided by Dow and two laboratories.

The estimated costs of extended aeration sludge treatment include the costs for aeration basins and equipment, a clarifier (clari-flocculator type), sludge pumps, and a belt press (including the costs of the press, conveyor systems, piping, and instrumentation). These costs were estimated using cost curves from the effluent guidelines development documents and assumed a nominal 24 hour detention time.[2] The fluidized bed incinerator capital costs include the costs of the incinerator, enclosure building, piping, and necessary utility systems; O&M costs include ash disposal. The

[2] For these cost curves and other cost data for the organic chemical industry, see U.S. Environmental Protection Agency, *Innovative and Alternative Technology Assessment Manual,* 1980 and U.S. Environmental Protection Agency, *Development Document for Effluent Guidelines Limitations and Standards for Organic Chemicals, Plastics and Synthetic Resins*, 1987.

granulated carbon system costs include the costs of contact vessels and piping. These costs were based on a cost curve for a small, end-of-pipe system, assuming a medium-sized capacity system. The capital costs were annualized assuming a 20-year life for the equipment and an interest rate of seven percent. All costs were adjusted to 1994 dollars using the ENR Construction Cost Index (CCI).

For direct dischargers, EPA estimated that facilities would use activated carbon treatment to comply with the rule. EPA believed that this treatment system would suffice since these facilities have lower organic chemical concentrations in their wastewaters than the indirect dischargers, based on the affected industry analysis of the TRI data. However, use of this treatment technology assumes a relatively low suspended solids level; if higher suspended solids levels are encountered, some pretreatment might be required. Table R-1 also presents these cost estimates. For these direct discharges activated carbon treatment costs are based on a cost curve for large, end-of-pipe systems, assuming a medium capacity system as defined based on that curve. The capital costs include the cost of contact vessels, piping, carbon handling, and a small, on-site, regeneration furnace. As in the case of indirect dischargers, the capital costs are also presented on an annualized basis and all costs were converted to 1994 dollars.

In the final step of our analysis, we applied these cost estimates to the estimated number of affected facilities, based on the analyses summarized in Chapter 2. These cost estimates are presented in Chapter 3.

Petroleum Refining

Under the treatment to UTS option, EPA estimated that indirect dischargers in the petroleum refining industry would comply with the rule by installing a granulated carbon adsorption system. EPA estimated the capital and O&M costs of this system, assuming an average flow rate at a facility of 720,000 gallons per day. These capital costs include the costs of carbon units, pumps, piping, and carbon handling equipment. These costs were taken from the development documents for the petroleum industry.[3] The estimated cost of a system of the appropriate size (based on the assumed average flow rate) was developed based on a linear interpolation of the cost data in the development document and adjusted to 1994 dollars using the ENR CCI. In addition, the annualized costs were calculated, assuming a 20-year operating life for capital equipment and a seven percent interest rate. These costs are summarized in Table Q-4.

For direct dischargers, EPA estimated that facilities would comply with the rule using powdered activated carbon adsorption (to be used in addition to existing biological treatment systems). The capital and O&M costs of this system were estimated based on data in the development documents using a similar approach as for indirect dischargers. The costs assume an average flow rate of 3.2 million gallons per day. The costs include carbon storage and feed equipment costs.

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[3] U.S. Environmental Protection Agency, *Development Document for Effluent Guideline Limitations and Standards for the Petroleum Refining Point Source Category*, 1979.

Table Q-4

PER FACILITY COSTS FOR PETROLEUM REFINERS

Technology	Capital Cost	Annual O&M Cost	Annualized Costs[1]
Indirect Dischargers			
Granulated carbon system	$4,119,000	$527,000	
Sampling and testing[2]		$21,480	
On-going monitoring		$1,000	
Total		$549,480	$938,284
Direct Dischargers			
Powdered activated carbon adsorption	$265,000	$992,000	
Sampling and testing[2]		$21,480	
On-going monitoring		$1,000	
Total		$1,014,480	$1,059,494

1 Based on a 20-year operating life for capital equipment and a discount rate of 7.0 percent.

2 Based on an average of the range of testing costs provided by Dow and two laboratories.

In the final step of this analysis, EPA applied these cost estimates to the estimated number of petroleum refiners affected by the rule. The resulting cost estimates are reviewed in Chapter 3.

Appendix R

ECONOMIC IMPACT CALCULATIONS

Economic Impact Analysis - Pollution Control Operating Costs
(in millions of dollars)

SIC Code	1982				1983			
	Net Operating Costs	Number of Establishments	Ave. Cost per Establishment	Ave. Cost 1994 $	Net Operating Costs	Number of Establishments	Ave. Cost per Establishment	Ave. Cost 1994 $
Organic Chemicals 2821-24, 2865-69								
2821	$178.4	359	$0.5	$0.77	$201.6	428	$0.5	$0.71
2822	$42.0	43	$1.0	$1.50	$60.0	38	$1.6	$2.38
2823	$27.1	10	$2.7	$4.17	$23.0	11	$2.1	$3.16
2824	$64.6	32	$2.0	$3.11	$58.5	59	$1.0	$1.50
2865	$109.5	133	$0.8	$1.27	(D)	125	$0.0	$0.00
2869	$602.8	344	$1.8	$2.70	$595.6	388	$1.5	$2.32
Petroleum Refining 2911								
2911	$1,265.3	310	$4.1	$6.29	$1,297.0	292	$4.4	$6.71
Spent Al Potliners 3334								
3334	$37.8	36	$1.1	$1.62	$82.4	28	$2.9	$4.44

Economic Impact Analysis - Pollution Control Operating Costs
(in millions of dollars)

SIC Code	1984				1985			
	Net Operating Costs	Number of Establishments	Ave. Cost per Establishment	Ave. Cost 1994 $	Net Operating Costs	Number of Establishments	Ave. Cost per Establishment	Ave. Cost 1994 $
Organic Chemicals 2821-24, 2865-69								
2821	$179.2	329	$0.5	$0.79	$203.5	340	$0.6	$0.85
2822	$70.2	33	$2.1	$3.09	$69.2	35	$2.0	$2.82
2823	$18.3	8	$2.3	$3.32	(D)	9	$0.0	$0.00
2824	$70.2	60	$1.2	$1.70	(D)	65	$0.0	$0.00
2865	$119.2	125	$1.0	$1.39	(D)	128	$0.0	$0.00
2869	$649.3	384	$1.7	$2.46	$674.3	384	$1.8	$2.51
Petroleum Refining 2911								
2911	$1,473.5	278	$5.3	$7.70	$1,515.9	268	$5.7	$8.07
Spent Al Potliners 3334								
3334	$86.3	28	$3.1	$4.48	$94.4	31	$3.0	$4.35

Economic Impact Analysis - Pollution Control Operating Costs (in millions of dollars)								
	1986				1988			
SIC Code	Net Operating Costs	Number of Establishments	Ave. Cost per Establishment	Ave. Cost 1994 $	Net Operating Costs	Number of Establishments	Ave. Cost per Establishment	Ave. Cost 1994 $
Organic Chemicals 2821-24, 2865-69								
2821	$233.6	350	$0.7	$1.00	$220.2	331	$0.7	$0.83
2822	$58.4	39	$1.5	$2.24	$60.9	46	$1.3	$1.66
2823	$17.5	9	$1.9	$2.91	$16.9	7	$2.4	$3.03
2824	$54.2	67	$0.8	$1.21	$64.4	68	$0.9	$1.19
2865	$151.9	123	$1.2	$1.85	$173.0	123	$1.4	$1.77
2869	$655.9	383	$1.7	$2.56	$833.8	432	$1.9	$2.42
Petroleum Refining 2911								
2911	$1,443.3	272	$5.3	$7.94	$1,426.3	226	$6.3	$7.92
Spent Al Potliners 3334								
3334	$51.1	35	$1.5	$2.18	$76.7	30	$2.6	$3.21

Economic Impact Analysis - Pollution Control Operating Costs (in millions of dollars)								
	1989				1990			
SIC Code	Net Operating Costs	Number of Establishments	Ave. Cost per Establishment	Ave. Cost 1994 $	Net Operating Costs	Number of Establishments	Ave. Cost per Establishment	Ave. Cost 1994 $
Organic Chemicals 2821-24, 2865-69								
2821	$309.9	346	$0.9	$1.01	$403.6	343	$1.18	$1.30
2822	$80.8	39	$2.1	$2.33	$84.1	43	$1.96	$2.16
2823	(D)	7	$0.0	$0.00	(D)	9	$0.00	$0.00
2824	$68.7	59	$1.2	$1.31	(D)	62	$0.00	$0.00
2865	$236.1	126	$1.9	$2.11	($33.1)	130	($0.25)	($0.28)
2869	$982.1	419	$2.3	$2.64	$1,198.8	424	$2.83	$3.12
Petroleum Refining 2911								
2911	$1,525.2	219	$7.0	$7.84	$2,011.0	212	$9.49	$10.47
Spent Al Potliners 3334								
3334	($88.4)	29	($3.0)	($3.43)	$87.1	30	$2.90	$3.21

Economic Impact Analysis - Pollution Control Operating Costs (in millions of dollars)					SUMMARY		
	1991				TOTAL	UPPER BOUND	LOWER BOUND
SIC Code	Net Operating Costs	Number of Establishments	Ave. Cost per Establishment	Ave. Cost 1994 $	Ave. Cost per Establishment	Wtd. Ave. Annual Operating Cost	Wtd. Ave. Annual Operating Cost
Organic Chemicals 2821-24, 2865-69							
2821	$544.4	341	$1.60	$1.70	$1.00	$0.46	$0.02
2822	$86.7	44	$1.97	$2.10	$2.26	$0.46	$0.02
2823	$41.5	10	$4.15	$4.43	$3.50	$0.46	$0.02
2824	$61.4	65	$0.94	$1.01	$1.57	$0.46	$0.02
2865	($28.9)	132	($0.22)	($0.23)	$1.12	$0.46	$0.02
2869	$1,082.9	421	$2.57	$2.74	$2.61	$0.46	$0.02
Petroleum Refining 2911					AVERAGE $2.01		
2911	$2,237.9	220	$10.17	$10.85	$8.20	$0.93	$0.02
Spent Al Potliners 3334							
3334	$94.3	32	$2.95	$3.14	$2.58	$2.28	$2.28

NOTES:
(D) = Information withheld to avoid disclosing operations of individual companies.
(Z) = Less than half the unit shown.
No PACE data is available for 1987.
Costs adjusted to July 1994 dollars using the Chemical Engineering Plant Cost Index.
SOURCES:
"Pollution Abatement Costs and Expenditures", 1982-1991, Bureau of the Census, U.S. Department of Commerce.
"County Business Patterns", 1982-1991, Bureau of the Census, Department of Commerce.

Economic Impact Analysis - Pollution Control Capital Expenditures (in millions of dollars)								
	1982				1983			
SIC Code	Total Capital Expenditures	Number of Establishments	Average Cost per Establishment	Average Cost in 1994 $	Total Capital Expenditures	Number of Establishments	Average Cost per Establishment	Average Cost in 1994 $
Organic Chemicals 2821-24, 2865-69								
2821	$67.4	359	$0.19	$0.29	$63.5	428	$0.15	$0.22
2822	(D)	43	$0.00	$0.00	$9.8	38	$0.26	$0.39
2823	(D)	10	$0.00	$0.00	$5.5	11	$0.50	$0.76
2824	$24.0	54	$0.44	$0.68	$4.3	59	$0.07	$0.11
2865	(D)	133	$0.00	$0.00	$23.7	125	$0.19	$0.29
2869	(D)	344	$0.00	$0.00	$114.9	388	$0.30	$0.45
Petroleum Refining 2911								
2911	$699.3	310	$2.26	$3.47	$460.2	292	$1.58	$2.38
Spent Al Potliners 3334								
3334	(D)	36	$0.00	$0.00	$15.4	26	$0.59	$0.89

Economic Impact Analysis - Pollution Control Capital Expenditures (in millions of dollars)								
	1984				1985			
SIC Code	Total Capital Expenditures	Number of Establishments	Average Cost per Establishment	Average Cost in 1994 $	Total Capital Expenditures	Number of Establishments	Average Cost per Establishment	Average Cost in 1994 $
Organic Chemicals 2821-24, 2865-69								
2821	$35.3	329	$0.11	$0.16	$54.8	340	$0.16	$0.23
2822	$6.3	33	$0.19	$0.28	$7.2	35	$0.21	$0.29
2823	$1.4	8	$0.18	$0.25	$4.1	9	$0.46	$0.65
2824	$13.7	60	$0.23	$0.33	$22.8	65	$0.35	$0.50
2865	$27.0	125	$0.22	$0.31	$31.7	128	$0.25	$0.35
2869	$132.4	384	$0.34	$0.50	$167.9	384	$0.44	$0.62
Petroleum Refining 2911								
2911	$303.2	278	$1.09	$1.58	$278.9	268	$1.04	$1.49
Spent Al Potliners 3334								
3334	$29.4	28	$1.05	$1.53	$17.2	31	$0.55	$0.79

Economic Impact Analysis - Pollution Control Capital Expenditures (in millions of dollars)								
	1986				1988			
SIC Code	Total Capital Expenditures	Number of Establishments	Average Cost per Establishment	Average Cost in 1994 $	Total Capital Expenditures	Number of Establishments	Average Cost per Establishment	Average Cost in 1994 $
Organic Chemicals 2821-24, 2865-69								
2821	$93.1	350	$0.27	$0.40	$119.9	331	$0.36	$0.45
2822	$22.1	39	$0.57	$0.85	$43.3	46	$0.94	$1.18
2823	$3.8	9	$0.42	$0.63	$2.4	7	$0.34	$0.43
2824	$27.2	67	$0.41	$0.61	$15.9	68	$0.23	$0.29
2865	$55.0	123	$0.45	$0.67	$79.4	123	$0.65	$0.81
2869	$145.0	383	$0.38	$0.57	$350.4	432	$0.81	$1.02
Petroleum Refining 2911								
2911	$413.2	272	$1.52	$2.27	$470.3	226	$2.08	$2.61
Spent Al Potliners 3334								
3334	$14.3	35	$0.41	$0.61	$15.5	30	$0.52	$0.65

Economic Impact Analysis - Pollution Control Capital Expenditures (in millions of)					SUMMARY		
	1991				TOTAL	UPPER BOUND	LOWER BOUND
SIC Code	Total Capital Expenditures	Number of Establishments	Average Cost per Establishment	Average Cost in 1994 $	Average Cost per Establishment	Weighted Average Annual Capital Cost	Weighted Average Annual Capital Cost
Organic Chemicals 2821-24, 2865-69							
2821	$292.6	341	$0.86	$0.92	$0.44	$0.39	$0.02
2822	$77.6	44	$1.76	$1.88	$1.16	$0.39	$0.02
2823	$28.0	10	$2.80	$2.99	$0.95	$0.39	$0.02
2824	$42.2	65	$0.65	$0.69	$0.46	$0.39	$0.02
2865	$175.3	132	$1.33	$1.42	$0.72	$0.39	$0.02
2869	$637.8	421	$1.51	$1.62	$0.92	$0.39	$0.02
Petroleum Refining 2911					AVERAGE $0.77		
2911	$1,434.4	220	$6.52	$6.96	$3.05	$0.08	$0.02
Spent Al Potliners 3334							
3334	$36.1	32	$1.13	$1.20	$0.94	$2.28	

NOTES:
(D) = Information withheld to avoid disclosing operations of individual companies.
(Z) = Less than half the unit shown.
No PACE data is available for 1987.
Costs adjusted to July 1994 dollars using the Chemical Engineering Plant Cost Index.
SOURCES:
"Pollution Abatement Costs and Expenditures", 1982-1991, Bureau of the Census, U.S. Department of Commerce.
"County Business Patterns", 1982-1991, Bureau of the Census, Department of Commerce.

Economic Impact Analysis - Pollution Control Capital Expenditures (in millions of dollars)								
	1989				1990			
SIC Code	Total Capital Expenditures	Number of Establishments	Average Cost per Establishment	Average Cost in 1994 $	Total Capital Expenditures	Number of Establishments	Average Cost per Establishment	Average Cost in 1994 $
Organic Chemicals 2821-24, 2865-69								
2821	$155.4	346	$0.45	$0.51	$238.5	343	$0.70	$0.77
2822	$74.0	39	$1.90	$2.14	$88.1	43	$2.05	$2.26
2823	(D)	7	$0.00	$0.00	(D)	9	$0.00	$0.00
2824	(D)	59	$0.00	$0.00	(D)	62	$0.00	$0.00
2865	$68.3	126	$0.54	$0.61	$149.9	130	$1.15	$1.27
2869	$407.0	419	$0.97	$1.09	$586.8	424	$1.38	$1.53
Petroleum Refining 2911								
2911	$388.2	219	$1.77	$2.00	$893.0	212	$4.21	$4.65
Spent Al Potliners 3334								
3334	$16.1	29	$0.56	$0.63	$32.1	30	$1.07	$1.18

SUMMARY		
TOTAL	UPPER BOUND	LOWER BOUND
Average Cost per Establishment	Weighted Average Annual Capital Cost	Weighted Average Annual Capital Cost
$3.70	$0.39	$0.02
$3.07	$0.39	$0.02
$6.87	$0.39	$0.02
$9.61	$0.39	$0.02
$3.58	$0.39	$0.02
$5.33	$0.39	$0.02
AVERAGE $5.4		
$12.28	$0.08	$0.02
$5.29	$2.28	$2.28

NOTES:
Costs in millions of dollars
(D) = Withheld to avoid disclosing data for individual companies.
(Z) = Less than half of the unit shown.
Costs adjusted to July 1994 dollars using the Chemical Engineering Plant Cost Index.
SOURCES: "Annual Survey of Manufactures", 1982-1991, Bureau of the Census, U.S. Department of Commerce.
"County Business Patterns", 1982-1991, Bureau of the Census, Department of Commerce.

Economic Impact Analysis - Total Annual Capital Expenditures (in millions of dollars)								
	1990				1991			
SIC Code	Total Capital Expenditures	Number of Establishments	Average Cost per Establishment	Average Cost 1994 $	Total Capital Expenditures	Number of Establishments	Average Cost per Establishment	Average Cost 1994 $
Organic Chemicals 2821-24, 2865-69								
2821	$2,446.7	498	$4.9	$5.42	$2,264.8	519	$4.4	$4.66
2822	$378.6	76	$5.0	$5.50	$365.4	92	$4.0	$4.24
2823	$71.5	9	$7.9	$8.77	$106.3	13	$8.2	$8.72
2824	$815.9	71	$11.5	$12.69	$810.4	78	$10.4	$11.09
2865	$958.3	181	$5.3	$5.85	$717.3	190	$3.8	$4.03
2869	$4,241.9	651	$6.5	$7.19	$4,578.3	661	$6.9	$7.39
Petroleum Refining 2911								
2911	$3,969.2	326	$12.2	$13.44	$5,864.4	343	$17.1	$18.24
Spent Al Potliners 3334								
3334	$189.1	54	$3.5	$3.87	$209.5	57	$3.7	$3.92

Economic Impact Analysis - Total Annual Capital Expenditures (in millions of dollars)								
	1988				1989			
SIC Code	Total Capital Expenditures	Number of Establishments	Average Cost per Establishment	Average Cost 1994 $	Total Capital Expenditures	Number of Establishments	Average Cost per Establishment	Average Cost 1994 $
Organic Chemicals 2821-24, 2865-69								
2821	$1,618.0	487	$3.3	$4.17	$1,988.7	510	$3.9	$4.39
2822	$216.4	115	$1.9	$2.36	$266.5	86	$3.1	$3.49
2823	$113.2	10	$11.3	$14.21	$105.3	10	$10.5	$11.86
2824	$635.5	81	$7.8	$9.85	$699.7	74	$9.5	$10.65
2865	$436.0	186	$2.3	$2.94	$590.7	185	$3.2	$3.60
2869	$2,780.3	685	$4.1	$5.09	$3,516.6	648	$5.4	$6.11
Petroleum Refining 2911								
2911	$2,362.7	336	$7.0	$8.82	$3,005.8	335	$9.0	$10.10
Spent Al Potliners 3334								
3334	$150.2	49	$3.1	$3.85	$183.0	52	$3.5	$3.96

Economic Impact Analysis - Total Annual Capital Expenditures (in millions of dollars)								
	1986				1987			
SIC Code	Total Capital Expenditures	Number of Establishments	Average Cost per Establishment	Average Cost 1994 $	Total Capital Expenditures	Number of Establishments	Average Cost per Establishment	Average Cost 1994 $
Organic Chemicals 2821-24, 2865-69								
2821	$1,310.7	477	$2.7	$4.11	$1,311.0	540	$2.4	$3.50
2822	$116.6	87	$1.3	$2.00	$170.5	122	$1.4	$2.02
2823	$54.9	18	$3.1	$4.56	$23.8	19	$1.3	$1.81
2824	$465.9	76	$6.1	$9.17	$464.0	80	$5.8	$8.36
2865	$335.8	183	$1.8	$2.75	$392.1	183	$2.1	$3.09
2869	$1,504.8	619	$2.4	$3.64	$2,067.1	632	$3.3	$4.72
Petroleum Refining 2911								
2911	$2,316.7	441	$5.3	$7.86	$2,103.4	457	$4.6	$6.64
Spent Al Potliners 3334								
3334	$71.3	52	$1.4	$2.05	$223.0	67	$3.3	$4.80

Economic Impact Analysis - Total Annual Capital Expenditures (in millions of dollars)								
	1982				1983			
SIC Code	Total Capital Expenditures	Number of Establishments	Average Cost per Establishment	Average Cost 1994 $	Total Capital Expenditures	Number of Establishments	Average Cost per Establishment	Average Cost 1994 $
Organic Chemicals 2821-24, 2865-69								
2821	$898.8	518	$1.7	$2.67	$756.4	634	$1.2	$1.80
2822	$246.4	92	$2.7	$4.12	$101.5	89	$1.1	$1.72
2823	$88.4	24	$3.7	$5.67	$44.4	24	$1.9	$2.79
2824	$442.9	64	$6.9	$10.66	$257.4	70	$3.7	$5.55
2865	$454.7	186	$2.4	$3.76	$532.4	178	$3.0	$4.52
2869	$2,580.5	582	$4.4	$6.83	$1,821.6	666	$2.7	$4.13
Petroleum Refining 2911								
2911	$6,322.4	460	$13.7	$21.17	$4,319.1	439	$9.8	$14.86
Spent Al Potliners 3334								
3334	$181.2	49	$3.7	$5.69	$390.7	38	$10.3	$15.53

Economic Impact Analysis - Total Annual Capital Expenditures (in millions of dollars)								
	1984				1985			
SIC Code	Total Capital Expenditures	Number of Establishments	Average Cost per Establishment	Average Cost 1994 $	Total Capital Expenditures	Number of Establishments	Average Cost per Establishment	Average Cost 1994 $
Organic Chemicals 2821-24, 2865-69								
2821	$925.3	469	$2.0	$2.87	$1,135.3	470	$2.4	$3.45
2822	(D)	80	$0.0	$0.00	$118.2	78	$1.5	$2.16
2823	(D)	18	$0.0	$0.00	$43.8	18	$2.4	$3.47
2824	$334.9	72	$4.7	$6.76	$611.5	77	$7.9	$11.33
2865	$261.9	181	$1.4	$2.10	$398.3	182	$2.2	$3.12
2869	$1,617.7	643	$2.5	$3.66	$2,013.0	635	$3.2	$4.52
Petroleum Refining 2911								
2911	$3,494.4	433	$8.1	$11.73	$3,072.5	442	$7.0	$9.92
Spent Al Potliners 3334								
3334	$154.4	42	$3.7	$5.34	$122.8	45	$2.7	$3.89

SUMMARY		
TOTAL	UPPER BOUND	LOWER BOUND
Average Cost per Establishment	Weighted Average Annual Operating Costs	Weighted Average Annual Operating Costs
$46.49	$0.46	$0.02
$39.67	$0.46	$0.02
$102.52	$0.46	$0.02
$129.66	$0.46	$0.02
$48.32	$0.46	$0.02
$59.24	$0.46	$0.02
AVERAGE $71.0		
$458.35	$0.93	$0.02
$135.62	$2.28	$2.28

NOTES:
Costs in millions of dollars
(D) = Withheld to avoid disclosing data for individual companies.
(Z) = Less than half of the unit shown.
Costs adjusted to July 1994 dollars using the Chemical Engineering Plant Cost Index.
SOURCES: "Annual Survey of Manufactures", 1982-1991, Bureau of the Census, U.S. Department of Commerce.
"County Business Patterns", 1982-1991, Bureau of the Census, Department of Commerce.

Economic Impact Analysis - Total Annual Operating Costs (in millions of dollars)								
	1990				1991			
SIC Code	Net Operating Costs	Number of Establishments	Average Cost per Establishment	Average Cost 1994 $	Net Operating Costs	Number of Establishments	Average Cost per Establishment	Average Cost 1994 $
Organic Chemicals 2821-24, 2865-69								
2821	$22,496.2	510	$44.1	$48.70	$21,731.3	519	$41.9	$44.68
2822	$3,145.6	86	$36.6	$40.38	$2,876.0	92	$31.3	$33.36
2823	$1,168.9	10	$116.9	$129.05	$1,251.5	13	$96.3	$102.72
2824	$7,460.8	74	$100.8	$111.31	$6,949.6	78	$89.1	$95.07
2865	$8,161.7	185	$44.1	$48.71	$8,001.4	190	$42.1	$44.93
2869	$35,320.3	648	$54.5	$60.18	$36,174.9	661	$54.7	$58.39
Petroleum Refining 2911								
2911	$142,528.3	335	$425.5	$469.71	$128,260.8	343	$373.9	$398.99
Spent Al Potliners 3334								
3334	$5,850.8	54	$108.3	$119.62	$5,589.8	57	$98.1	$104.64

Economic Impact Analysis - Total Annual Operating Costs (in millions of dollars)								
	1988				1989			
SIC Code	Net Operating Costs	Number of Establishments	Average Cost per Establishment	Average Cost 1994 $	Net Operating Costs	Number of Establishments	Average Cost per Establishment	Average Cost 1994 $
Organic Chemicals 2821-24, 2865-69								
2821	$22,007.3	487	$45.2	$56.71	$23,248.4	498	$46.7	$52.57
2822	$3,054.1	115	$26.6	$33.33	$2,969.5	76	$39.1	$44.00
2823	$1,098.7	10	$109.9	$137.89	$1,162.5	9	$129.2	$145.44
2824	$7,281.7	81	$89.9	$112.82	$7,785.2	71	$109.7	$123.47
2865	$7,214.1	186	$38.8	$48.68	$8,106.3	181	$44.8	$50.43
2869	$31,664.8	685	$46.2	$58.01	$34,298.6	651	$52.7	$59.32
Petroleum Refining 2911								
2911	$100,909.3	336	$300.3	$376.91	$114,218.5	326	$350.4	$394.51
Spent Al Potliners 3334								
3334	$5,066.8	49	$103.4	$129.77	$5,702.8	52	$109.7	$123.49

Economic Impact Analysis - Total Annual Operating Costs (in millions of dollars)								
	1986				1987			
SIC Code	Net Operating Costs	Number of Establishments	Average Cost per Establishment	Average Cost 1994 $	Net Operating Costs	Number of Establishments	Average Cost per Establishment	Average Cost 1994 $
Organic Chemicals 2821-24, 2865-69								
2821	$15,570.5	477	$32.6	$48.83	$17,865.1	540	$33.1	$47.71
2822	$2,015.5	87	$23.2	$34.66	$2,570.2	122	$21.1	$30.38
2823	$1,089.7	18	$60.5	$90.57	$1,011.8	19	$53.3	$76.79
2824	$7,048.4	76	$92.7	$138.74	$6,697.4	80	$83.7	$120.72
2865	$5,154.4	183	$28.2	$42.14	$6,475.3	183	$35.4	$51.02
2869	$21,576.6	619	$34.9	$52.15	$28,713.6	632	$45.4	$65.51
Petroleum Refining 2911								
2911	$99,792.6	441	$226.3	$338.53	$108,267.4	457	$236.9	$341.62
Spent Al Potliners 3334								
3334	$3,779.3	52	$72.7	$108.73	$3,820.2	67	$57.0	$82.22

Economic Impact Analysis - Total Annual Operating Costs (in millions of dollars)								
	1982				1983			
SIC Code	Net Operating Costs	Number of Establishments	Average Cost per Establishment	Average Cost 1994 $	Net Operating Costs	Number of Establishments	Average Cost per Establishment	Average Cost 1994 $
Organic Chemicals 2821-24, 2865-69								
2821	$12,588.9	518	$24.3	$37.43	$14,186.6	634	$22.4	$33.79
2822	$2,661.2	92	$28.9	$44.55	$2,595.8	89	$29.2	$44.04
2823	$1,169.0	24	$48.7	$75.01	$1,320.0	24	$55.0	$83.05
2824	$6,714.1	64	$104.9	$161.56	$7,051.9	70	$100.7	$152.12
2865	$5,926.1	186	$31.9	$49.07	$5,978.6	178	$33.6	$50.72
2869	$23,986.1	582	$41.2	$63.47	$25,276.0	666	$38.0	$57.31
Petroleum Refining 2911								
2911	$182,841.1	460	$397.5	$612.12	$167,790.3	439	$382.2	$577.14
Spent Al Potliners 3334								
3334	$4,909.8	49	$100.2	$154.31	$5,132.0	38	$135.1	$203.93

Economic Impact Analysis - Total Annual Operating Costs (in millions of dollars)								
	1984				1985			
SIC Code	Net Operating Costs	Number of Establishments	Average Cost per Establishment	Average Cost 1994 $	Net Operating Costs	Number of Establishments	Average Cost per Establishment	Average Cost 1994 $
Organic Chemicals 2821-24, 2865-69								
2821	$15,356.0	469	$32.7	$47.57	$15,465.6	470	$32.9	$46.96
2822	$2,733.3	80	$34.2	$49.64	$2,315.0	78	$29.7	$42.35
2823	$1,193.5	18	$66.3	$96.34	$1,114.8	18	$61.9	$88.38
2824	$7,454.9	72	$103.5	$150.44	$7,033.4	77	$91.3	$130.35
2865	$6,048.6	181	$33.4	$48.56	$6,243.1	182	$34.3	$48.95
2869	$27,382.5	643	$42.6	$61.88	$24,988.9	635	$39.4	$56.16
Petroleum Refining 2911								
2911	$169,045.5	433	$390.4	$567.26	$156,947.5	442	$355.1	$506.71
Spent Al Potliners 3334								
3334	$5,561.7	42	$132.4	$192.41	$4,321.9	45	$96.0	$137.05

Appendix S

RISK ASSESSMENT EQUATIONS

Appendix S

RISK ASSESSMENT EQUATIONS

This Appendix summarizes the equations used in evaluating the risks associated with the affected wastestreams based on the four pathways analyzed. These four pathways include ingestion of drinking water, ingestion of contaminated fish tissue, ingestion of dairy products contaminated because dairy cattle consumed water from the affected surface waters, and ingestion of beef products contaminated because beef cattle consumed water from affected surface waters. The equations are taken from the Risk Assessment Guidance for Superfund (EPA 1991) and Combustor Indirect Exposure Methodologies report (EPA 1990 and EPA 1993). Sources for the values of input parameters are listed in Exhibits U-1 and U-2 at the end of this Appendix.

Ingestion of Drinking Water

The following equations were used in evaluating the risk associated with exposure to constituents through the drinking water pathway. These equations estimate mixing of the effluent discharge and the receiving surface water body, partitioning between suspended solids and the water column[1], intake by humans, and the resulting cancer or noncancer exposure risk, as outlined below.

$$Csw = \frac{Ceff * Qeff}{(Vfx + Qeff)} \qquad \text{(DW-1)}$$

$$Cdw = Csw/(1 + [kd_{sw} * TSS * 10^{-6}\ kg/mg]) \qquad \text{(DW-2)}$$

$$I = \frac{Cdw * CRw}{BW} \qquad \text{(DW-3)}$$

- **Cancer Risk:**

$$TR = \frac{ED * EF * CSForal}{AT * 365\ day/yr} * I \qquad \text{(DW-4)}$$

Noncancer Risk:

$$HR = I/RfD \qquad \text{(DW-5)}$$

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[1] Note that we did not take into account biodegradation, hydrolysis or partitioning to sediments. For the drinking water ingestion pathway, we assumed that drinking water is filtered at treatment plants and thus any constituent that partitions to suspended solids would be filtered out from the drinking water and would not contribute to human exposure levels.

where:

Ceff	concentration in effluent (mg/L)
Qeff	flow of effluent (m^3/yr)
Vfx	flow of surface water (m^3/yr)
Csw	concentration in surface water (mg/L)
Cdw	concentration in drinking water (mg/L)
kd_{sw}	suspended sediment/surface water partition coefficient (L/kg)
TSS	total suspended solids (mg/L)
BW	body weight (kg)
CRw	consumption rate of water (L/day)
I	intake (mg/kg/day)
ED	exposure duration (yr)
EF	exposure frequency (day/yr)
CSForal	cancer slope factor $(mg/kg/day)^{-1}$
AT	averaging time (yr)
RfD	reference dose (mg/kg/day)
TR	total cancer risk (unitless)
HR	hazard ratio, noncancer risk (unitless)

Ingestion of Fish Tissue

The following equations were used in estimating the risk associated with exposure from ingestion of contaminated fish tissue. These equations evaluate mixing of the effluent discharge and receiving surface water, partitioning between suspended solids and the water column, uptake by fish, intake by humans, and the resulting cancer or noncancer exposure risk.

$$Csw = \frac{Ceff * Qeff}{(Vfx + Qeff)} \tag{F-1}$$

$$Cdw = Csw/(1 + [kd_{sw} * TSS * 10^{-6}\ kg/mg]) \tag{F-2}$$

$$C_{fish} = Cdw * BCF \tag{F-3}$$

$$I = \frac{C_{fish} * CR_{fish} * 10^{-3}\ kg/g}{BW} \tag{F-4}$$

Cancer Risk:

$$TR = \frac{ED * EF * CSForal}{AT * 365\ day/yr} * I \tag{F-5}$$

Noncancer Risk:

$$HR = I/RfD \tag{F-6}$$

where:

Ceff	concentration in effluent (mg/L)
Qeff	flow of effluent (m^3/yr)
Vfx	flow of surface water (m^3/yr)
Csw	concentration in surface water (mg/L)
Cdw	concentration in drinking water (mg/L)
kd_{sw}	suspended sediment/surface water partition coefficient (L/kg)
TSS	total suspended solids (mg/L)
C_{fish}	concentration level in fish tissue (mg/kg)
BCF	bioconcentration factor (L/kg)
CR_{fish}	consumption rate of fish (g/day)
BW	body weight (kg)
I	intake (mg/kg/day)
ED	exposure duration (yr)
EF	exposure frequency (day/yr)
CSForal	cancer slope factor $(mg/kg/day)^{-1}$
AT	averaging time (yr)
RfD	reference dose (mg/kg/day)
TR	total cancer risk (unitless)
HR	hazard ratio, noncancer risk (unitless)

Ingestion of Dairy/Beef Products Contaminated Because
Dairy/Beef Cattle Consumed Contaminated Surface Water

The following equations were used to estimate resulting risk levels from exposure via two pathways: (1) human ingestion of dairy products contaminated because dairy cattle consumed water from affected surface waters; and (2) human ingestion of beef products contaminated because beef cattle consumed water from affected surface waters. The only difference in the application of these equations occurs in the input values for the biotransfer factor (Ba) which measures the degree to which contaminants are transferred from the environment (water) to specific animal tissues, and the animal product consumption rate (CR_p -- i.e., the amount of dairy products or beef products consumed by an individual). These equations evaluate mixing of the effluent discharge with receiving surface waters, uptake by dairy or beef cattle, intake by humans, and the resulting cancer or noncancer risk levels.

$$Csw = \frac{Ceff * Qeff}{(Vfx + Qeff)} \tag{AP-1}$$

$$C_{animal} = Ba * Qw * Csw \tag{AP-2}$$

$$I = C_{animal} * \frac{F * CR_p}{BW * 10^{-3}\ g/kg} \qquad \text{(AP-3)}$$

Cancer:

$$TR = \frac{I * ED * EF * CSForal}{AT * 365\ day/yr} \qquad \text{(AP-4)}$$

Noncancer:

$$HR = I/RfD$$

Ceff	concentration in effluent (mg/L)
Qeff	flow of effluent (m^3/yr)
Vfx	flow of surface water (m^3/yr)
Csw	concentration in surface water (mg/L)
C_{animal}	concentration in beef (dairy) product (mg/kg)
Ba	biotransfer factor (day/kg) - separate values for beef and dairy, by constituent
Qw	quantity of water consumed by cattle (L/day)
I	intake (mg/kg/day)
F	fraction of individual's consumption of beef product (dairy product) that is contaminated
CR_p	consumption rate of beef (dairy) product (g/day)
BW	body weight (kg)
ED	exposure duration (yr)
EF	exposure frequency (day/yr)
CSForal	cancer slope factor $(mg/kg/day)^{-1}$
AT	averaging time (yr)
RfD	reference dose (mg/kg/day)
TR	total cancer risk (unitless)
HR	hazard ratio, noncancer risk (unitless)

Input Parameters

Exhibits S-1 and S-2 summarize the values and sources for all input parameter assumptions used in our analysis. For many of these parameters, including TR, HR, AT, EF, ED, BW, CRw, F, CR_p, and Qw we used inputs commonly used in other EPA risk analyses. For C_{fish}, we used a high-end estimate for fish consumption by the adult general population. For the inputs related to mixing of effluent discharges with receiving waters, (i.e., OC_{sw}, TSS, and Vfx), we used values that would yield high-end risk values. For example, we used the lower bound of the estimated range for TSS in streams and rivers. This assumption would translate into higher exposure risk estimates based on the drinking water pathway.

Exhibit S-1 RISK ASSESSMENT INPUT PARAMETERS			
Abbreviation	**Input Parameters**	**Value**	**Reference**
OC_{SW}	Fraction of Organic Content of Surface Water (unitless)	0.05	U.S. EPA (1993)
TSS	Total Suspended Solids (mg/L)	10	U.S. EPA (1993)
Vfx	Flow Rate of Receiving Waters (m^3/yr)	1.34E+07	Van Der Leeden (et al. 1990)
CRw	Consumption Rate of Water (L/day)	2	U.S. EPA (1990a)
TR	Total Cancer Risk (unitless)	1E-06	U.S. EPA (1991)
AT	Averaging Time (years)	70	U.S. EPA (1990a)
ED	Exposure Duration (years)	30	U.S. EPA (1991)
EF	Exposure Frequency (days/year)	350	U.S. EPA (1991)
HR	Hazard Ratio, Noncancer Risk (unitless)	1	U.S. EPA (1990b)
BW	Body Weight (kg)	70	U.S. EPA (1990a)
CR_{fish}	Consumption Rate of Fish (g/day)	16.5	USDA (1977-1978)
F	Fraction of Individual's Consumption of Product that is Contaminated		
	Beef	0.44	U.S. EPA (1990a)
	Dairy	0.4	U.S. EPA (1990a)
CR_p	Consumption Rate of Animal Product (g/day)		
	Beef	100	U.S. EPA (1990a)
	Dairy	300	U.S. EPA (1990a)
Qw	Ingestion Rate of Drinking Water for Cattle (L/day)	50	Travis and Arms (1988)
RfD	Reference Dose (mg/kg/day)	Chemical Specific	IRIS (1994)
CSF_{oral}	Cancer Slope Factor $(mg/kg/day)^{-1}$	Chemical Specific	IRIS (1994)

Exhibit S-2 EQUATIONS USED TO DERIVE CHEMICAL SPECIFIC INPUT PARAMETERS			
Abbreviation	**Variable**	**Equation Used to Derive Chemical Specific Values**	**Source**
Kow	Octanol - water partition coefficient (unitless)	Log Kow	Kollig (1993)
Koc	Organic - carbon-normalized partition coefficient (L/kg)	Log Koc = Log Kow - 0.21	U.S. EPA (1993)
Kd_{sw}	Suspended sediment/ surface water partition coefficient (L/kg)	Kd_{sw} = Koc * OC_{sw}	U.S. EPA (1993)
BCF	Bioconcentration factor (L/kg)	Log BCF = 0.76 * Log Kow - 0.23	U.S. EPA (1993)
Ba	Biotransfer factor (day/kg)		
	Beef	Log Ba Beef = -7.6 + Log Kow	Baes et al. (1984)
	Dairy	Log Ba Dairy = -8.1 + Log Kow	Baes et al. (1984)

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Appendix T

AMERICAN AIRLINES COMMENT

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AmericanAirlines

MAINTENANCE & ENGINEERING CENTER

M6

February 18, 1993

U.S. Environmental Protection Agency
RCRA Docket (OS-305)
401 M Street, S.W.
Washington, D.C. 20460

Re: Docket No. F93-TTCA-FFFFF; Comments in Response to EPA's Notice of Data Availability (Published January 19, 1993) Proposing New Treatment Standards for Land Disposal of Characteristic Wastes

Dear Sir or Madam:

American Airlines, Inc. ("American") is pleased to submit these comments in response to EPA's Notice of Data Availability (published January 19, 1993) ("Notice") and Supplemental Information Report ("Report") proposing changes in the treatment standards for the land disposal of characteristic wastes.

I. Summary of American's Position.

American operates two Class I nonhazardous injection wells and is particularly concerned about the proposed restrictions upon characteristic wastes which are rendered nonhazardous through aggregation prior to injection in Class I nonhazardous deep wells ("deep wells") regulated under the Safe Drinking Water Act ("SDWA") Underground Injection Control ("UIC") program. The data relied upon by EPA in considering this action do not include many operators like American which legitimately aggregate wastewaters to facilitate centralized treatment and inject decharacterized wastewaters in deep wells. When the volume of these waste streams is added to that considered in EPA's Report, it is clear that the proposed elimination of authority to inject decharacterized wastes and the imposition of an F039 treatment standard would have a devastating impact upon industry.

Although EPA must respond to the decision in *Chemical Waste Management, Inc. v. U.S.E.P.A.*, 976 F.2d 2 (D.C. Cir. 1992), the Court did *not* vacate the rules

authorizing injection of decharacterized wastes.[1] Accordingly, EPA should allow these rules to remain in place while it develops the factual record justifying decharacterization and deep well injection as a form of treatment satisfying RCRA § 3004(m)(1). American believes that the proposed application of the F039 standard to deep well injection is unnecessary to satisfy the "minimize threat" standard mandated by § 3004(m)(1), will be devastating to many operators and extremely costly for others to meet, all without any showing that the additional treatment required to meet such a standard would result in a greater minimization of threats to human health and the environment than the current rules. EPA has previously found that treatment beyond decharacterization and deep well injection would *not* further minimize threats to human health and the environment[2] and should not impose upon deep well injection a standard designed for surface disposal where the consequential cost and disruption are not offset by reduced threat.

While American does not support the addition of raw water into characteristic waste streams as a method of avoiding practical treatment alternatives, legitimate aggregation of wastewaters to facilitate centralized treatment and injection of decharacterized wastewater in deep wells clearly satisfies RCRA § 3004(m)(1). Reduction of the concentration of the hazardous constituent below characteristic levels reduces its toxicity and minimizes the short-term threat presented by the waste. Injection of the resulting decharacterized waste in deep wells minimizes the long-term threat by placing the nonhazardous waters in remote locations where the opportunity for exposure to humans or contamination of usable groundwater is minimized.

American opposes the imposition of FO39 or any other treatment standard developed for *surface* disposal. If a record supporting decharacterization and deep well injection cannot be developed to meet the requirements of § 3004(m)(1), EPA should develop a treatment standard *specifically for Class I nonhazardous deep well injection* based upon the § 3004(m)(1) "minimize threat" standard. Since deep well injection clearly presents a different (and much lower) threat than surface disposal, two different standards make logical sense. Finally, any change which results in restrictions upon or prohibition of the injection of characteristic wastes rendered nonhazardous prior to disposal should be implemented in a fashion which allows industry sufficient time for compliance. The decharacterization standard has been in place since 1990 and operators such as American spent millions of dollars

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1 40 C.F.R. §§ 148.1(d), 263.1(c)(3).

2 *See* 55 Fed. Reg. 22520, 22658 (June 1, 1990).

designing and building wastewater treatment facilities to meet current legal requirements. To make a major change at this time will likewise cost millions of dollars and take substantial time to design and build.

II. EPA's Proposed Action Will Affect Much Larger Volumes of Wastes and Have a Greater Impact than Discussed in the Report.

EPA recognizes that it does not have an accurate assessment of the total volume of waste which will be affected by its proposed action. Report at pp. 44, 45, 57 and 64. Specifically, EPA has reviewed Biennial Reports and TSDR Capacity Data Sets which EPA recognizes do not reflect quantities of waste disposed "if wastes were diluted very shortly after generation and not reported in the survey." *Id.* at 44. Additionally, some operators are not counted because, due to their industrial codes, they do not file reports. The operators handling wastes in this fashion are among those which will be most severely affected by EPA's proposed action. In addition to underestimating the total volume of waste affected, EPA's analysis of the impact of its proposed action and the practical options which would remain for operators of deep wells fails to consider the drastically different waste management practices which currently include injection of decharacterized wastewaters.

American is an example of an operator who would be severely impacted by the proposed action but who apparently is not represented in EPA's analysis. American's servicing and repair of its aircraft result in the generation of several hazardous wastes, some listed and some characteristic. The American facility utilizes over 200 tanks in which various aircraft parts are cleaned (through corrosive etching) or in which certain plating operations take place. The etching and plating solutions, as well as virtually all other listed and characteristic wastes generated by American, are segregated for off-site treatment.

The sole exception to American's waste segregation program is the large volume of rinsewaters used throughout the plant. After a part is dipped in an etching or plating tank, it is removed from the tank and rinsed in a freshwater rinse tank. These rinse tanks receive very small amounts of the etching or plating solutions which may remain on or in the part. These contaminants, called "drag-out," may cause the constituent concentration level within a particular rinse tank to briefly (and randomly) reach a characteristic level. The effluent from all 109 rinse tanks is aggregated in closed piping and header systems and is directed to an on-site treatment facility.[3] The aggregated waste stream on occasion exhibits a

[3] American's treatment facility was constructed in 1990 at a total cost of approximately $7 million.

characteristic concentration level for a toxic metal (chromium--D007) and is therefore continuously monitored for that constituent and is treated according to the appropriate BDAT standard when and if the concentration exceeds the characteristic level. When the concentration exhibited by the aggregated waste stream is below the characteristic level, American injects the wastewaters directly into two Class I nonhazardous deep wells located on its facility. When the concentration level meets or exceeds the characteristic level, the waste stream is diverted for treatment in the on-site facility, the resulting sludge is shipped off-site for further treatment, and the nonhazardous effluent waters are injected in the wells.

American's operations typically result in the injection of over 300 gallons per minute, 24 hours per day. American is therefore injecting approximately 165 million gallons or 1.38 billion pounds of wastewaters per year in its two injection wells. Because the wastewater injected by American is not hazardous, these volumes are not reflected in Biennial Reports. Additionally, because American refurbishes rather than manufactures the aircraft, its industry code is 4512 and American is therefore not included in TSDR survey data. Thus, American represents but one example of an operator with a significant volume of wastes that will be affected by the proposed rule, but who has not been considered by EPA.

The limited data reviewed by EPA not only understates the total volume of wastes at issue (and the resulting impact of EPA's proposed action from a cost and national capacity standpoint), the data also does not reflect the vastly different waste management practices at issue. American, for example, has engaged in waste minimization and pollution prevention procedures to the full extent practical by undertaking waste segregation and off-site shipment of all listed and characteristic wastes. However, American has no practical alternative to its handling of its rinsewaters. It would be virtually impossible to monitor each of 109 rinse tanks and design diversion and segregation facilities to capture the incremental volume of waters in a particular tank which briefly and randomly reaches a characteristic concentration level. American believes that the legitimate aggregation of wastewater streams and injection of the decharacterized wastewaters, at least under circumstances such as these, fully satisfies the requirements of § 3004(m)(1).[4]

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[4] EPA has recognized that aggregation for centralized treatment is an appropriate and sometimes necessary waste management practice that is not considered dilution. *See, e.g.*, 53 Fed. Reg. 28124 (July 26, 1988).

EPA's Report draws no distinction between American's situation and that presented by a hypothetical operator who mixes small volumes of a characteristic ignitable waste with a large nonhazardous waste stream specifically to avoid what would otherwise be a simple process of segregating its ignitable wastes for treatment or off-site disposal. The striking difference between these types of practices illustrates how EPA has not considered the full impact of its proposed action. The hypothetical operator described above may be considered by some to be simply using dilution to avoid practical treatment alternatives that are readily available. However, American is an example of an operator who segregates and treats its waste to the full extent practical and utilizes aggregation and injection as the only reasonable alternative for its operations.

These factors highlight the need for the careful consideration of treatment requirements tailored specifically for deep well injection that do not needlessly prohibit waste management practices which, as will be discussed below, already satisfy the § 3004(m)(1) requirements. So long as a record supporting decharacterization can be established to support the § 3004(m)(1) standards, EPA's current rules are valid.

III. The Court Did Not Vacate the Rules Authorizing the Injection of Decharacterized Waste Streams; It Only Required a Better Record to Support EPA's Rules.

Considering the severe capacity and disruption problems which would follow from hastily promulgating new standards which effectively prohibit injection of decharacterized wastes, such a prohibition is not advisable nor is it in fact required, at least in the near term.[5] The Court merely *remanded* the rules authorizing the injection in deep wells of wastes rendered nonhazardous at the point of disposal.[6] Specifically, the Court rejected only EPA's present *justification* for the rule, not the

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[5] As discussed in Section V below, American also believes that, *given adequate time to supplement the record*, injection of wastes rendered nonhazardous through legitimate aggregation can be shown to fully satisfy all requirements of RCRA § 3004(m)(1).

[6] 976 F.2d at 24-26. *See also*, Order of January 11, 1993. Had the Court *vacated* the rules, they would be of no further force and effect upon issuance of the Court's mandate. *Independent U.S. Tanker Owner Committee v. Dole*, 809 F.2d 847, 855 (D.C. Cir. 1987). By *remanding* the rules for further consideration, the Court exercised its equitable discretion to leave the challenged rules in place during such reconsideration. *See Fertilizer Institute v. U.S.E.P.A.*, 935 F.2d 1303, 1312 (D.C. Cir. 1991); *Hazardous Waste Treatment Council v. U.S.E.P.A.*, 886 F.2d 355, 361 (D.C. Cir. 1989).

rule itself.[7] Thus, the rule remains in effect and need not be replaced by a new treatment standard before EPA and industry have been afforded time sufficient to supplement the record to provide the necessary justification.[8]

There is also no practical urgency in withdrawing the authority to inject decharacterized wastes in deep wells. EPA has previously determined that injection of nonhazardous wastes in Class I wells is "fully protective of underground drinking water and human health and the environment." Report at 26, n. 11. *See also*, 55 Fed. Reg. 22658. Having acknowledged both the severe disruption and capacity problems which will result from its proposed action (Report at 42) and the fact that more time is needed to develop a "minimize threat" standard as is required under § 3004(m)(1) (Report at 28, 38), EPA should allow the current rule to remain in place while it considers hard data and studies currently available to support the present rule or, alternatively, develops a treatment standard specifically for deep well injection.[9]

IV. The Treatment Standard Proposed by EPA (FO39) Is Inappropriate for Deep Well Injection and Is Not Required by RCRA § 3004(m)(1).

EPA proposes the utilization of an FO39 "universal" treatment standard for disposal in either CWA surface impoundments or Class I injection wells. This standard is clearly inappropriate, at least as it applies to injection wells, for a number of reasons. FO39 was developed as a standard for "multi-source leachates" which are defined as liquids which have "percolated through or drained from the treatment, storage, or disposal of more than one listed hazardous waste."[10] The primary example of a multi-source leachate is liquid draining into soils from a landfill unit.[11] Surface disposal, including temporary placement in CWA surface

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[7] 976 F.2d at 25.

[8] The Court recognized that even simple dilution of wastes to eliminate their hazardous characteristic could constitute treatment satisfying the requirements of § 3004(m)(1) under certain circumstances. 976 F.2d at 15-16.

[9] Since whatever treatment standard is ultimately developed may itself provide a capacity problem, American suggests that EPA reserve the National Capacity Variance and case-by-case extensions to provide time for compliance with the ultimate standard issued by EPA.

[10] *See Final BDAT Background Document for U and P Wastes and Multi-Source Leachate*, Volume A, NTIS #PB90-234337 (May 8, 1990), at 1-3.

[11] *Id.* at 2-2.

impoundments, presents demonstrably greater risks to human health and the environment than does deep well injection. Specifically, surface disposal by definition occurs *above* groundwater supplies. Leachates from surface disposal therefore present a greater risk of groundwater contamination and exposure to humans. Migration of surface-disposed wastes would also be subject to different dilution and attenuation factors ("DAFs") than deep well disposal.[12]

Deep well injection "beneath the lowermost formation containing, within one-quarter mile of the well bore, an underground source of drinking water,"[13] virtually eliminates these threats by placing the wastes--previously rendered nonhazardous--beyond human or usable groundwater contact. Section 3004(m)(1), rather than defining the *treatment* required, defines the *purposes* that the method of treatment imposed by the EPA must achieve.[14] These purposes are the minimization of "short-term and long-term threats to human health and the environment." *Id.* *Surface* disposal presents a far greater risk of human contact or contamination of USDW than does deep well injection and therefore may merit greater limitation on constituent concentration levels. The FO39 standard draws no distinction between surface and deep well disposal and thus requires treatment prior to injection to concentration levels which will *not* further "minimize threats"[15] beyond the reduced threat achieved by injection in properly-constructed deep wells. Such standard *will*, however, require costly adjustments or shutdowns by many deep well operators.

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[12] EPA utilized a DAF of 100 for surface disposal of TCLP toxics based upon subsurface fate and transport model. 55 Fed. Reg. 11803 (March 29, 1990). This factor is inapplicable to subsurface fate and transport of diluted wastes injected into formation *below* any possible USDW.

[13] 40 C.F.R. § 144.6(a).

[14] 976 F.2d at 15. The Court rejected the argument that § 3004(m)(1) *requires* the use of best demonstrated available technologies ("BDAT") (which FO39 represents) and instead recognized that any treatment that meets the objectives of § 3004(m)(1) is permissible under the statute. *Id.* The proper inquiry is therefore whether FO39 is necessary to minimize threats when the decharacterized wastes are injected in deep wells rather than placed on the surface where there is a recognized risk of direct human contact and seepage to groundwater supplies.

[15] EPA has recognized that treatment of wastes which were decharacterized prior to injection would *not* further minimize threats to human health and the environment. 55 Fed. Reg. at 22658, col. 2 (June 1, 1990). It is therefore unreasonable for EPA to require treatment of waste destined for deep well disposal to an FO39 standard, thereby mandating treatment which EPA has considered unnecessary to satisfy the requirements of § 3004(m)(1).

Application of an FO39 standard to deep well injection also results in a contradictory regulatory framework which in some cases results in the characteristic standards defining wastes as hazardous becoming arbitrary "triggers" requiring treatment of *nonhazardous* constituents in the same waste stream which are not otherwise prohibited from land disposal.[16] For example, an operator whose aggregated waste stream is characteristic as to only one of five constituents presently need only treat *that characteristic constituent* prior to deep well injection and does not have to treat the other four constituents within the waste stream (assuming they never reach their individual characteristic levels). However, since the treatment standards for TCLP toxic metals under FO39 often *exceed* the characteristic level and treatment standards for the individual metal constituents, the proposed standard could require that operator to treat some or all of these noncharacteristic (and therefore nonhazardous) constituents in its waste stream prior to injection, *despite the fact that only a single constituent ever reached a characteristic concentration level and was therefore "hazardous."*[17] This anomalous result ignores the "minimize threat" standard since these "other constituents" are being treated *not* because they present a threat or are hazardous but because they merely happen to be within a waste stream in which a characteristic (and therefore hazardous) constituent is present.

Another contradictory result follows if decharacterization and injection is rejected as a proper method of treatment under § 3004(m)(1). "Operator A," whose aggregated waste stream is *below* the characteristic level for a particular constituent, will be forced to treat that constituent if it exceeds a characteristic level prior to aggregation. "Operator B," with a waste stream *chemically identical* to the aggregated waste stream of Operator A in all respects except that it did not result from aggregation, will be allowed to inject that waste stream. This result makes little sense from a policy standpoint since both waste streams are chemically identical and thus present *exactly the same* toxicity and "short-term and long-term

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[16] It is fundamental that only "hazardous" wastes fall within RCRA's land ban restrictions, 40 C.F.R. § 268, and only becomes "hazardous" based upon the toxicity characteristic upon reaching or exceeding its characteristic concentration level. 40 C.F.R. § 261.

[17] For example, a wastewater containing 0.4 mg/l of cadmium would *not* require treatment prior to injection since the characteristic concentration level for cadmium in wastewaters is 1.0 mg/l. 40 C.F.R. § 268.43(a). However, if the same wastewater also contained 1.5 mg/l of selenium (which would require treatment as it exceeds its 1.0 mg/l characteristic level), application of an FO39 standard would also require treatment of the cadmium constituent to reduce its concentration level to 0.2 mg/l as required by FO39. Thus, the rule would allow injection of one waste stream containing 0.4 mg/l of cadmium (if no characteristic constituent is also present) but would prohibit the injection of the same concentration of cadmium in the other waste stream.

threats to human health and the environment." Yet only Operator A must treat his waste stream prior to injection.

Finally, the cost and time required to comply with an FO39 standard will be extreme. As discussed above, EPA's analysis doesn't include the volume of decharacterized waste streams that are currently injected[18] and therefore fails to take into consideration the additional cost of treatment for the never-characteristic "other constituents" within an aggregated waste stream which would be required to be treated under an FO39 standard. For example, an operator may have constructed treatment facilities to treat his single characteristic waste in response to EPA's prior land ban restrictions. But if faced with compliance to an FO39 standard, an operator would be required to treat or ship off-site the "other constituents" which never reach a characteristic level but which are present in concentrations higher than allowed under FO39. American has determined that it would take at least two years and cost approximately $21 million to construct an on-site treatment facility that could treat all constituents in its waste stream to an FO39 standard. Transportation and off-site treatment is even more prohibitive, costing approximately $13 million *per month*.

The cost and disruption which will result from the imposition of an FO39 standard--a standard which is unnecessary to meet § 3004(m)(1) requirements--are likewise unnecessary as a coercive vehicle to promote waste minimization and pollution prevention. Other incentives exist to encourage such practices. As discussed above, American segregates all wastes to the extent practical and is engaged in recycling and other efforts to minimize its disposal. Only its aggregated rinsewaters are injected because there is simply no practical way to segregate rinse waters from each individual rinse tank which randomly "spike" above a characteristic level. While an FO39 standard may be appropriate for surface disposal and the threats thereby presented, the standard is clearly inappropriate for deep well injection, fails to consider the fact that deep well injection of decharacterized wastes in and of itself "minimizes threats" presented by such wastes, and results in needless costs and disruption in existing sound waste management practices.

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[18] *See* Report at 69.

V. Decharacterization Through Legitimate Aggregation and Injection in Deep Wells Satisfies the Toxicity and "Minimize Threat" Standards of § 3004(m)(1).

As discussed in Section III above, the Court did not vacate the current rules allowing deep well injection of wastes rendered nonhazardous at the point of disposal. Instead, the Court rejected the *justification* presented by the EPA to show that the practice satisfied the statutory requirements of § 3004(m)(1). Injection of wastewaters which are decharacterized through legitimate aggregation does in fact satisfy all requirements of § 3004(m)(1).

The first requirement under a § 3004(m)(1) is to substantially diminish the toxicity *of the waste*.[19] The toxicity of a characteristic waste depends upon the concentration levels of hazardous constituents present in the waste; by definition, the wastes are not "hazardous" unless concentrations reach characteristic levels.[20] Reducing the concentration level of the constituents therefore reduces the toxicity *of the waste* regardless of whether there is a reduction in the number of individual molecules of the constituent within the waste stream.

To determine the reasonable limit to which constituent concentration levels should be reduced in order to minimize threats to human health and the environment presented by deep well injection, it is necessary to define the "threat" and examine the concentration levels which are in fact toxic to humans. EPA utilized this form of risk analysis in determining characteristic levels for toxicity. First, EPA determined "chronic toxicity reference levels . . . below which chronic exposure for individual toxicants in drinking water is considered safe or considered to pose minimal risk." 55 Fed. Reg. 11801, 11813 (March 29, 1990). A dilution attenuation factor ("DAF") was then determined to estimate the dilution and attenuation of the constituents in the waste as they travel *from landfill disposal* to a USDW. *Id.* at 11816. These two figures were then used to calculate characteristic levels which define the waste as "hazardous" and trigger the ban on land disposal.

A similar analysis applied to Class I wells reveals that decharacterization and deep well injection satisfy the "minimize threat" standards of § 3004(m)(1). Since the chronic toxicity reference levels have already been determined, the remaining

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[19] Section 3004(m)(1) alternatively provides that the level or treatment method may instead "substantially reduce the likelihood of migration of hazardous constituents from the waste."

[20] 40 C.F.R. §§ 261.3(a), 261.20.

issue is whether the concentration of the toxic constituent would exceed the chronic toxicity reference level if the waste reached a USDW. However, since the decharacterized wastes are injected *beneath* any possible USDW,[21] deep well injection presents a significantly *lesser* risk of contamination and human exposure. Thus, the actual threat for which EPA established the characteristic levels--potential contamination of USDW at a level toxic to human health--is minimized to a greater degree than permissible surface disposal.

EPA has previously determined that decharacterization and deep well injection is "fully protective of underground sources of drinking water and human health and the environment." Report at 26, n. 11. *See also*, 55 Fed. Reg. 22658. It correctly concluded that treatment beyond elimination of hazardous characteristics and deep well injection *"would not further minimize threats to human health or the environment."* 55 Fed. Reg. at 22658. The Court likewise did not reject decharacterization and dilution as an appropriate treatment standard for injected wastes; it simply rejected EPA's *justification* which was expressed as a need to accommodate the SWDA and conclusions that all deep wells could meet no-migration requirements. 976 F.2d at 25. American suggests that given adequate time to develop the factual record, a treatment standard of decharacterization and injection in Class I nonhazardous wells can be shown to fully satisfy the "minimize threat" standard.

VI. EPA Should Develop a Treatment Standard Specifically For Deep Well Injection.

Considering the different risks presented by surface disposal and the fact that Congress has mandated a "minimize threat" analysis under § 3004(m)(1),[22] if EPA determines that decharacterization and deep well injection cannot be factually supported as satisfying the § 3004(m)(1) standard, EPA should develop a *separate* treatment standard specifically for deep well injection. The application of a surface disposal standard to deep well injection, while more expedient from a rulemaking standpoint, is inconsistent with Congressional intent, unnecessarily costly and disruptive, and may require treatment beyond the point at which any real threat to human health or the environment can be shown to exist. *See Hazardous Waste*

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[21] 40 C.F.R. § 144.6(a).

[22] EPA recognizes the "minimize threat" levels are the ultimate cap for required treatment under § 3004(m). Report at 28.

Treatment Council v. U.S. Environmental Protection Agency, 887 F.2d 355, 362 (D.C. Cir. 1989).

VII. Conclusion.

For the reasons discussed above, American urges that an FO39 standard not be adopted, and that EPA instead leave the present rules authorizing injection of decharacterized wastes in place and allow time for a record to be established that decharacterization plus injection is a statutorily-permissible treatment standard.

If you would like additional information, please contact Kenneth Ede at (918) 292-2835 or outside counsel Scott R. Rowland at (918) 587-0000.

Very truly yours,

J. G. Zink

J. G. Zink
Manager, Facilities
Maintenance and Engineering

cc: L. A. Laster, Vice President,
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Appendix U

ANALYSIS OF THE EFFECT OF THE HAZARDOUS WASTE IDENTIFICATION RULE (HWIR) ON THE AFFECTED UNIVERSE FOR THE PETROLEUM REFINING AND ORGANIC CHEMICALS INDUSTRIES

Appendix U

ANALYSIS OF THE EFFECT OF THE HAZARDOUS WASTE IDENTIFICATION RULE (HWIR) ON THE AFFECTED UNIVERSE FOR THE PETROLEUM REFINING AND ORGANIC CHEMICALS INDUSTRIES

This appendix describes EPA's analysis of the effect of Hazardous Waste Identification Rule (HWIR) exit criteria on wastewaters regulated by the Phase III Land Disposal Restriction (LDR) rule. In the Phase III rule, underlying hazardous constituents in decharacterized wastewaters managed in land-based units must meet UTS or BAT standards prior to final discharge. In this appendix, EPA considers the joint effect of HWIR risk-based exit levels and the Phase III standards on affected wastes.

The HWIR exit levels, if considered in the context of the Phase III LDR rule, could have an effect in one of three ways. First, they could act as a cap on UTS levels at the point of disposal (i.e., the less stringent standard would apply), therefore taking effect only for those wastestreams where UTS is exceeded. Second, the HWIR exit levels could replace UTS values as a point of disposal criteria for RCRA equivalency. Because some HWIR levels are more stringent than UTS, this second option could imply that some wastestreams not currently affected by Phase III could additionally be brought into the affected universe.

The use of HWIR exit levels at the point of disposal, however, may be problematic. The methods used to determine the risk-based HWIR exit levels may not consider the direct discharge of polluted wastewaters into surface waters or POTWs. They may instead only consider such situations as the overflow of contaminated wastewater from surface impoundments, which would include such factors as possible pollutant attenuation in soils, therefore reducing the final concentrations entering the surface water. Therefore, the third option for the incorporation of HWIR exit levels into the Phase III rule would be application only at the point of generation, perhaps in conjunction with additional point of disposal requirements.

To address the first option, this analysis estimates the change in the number of facilities affected by the Phase III LDR rule if HWIR exit levels cap the UTS treatment standards at the point of disposal. To address the second option EPA analyzed the number of affected facilities if HWIR exit levels instead replace UTS standards. At this point, although we lack complete data to assess the third option, we have analyzed Generator Survey data for one industry, organic chemicals, plastics, and synthetic fibers (OCPSF), to determine the percentage of facilities that would exit at the point of generation as a result of HWIR.

METHODOLOGY

To determine the effect of incorporating HWIR exit levels into the rule as a cap on treatment standards, EPA compared end-of-pipe wastestream constituent concentrations to HWIR exit levels for only those samples found to exceed UTS. EPA compared the high-flow and low-flow constituent concentrations for each sample with the HWIR exit levels to determine the number of exceedences within the two affected industries. If a facility determined "likely" or "possibly" affected by the rule under the UTS screen was found unaffected in the HWIR screen (at both high- and low-flow concentrations), the facility was then considered to drop out of the group of affected facilities. To determine the effect of replacing (rather than capping) UTS with HWIR exit levels at the point of disposal, EPA compared all non-priority pollutant samples (with and without UTS exceedences) to the HWIR exit levels, using both the high- and low-flow concentrations. If a wastestream constituent concentration exceeded the HWIR exit level at the high-flow concentration estimate, the facility was considered very likely affected. If only the low-flow concentration exceeded the HWIR level, however, the facility was considered only possibly affected.

Point of Generation Analysis

EPA compared Generator Survey point of generation data for the OCPSF industry, available from the Phase IV analysis, with HWIR exit levels to determine the effect on the Phase III rule. If a facility wastestream contained no non-priority pollutants at a concentration greater than the HWIR level at the point of generation, that facility dropped out of the affected universe. Due to a lack of related point of generation and disposal data, however, we could not determine whether the facilities that dropped from the affected universe due to an HWIR screen at the point of generation would have been considered affected by the rule under the original UTS screen.

RESULTS

Petroleum Refining Industry

EPA's analysis of the petroleum refining industry found that eight of the 16 facilities considered likely to be affected by the Phase III LDR rule, would no longer be affected if HWIR exit levels were included as treatment standard caps (see Exhibit U-1). The analysis also showed that none of the 42 facilities considered "possibly affected" by the UTS screen would remain affected under the new analysis. In the analysis using HWIR levels in place of UTS values, we found that of the 108 facilities, four were likely to be, and five would possibly be, affected by the Phase III rule. The number of facilities possibly affected increased by one in comparison to the HWIR cap value, because one facility with no UTS exceedences does have an HWIR exceedence.

Exhibit U-1 RESULTS OF DATA ANALYSES FOR THE PETROLEUM REFINING INDUSTRY			
	UTS Screen	**HWIR Cap Screen**	**HWIR Replacement Screen**
Number of Facilities Considered	108	58	108
Number of Facilities Very Likely Affected	16	4	4
Number of Facilities Possibly Affected	42	4	5

OCPSF Industry

EPA's analysis of the OCPSF industry found that 11 of the 113 facilities found very likely affected by the UTS screen, would no longer be affected if HWIR exit levels capped UTS in the Phase III LDR rule (see Exhibit U-2). In addition, 78 of the 120 facilities found possibly affected would also drop from the list of affected facilities. Using HWIR standards in place of the UTS levels, we found that 80 facilities would certainly be affected, and an aditional 107 would possibly be affected.

Exhibit U-2 RESULTS OF DATA ANALYSES FOR THE OCPSF INDUSTRY				
	UTS Screen	**HWIR Cap Screen**	**HWIR Replacement Screen**	**Point of Generation Analysis**
Number of Facilities Considered	1,305	233	474	24
Number of Facilities Very Likely Affected	113	48	80	16
Number of Facilities Possibly Affected	120	96	107	--

EPA's analysis of the effect of HWIR at the point of generation found that of the 24 facilities with wastewaters containing nonpriority pollutants, eight would meet HWIR exit criteria.[1] Because we could not determine whether those facilities that would exit at the point of generation would also have been originally affected at the point of disposal, it is possible that less than one third of the affected universe would exit Phase III because of the HWIR point of generation exit option.

CONCLUSION

The results of this analysis show that incorporating HWIR exit levels as additional or exclusive treatment standards at the point of disposal could significantly reduce the number of facilities affected by the Phase III LDR rule. For the petroleum refining industry, the analysis using only UTS levels found that 15 to 54 percent of all facilities discharging non-priority pollutants (16 to 58 out of 108) would be affected. When incorporating HWIR levels as a cap, these values drop to 3.7 to 7.4 percent (4 to 8 out of 108). When HWIR levels are used in place of UTS, however, these values increase slightly to 3.7 to 8.3 percent of the facilities (4 to 9 out of 108). For the OCPSF industry, the original analysis found that 24 to 49 percent of all facilities discharging non-priority pollutants (113 to 233 out of 474) would be affected. With an HWIR cap, the number of affected facilities would drop to 10 to 30 percent (48 to 144 of 474). When HWIR levels are used in place of the UTS standards, however, 17 to 39 percent of the facilities are affected (80 to 187 of 474).

[1] Generator Survey data provides a maximum and minimum concentration for each sample. We used only the concentration maximum to provide a conservative (high) estimate of affected facilities.

ADDENDUM TO THE REGULATORY IMPACT ANALYSIS OF THE PHASE III LAND DISPOSAL RESTRICTION FINAL RULE: REVISED RISK ASSESSMENT FOR SPENT ALUMINUM POTLINERS

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February 14, 1996

INTRODUCTION

As part of the Regulatory Impact Analysis (RIA) of the Phase III Land Disposal Restriction (LDR) rule, we estimated the benefits that would result from the proposed regulation of spent aluminum potliners.[1] We focused our analysis on potential cancer and noncancer human health risk reduction benefits. We performed a risk assessment of baseline (current) waste management practices and compared their human health risks with those posed by post-regulatory management practices.

After completion of the risk assessment performed for the RIA, new fate and transport data for spent aluminum potliner disposal became available. EPA performed constituent-specific fate and transport modeling using its Composite Model for Leachate Migration and Transformation Products (EPACMTP). Using these additional data, our assessment of baseline risks shows that individual lifetime cancer risks increase to about 10^{-6} under central tendency assumptions and 10^{-3} under high-end assumptions. In addition, the new estimates suggest that under high-end assumptions baseline concentrations in drinking water may be high enough to present non-cancer risks; previously, baseline non-cancer risks were estimated to be negligible. Since post-regulatory risks were shown in the RIA to be negligible, these higher baseline risks indicate that the incremental risk reduction benefits are greater than previously estimated. The rule has the potential to reduce individual risks substantially.

We describe below our methodology and results of the risk assessment using constituent-specific fate and transport modeling. For some parts of the assessment, we used approaches and assumptions that are similar to those used in the analysis performed for the RIA. We do not reiterate some of the background provided in the RIA; consequently, the reader should refer to Chapter 4 of the RIA for additional information.

METHODOLOGY

Baseline Risks

Our risk assessment is based largely on EPA's modeling of the fate and transport of regulated constituents that: may leach from spent aluminum potliners in a Subtitle C landfill; may contaminate underlying groundwater; and may migrate down-gradient to a drinking water well.[2] The general approach in EPA's analysis is similar to that used in the risk assessment we performed for the RIA.

EPA's analysis improves upon the fate and transport modeling approach that we used in the RIA. In the RIA, we applied generic dilution/attenuation factors (DAFs) to relate the concentration of contaminants in the leachate to their concentration in a down-gradient well. The use of generic

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[1] The Phase III LDR was proposed on March 22, 1995 (60 *FR* 11702-11766). See *Regulatory Impact Analysis of the Phase III Land Disposal Restriction Rule*, which can be found in the docket for this rule.

[2] A summary of the EPA analysis can be found in the docket to this rule.

DAFs did not reflect constituent-specific fate and transport processes, site-specific hydrogeological conditions, or waste characterization data available for the relevant baseline disposal sites. The Agency used EPACMTP to perform constituent-specific fate and transport modeling. This model takes into account transport through unsaturated and saturated zones, first-order degradation with daughter product formation, and linear and nonlinear sorption. Using Monte Carlo analysis, EPACMTP can also be linked to data on the landfill characteristics, hydrogeology, climate, and human receptor locations.[3] We believe that this constituent-specific modeling can be used to predict fate and transport more accurately than the use of generic DAFs.

EPA's Office of Solid Waste provided us with the results of their EPACMTP modeling. For each chemical modeled, four estimates were available for contaminant concentrations in a down-gradient drinking water well. These estimates reflect different combinations of assumptions related to DAF values and leak rates (the extent to which leachate leaks from a Subtitle C landfill and enters into underlying groundwater): the 50th and 90th percentile DAF values; and leak rates of 20 and 30 percent. The concentration estimates were most sensitive to the two different DAF assumptions, so we based our analysis of central tendency risks on the 50th percentile DAF value, while the high-end risks were based on the 90th percentile DAF. For both the central tendency and high-end calculations, we estimated two risk values, each based on one of the two leak rate assumptions.

We combined these groundwater concentrations with toxicity data and exposure assumptions to calculate individual lifetime cancer risk, as well as hazard quotients for noncarcinogens. To obtain toxicity information, we used EPA's IRIS and Health Effects Assessment Summary Table (HEAST) databases. For both the central tendency and high-end risk calculations, we used standard central tendency exposure assumptions:

- Ingestion of 1.4 liters of water per day.
- Body weight of 70 kilograms.
- Exposure duration of 9 years.
- Exposure frequency of 350 days per year.[4]

Post-Regulatory Risks

As described more fully in the RIA, we based our assessment of post-regulatory risks on two studies: one performed by Reynolds Metals Company for the Arkansas Department of Pollution Control and Ecology and the other completed by EPA. The Reynolds study examined human health risks caused by the dispersion of contaminants released into the air during pre-treatment and

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[3] EPA Office of Solid Waste, *EPACMTP Background Document*, C08-94.501, December 1994.

[4] EPA Office of Emergency and Remedial Response, "Risk Assessment Guidance for Superfund (RAGS): Volume I -- Human Health Evaluation Manual (Part B, Development of Risk-Based Preliminary Remediation Goals)," Interim, December, 1991.

treatment (incineration) operations. They concluded that cancer risks do not exceed 10^{-6} beyond the property boundary.[5] The EPA study examined the potential risks posed by kiln residue, which the Agency proposed to delist. EPA concluded that the Reynolds process "can render spent potliners non-hazardous." Available data suggest that post-regulatory cancer risks are likely to be negligible.

RESULTS

Incorporating the newly available constituent-specific fate and transport modeling, our risk assessment indicates that baseline cancer and noncancer risks are one to two orders of magnitude higher than previously estimated. As shown in Exhibit 1, cancer risks range from 10^{-6} under central tendency assumptions to about 10^{-3} under high-end assumptions. In addition, noncancer risks are expected under high-end assumptions.[6] The risk values are most sensitive to central tendency and high-end assumptions regarding landfill characteristics, hydrogeology, climate, and human receptor locations. The risks are affected relatively less by differences in assumptions about leak rates.

To estimate incremental risk reduction, we compared the baseline risks to post-regulatory risks. We did not perform additional analysis of post-regulatory risks. Evidence presented in the RIA suggests that post-regulatory cancer risks are less than 10^{-6} and therefore negligible.

Consequently, the benefits of regulating spent aluminum potliners are higher than previously estimated. Under central tendency assumptions, individual lifetime cancer risks resulting from current waste management practices are slightly higher than post-regulatory risks (10^{-6} vs. less than 10^{-6}); some incremental benefits may therefore be realized as a result of the LDRs. Under high-end assumptions, however, the regulation could reduce cancer risks by one or two orders of magnitude, while noncancer risks could be eliminated. Although population risks would also be reduced correspondingly, we are unable to specify the magnitude of the exposed population. As described in the RIA, interviews with several Subtitle C landfills that currently receive spent aluminum potliners suggest that the exposed population is likely to be low.

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[5] The Reynolds analysis may underestimate these risks, however. The air dispersion modeling did not include analysis of fluoride and cyanide, two chemicals that EPA is regulating in the Phase III rule. Staff from the Arkansas Department of Pollution Control and Ecology state that the Reynolds RCRA Part B Permit application is presently under review and note that the omission of these chemicals may be a deficiency in the air dispersion modeling. The absence of analysis for fluoride and cyanide introduces additional uncertainty into our assessment of post-regulatory risks.

[6] Attachment 1 contains a spreadsheet showing the risk calculations. It is included at the end of this document.

Exhibit 1

REVISED ESTIMATE FOR BASELINE RISKS

Type of Risk	Central Tendency Risk		High-End Risk	
	20% Leak Rate	30% Leak Rate	20% Leak Rate	30% Leak Rate
Cancer Risk (lifetime risk)				
Arsenic	2×10^{-7}	4×10^{-7}	4×10^{-5}	9×10^{-5}
Beryllium	6×10^{-9}	2×10^{-8}	2×10^{-6}	3×10^{-6}
Benzo(a)pyrene	2×10^{-6}	7×10^{-6}	9×10^{-4}	1×10^{-3}
Total (may not sum due to rounding)	2×10^{-6}	8×10^{-6}	9×10^{-4}	2×10^{-3}
Chemicals with Noncancer Risk (hazard quotient)	None	None	Fluoride (33)	Fluoride (67) Arsenic (1.3)

ATTACHMENT 1

CENTRAL TENDENCY RISK CALCULATIONS

Constituent	Groundwater Exposure Conc. (mg/L)		Cancer Risk		Non-Cancer Risk (Haz. Quotient)	
	20% Leak Rate	30% Leak Rate	20% Leak Rate	30% Leak Rate	20% Leak Rate	30% Leak Rate
Antimony	1E-05	3E-05			0.0	0.0
Arsenic	4E-05	1E-04	2E-07	4E-07	0.0	0.0
Barium	9E-06	2E-05			0.0	0.0
Beryllium	6E-07	2E-06	6E-09	2E-08	0.0	0.0
Cadmium	6E-07	2E-06			0.0	0.0
Chromium (total)	5E-06	1E-05			0.0	0.0
Lead	2E-08	6E-08			0.0	0.0
Mercury	3E-08	8E-08			0.0	0.0
Nickel	1E-05	3E-05			0.0	0.0
Selenium	5E-06	1E-05			0.0	0.0
Silver	3E-06	7E-06			0.0	0.0
Cyanide (total)	2E-07	7E-07			0.0	0.0
Fluoride	3E-01	8E-01			0.1	0.3
Benzo(a)pyrene	1E-04	4E-04	2E-06	7E-06		
Fluoranthene	2E-04	5E-04			0.0	0.0
Pyrene	2E-04	4E-04			0.0	0.0
SUM			2E-06	8E-06	0.1	0.3

HIGH END RISK CALCULATIONS

Constituent	Groundwater Exposure Conc. (mg/L)		Cancer Risk		Non-Cancer Risk (Haz. Quotient)	
	20% Leak Rate	30% Leak Rate	20% Leak Rate	30% Leak Rate	20% Leak Rate	30% Leak Rate
Antimony	4E-03	6E-03			0.2	0.3
Arsenic	1E-02	2E-02	4E-05	9E-05	0.7	1.3
Barium	3E-03	5E-03			0.0	0.0
Beryllium	2E-04	3E-04	2E-06	3E-06	0.0	0.0
Cadmium	2E-04	3E-04			0.0	0.0
Chromium (total)	2E-03	3E-03			0.0	0.0
Lead	8E-06	1E-05			0.0	0.0
Mercury	1E-05	2E-05			0.0	0.0
Nickel	4E-03	7E-03			0.0	0.0
Selenium	2E-03	3E-03			0.0	0.0
Silver	9E-04	1E-03			0.0	0.0
Cyanide (total)	8E-05	1E-04			0.0	0.0
Fluoride	1E+02	2E+02			33.3	66.7
Benzo(a)pyrene	5E-02	8E-02	9E-04	1E-03		
Fluoranthene	7E-02	1E-01			0.0	0.1
Pyrene	6E-02	9E-02			0.0	0.1
SUM			9E-04	2E-03	34.3	68.5

NOTES:

1. Cancer risk = Groundwater exposure concentration * Cancer exposure factor * Cancer slope factor
2. Cancer exposure factor = (1.4 L/day) / 70 kg * (9 yrs / 70 yrs) * (350 days / 365 days)
3. Noncancer risk (hazard quotient)= Groundwater exposure concentration * Noncancer exposure factor / Reference dose
4. Noncancer exposure factor = (1.4 L/day) / 70 kg
5. Cancer slope factors and reference doses are taken from IRIS and HEAST and are described in the RIA.
6. Groundwater exposure concentrations were obtained from Zubair Saleem, EPA/OSW. A description of EPA's analysis is included in this docket.
7. Missing cancer risk values indicate that no cancer slope factors are available.
8. Missing non-cancer risk values indicate that no oral reference doses are available.

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