HAZARDOUS WASTE IDENTIFICATION RULE (HWIR):

INDUSTRY CASE STUDIES

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EXECUTIVE SUMMARY:
HWIR INDUSTRY CASE STUDIES REPORT

Objectives

- To assess the validity of results generated from 1995 HWIR economic impact model.
- To provide qualitative and quantitative insights about potential impacts of the HWIR "exemption levels" framework, on facilities and industries.

Scope

- Focused on waste-generating facilities in industries most likely affected by HWIR: chemicals and allied products, petroleum refining, electronics, and fabricated metals (sample is not representative of all hazardous waste generators).
- Performed one to three in-depth case study interviews in each of these major industry sectors.
- Screened sample facilities by four qualitative criteria: (1) generate at least one wastestream potentially eligible under HWIR; (2) exhibit geographic diversity; (3) provide insightful and creative public comments on HWIR; (4) willing to host on-site interview and plant tour.
- Conducted five on-site visits and one telephone interview in September and October 1997.

Major Findings

- Waste **sampling and testing** for meeting HWIR exemption levels may be a potential barrier to demonstrating achievement of such levels because testing is costly and may not account for inherent variability in wastestreams and constituents.
- Some facilities may avoid the cost of future **capital investments** for on-site treatment technologies as well as for RCRA Subtitle C commercial offsite treatment and disposal.
- Because of concern about potential future **Superfund liabilities**, some facilities state they would not treat or dispose HWIR exempt waste in Subtitle D systems, but will continue to use Subtitle C systems indefinitely, particularly while Subtitle C unit costs are relatively low compared to perceived liability risks associated with using Subtitle D.
- Due to the relatively high cost of implementing HWIR, some **waste minimization** projects related to HWIR may be less cost-effective than other company investment opportunities.
- Generators will continue to submit RCRA **delisting petitions** if HWIR does not provide regulatory relief for particular waste streams they consider low risk.
- **Small quantity waste generators** feel the 1995 proposed HWIR is too complex and that the implementation requirements, in particular, are difficult to understand and apply.
- Many generators feel that the **public notification** requirement is of little value and that it may cause undue public concern.
- The case studies validate many of the assumptions and decision rules previously applied in the **1995 HWIR economic model**. The model could be refined to account for avoided capital investments to upgrade on-site treatment units as a result of HWIR waste exemptions.

BACKGROUND AND OBJECTIVES

In December 1995, USEPA proposed the Hazardous Waste Identification Rule (HWIR), in an effort to provide regulatory relief to generators of industrial process wastes that pose low risk to human health and the environment, but that are currently regulated as hazardous under Subtitle C of the 1976 Resource Conservation and Recovery Act (RCRA)[1]. One proposed regulatory option in HWIR will allow industrial wastes that meet human health and ecological risk-based, chemical constituent concentration levels (i.e. "exemption levels"), to become exempt from RCRA Subtitle C waste management requirements. HWIR-eligible generators and waste handlers may then manage wastestreams that become exempt under HWIR as industrial nonhazardous waste (under RCRA Subtitle D standards), and may realize costs savings associated with less expensive waste treatment and waste disposal, compared to the costs associated with management of wastes as hazardous according to RCRA's more stringent Subtitle C standards.

To estimate the national economic impacts of HWIR as proposed in 1995[2], including waste quantities potentially eligible for exemption and related cost savings, USEPA developed the "HWIR Process Waste" economic model, based on data from the USEPA's 1986 *National Survey of Hazardous Waste Generators*. This computer-based model facilitated comparison of constituent identities and concentration levels contained in the industrial process waste database, with the 1995 proposed HWIR exemption levels. The model estimated $44 to $67 million in potential national annual cost savings impacts of the 1995 HWIR, according to over 200 chemical constituent exemption levels as specified in 1995. However, these cost savings would be realized by a small number of very large annual quantity, eligible wastestreams within a relatively few number of major industries. The results of the analysis for the 1995 HWIR proposal are available in USEPA's report: *Assessment of the Potential Costs and Benefits of the Hazardous Waste Identification Rule for Industrial Process Wastes*, (Volumes I & II), Office of Solid Waste, 25 May 1995, 879pp.

[1] Information about RCRA is available in the USEPA's *RCRA Orientation Manual*, Office of Solid Waste & Emergency Response, report nr. EPA-530-R-98-004, May 1998, 290pp., available from the RCRA Hotline at 1-800-424-9346 or at http://www.epa.gov/epaoswer/general/orientat/ .

[2] The USEPA first proposed HWIR in 1992, and again in 1995, but withdrew both proposals as a result of extensive public comments. HWIR is scheduled for reproposal on 31 October 1999, according to the 11 April 1997 US District Court consent decree, with final rule by 30 April 2001.

Objectives for the Case Studies

USEPA had two objectives in conducting in-depth industry case studies of hazardous waste-generating facilities:

• First, USEPA felt that the case studies would provide insights about the validity of the assumptions, decision rules, analytical logic and results (i.e. cost savings estimates) of the 1995 HWIR Process Waste Economic Model.

• Second, because the 1995 analyses provided mainly quantitative and very aggregated measures of the impacts of the 1995 proposed HWIR (i.e, at the national level), USEPA felt the case studies could provide valuable insights about more qualitative, "real-world" impacts of the proposed HWIR rule on individual hazardous waste generators and industries.

Scope of Case Study Industries

To conduct these case studies, USEPA focused on facilities within industries identified in 1995 as most likely to be affected by the proposed HWIR, then assessed the knowledge, attitudes, and perceptions of key facility and waste management staff towards HWIR at these facilities. These industries included:[3]

- Chemicals and allied products industry (SIC 28, NAICS 325)[4]
- Petroleum refining industry (SIC 29, NAICS 324)
- Primary metal products industry (SIC 33, NAICS 331)
- Fabricated metal products industry (SIC 34, NAICS 332)
- Electronics and electrical equipment industry (SIC 36, NAICS 334 & 335).

Goal of Case Study Interviews

The goal of this report is to summarize the findings of these industry case studies addressing the proposed HWIR. In doing so, Industrial Economics Incorporated (hereinafter "we") hope to provide USEPA with insights about aspects of the proposed HWIR rulemaking that may inhibit the ability of specific industries and firms to take advantage of the deregulatory incentives of HWIR. Under the requirements of

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[3] Under the specifications of USEPA's 1995 HWIR proposal, three of these five industry sectors accounted for over 50 percent of the total quantity of waste eligible for exemption and cost savings under HWIR. For more information on the quantitative estimates of the impacts of the HWIR on these industries, refer to Chapter 6 of the *Assessment of the Potential Costs and Benefits of the Hazardous Waste Identification Rule for Industrial Process Wastes*, prepared by Industrial Economics, Incorporated, for USEPA's Office of Solid Waste, 25 May 1995.

[4] SIC= Standard Industrial Classification code; NAICS= North American Industrial Classification System. As of 1999, the NAICS system replaces the SIC code system. For more information about SIC and NAICS codes, refer to http://www.census.gov/epcd/www/naicsdev.htm and for SIC-to-NAICS conversion tables refer to http://www.census.gov/epcd/www/naicstab.htm

the 1995 HWIR proposal, for example, the costs of implementing an HWIR exemption probably outweigh potential waste treatment cost savings for all but very large quantity waste generators and handlers. As USEPA addresses these types of outstanding policy issues and finalizes the proposed rule, these case studies may help to identify modifications to HWIR that enable additional firms and industries to realize wastestream exemptions and associated RCRA regulatory cost savings.

CASE STUDY APPROACH

Selection of Case Study Facilities

The economic analysis in support of the 1995 HWIR proposal determined that large-quantity generators in the industry sectors listed above are likely to benefit from the overall cost savings impacts of HWIR. Consequently, we targeted these five industries with the objective of conducting an in-depth case study of at least one, and up to three, facilities in each of these industry sectors.

To identify at least one facility candidate in each of these industries, we used data from the *1993 National Biennial RCRA Hazardous Waste Report* (BRS), the 1997 *National Hazardous Waste Constituent Survey*, the 1995 HWIR Process Waste Economic Model database (based on USEPA's 1986 *National Generator Survey*), and other qualitative sources.[5] We anticipated that from the facility universe represented by these sources, we could identify a representative cross-section of facilities within each of the five industry sectors of study interest. The qualitative criteria applied to identify a representative set of facilities that have different characteristics and therefore different perspectives on HWIR include:

- **Potential HWIR impacts:** We primarily considered facilities that generate significant quantities of hazardous waste and at least one wastestream potentially eligible for HWIR exemption, because such facilities would be more likely to monitor the progress of the rulemaking, to participate in voluntary case studies, and to provide interesting insights about components of the rulemaking. We also tried to identify facilities that generate potentially eligible wastestreams, but that may not pursue an HWIR exemption due to the burden of HWIR implementation costs.

- **Geographic diversity:** Facilities located in different states or regions may experience different incentives for, or barriers to, taking advantage of HWIR exemptions. Regional differences in industrial waste treatment and disposal costs

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[5] Although it may appear outdated related to 1999, the USEPA's *1986 National Survey of Hazardous Waste Generators*, along with its companion survey the *1986 National Survey of Hazardous Waste Treatment, Storage, Disposal, and Recycling Facilities* (TSDRFs), released as two reports in July and October 1991, then comprised USEPA's third and most comprehensive effort to develop reliable national information describing such activities. The USEPA's *National Survey of Hazardous Waste Generators and TSDFs Regulated Under RCRA in 1981* (April 1984 report), presented the first such national picture. The second effort consisted of the USEPA's 1985 National Biennial Report of Hazardous Waste Generators and TSDFs (March 1989 report). Since the 1985 reporting year, the Biennial Report has continued as a series of reports (the 1991, 1993, 1995 & 1997 BRS reports are available via the Internet at http://www.epa.gov/epaoswer/hazwaste/data/#brs).

and state industrial waste regulations may affect individual facilities' responses to HWIR. For example, a facility located in a state with stringent RCRA Subtitle D regulations affecting non-hazardous industrial waste disposal, may feel that HWIR provides inadequate business financial incentives for seeking an exemption. We tried to choose facilities from different parts of the country to get a sense of how state and regional differences may influence the actual impacts of HWIR.

- **Public comments:** Various stakeholders, including industrial waste generators, waste managers, and other parties potentially affected by HWIR, provided USEPA with extensive public comments on the 1992 and 1995 proposed rulemakings. We reviewed these public comments and identified individual facilities that made insightful and creative comments, ideas, and suggestions about the rulemaking's strengths and weaknesses.

- **Willingness and ability to participate:** Of the facilities identified using the criteria above, only a few had staff who were able to devote the time and effort to provide us with a facility visit and tour, to conduct an extensive interview on-site, and to provide more information during follow-up telephone conversations.

After screening down to a final group of facilities, and ranking the candidates according to the above qualitative criteria, we provided a list of ranked candidates to USEPA. USEPA then began contacting environmental and waste management staff at these facilities about the possibility of conducting site visits. Based on the results of USEPA's efforts, we then arranged full-day site visits and interviews with candidates that expressed a willingness to host a visit, which included three facilities in the chemicals industry, one electronics facility, and one petroleum refinery. The five facilities, which we visited during September and October 1997, include:

- Tennessee Eastman Corporation, Kingsport, Tennessee (SIC 28, NAICS 325)
- Novartis Crop Protection, Inc., St. Gabriel, Louisiana (SIC 28, NAICS 325)
- Occidental Chemical Corporation, Deer Park, Texas (SIC 28, NAICS 325)
- Amoco Oil Company, Whiting, Indiana (SIC 29, NAICS 324)
- Texas Instruments Incorporated, Sherman, Texas (SIC 36, NAICS 334 & 335)

We also conducted many follow-up conversations with these participants and each provided written comments on drafts pertaining to their facility. Due to resource limitations, we were unable to conduct case studies of facilities in the primary and secondary metals industries. In addition, we had extensive telephone conversations with an additional facility in the chemical industry regarding specific aspects of the rulemaking:

- PPG Industries, Lake Charles, Louisiana (SIC 28, NAICS 325).

Facility Site Visits and Interviews

At each facility, we toured the plant and observed manufacturing operations, waste treatment and management facilities, waste minimization project laboratories, and on-site analytical labs. We also conducted extensive interviews with facility environmental and engineering staff. At each facility, we met with and interviewed at least one staff person with in-depth knowledge of the facility's hazardous waste generation and the HWIR rulemaking. Usually we also met with staff with expertise in other areas, such as waste treatment (e.g., incinerator operations), waste testing and analysis, or waste minimization and pollution prevention.

To conduct the interviews, we prepared an extensive interview protocol to guide our discussions. Exhibit 1-1 highlights major topics addressed during the interviews. We discussed the characteristics of each facility, its industry, the facility's production processes and wastestreams, and their staff's general knowledge and opinions of the proposed HWIR rulemaking. We focused on discerning generators' perceptions about aspects of the rulemaking (as specified in the 1995 HWIR proposal), and related issues that influence the overall impacts of HWIR, such as the requirements for implementing HWIR exemptions. The next section of this report summarizes these interview issues in more detail.

Key Discussion Issues

The following were key themes and issues that we focused on during discussions with facility staff.

- **Potential Benefits of HWIR:** In the 1995 assessment of HWIR costs and benefits, cost savings and regulatory relief are identified as the major benefits of HWIR. During the interviews, we tried to discern how many, if any, of the firm's and facility's wastestreams may be eligible for exemption under HWIR. In addition, we evaluated whether facilities that anticipate cost savings will avoid treatment or Subtitle C disposal of their wastes, and if other costs would be avoided in addition to treatment and disposal. We also assessed factors that influence the magnitude of benefits, and what indirect or non-quantifiable benefits, if any, may result from HWIR exemptions.

- **HWIR Implementation Requirements:** Barriers to implementing HWIR exemptions include minimal or non-existent economic (i.e. business financial) benefits, potential generator liability, and negative public perceptions about facility waste management practices. We discussed factors that firms and industries consider when deciding to implement HWIR exemptions, various approaches for reducing costs to allow more facilities to benefit from the rule, and whether the requirements assure an appropriate level of protectiveness. More specifically, we also solicited ideas and attitudes about the sampling and testing provisions of these requirements, which account for a majority of the costs of implementation.

Exhibit 1-1
HIGHLIGHTS OF CASE STUDY INTERVIEW PROTOCOL

I. General Case Study Facility Background?
- A) Industry and Facility Profile?
  - What processes does your facility use in production?
- B) Knowledge of HWIR rulemaking?
  - How familiar are you with the HWIR rulemaking?

II. Potential Facility Benefits of HWIR?
- A) Potential Cost Savings?
  - What industrial waste treatment and disposal costs do you incur annually under RCRA Subtitle C regulations?
- B) Relief from Subtitle C Requirements?
  - What administrative requirements do you follow for RCRA Subtitle C regulations?

III. Incentives for Waste Minimization?
- A) Opportunities for Reducing Waste Toxicities?
  - Will your facility undertake new waste minimization projects due solely to incentives provided by HWIR?

IV. HWIR Implementation Requirements?
- A) Industry and Facility Liability?
  - Would your facility consider aggregating waste with other generators and jointly performing the implementation requirements for HWIR?
- B) Public Perceptions and Opinions?
  - Do you anticipate that public perceptions could lead you to a decision to not seek and HWIR exemption for qualified waste?
- C) Implementation Costs and Requirements?
  - Does your facility estimate HWIR implementation costs to be greater than potential cost savings?

V. Other Issues?
- A) Alternatives to HWIR "National Generic" Exemption Level Option?
  - Are you familiar with regulatory options to the proposed HWIR based on contingent management of low-risk waste?
- B) Other Regulatory Programs and Their Impact on HWIR?
  - Has your facility pursued exemptions from RCRA Subtitle C regulations through any other regulatory programs (e.g. RCRA "delisting" program)?

Note: See Appendix A-1 for a complete copy of the interview protocol.

- **Incentives for Waste Minimization:** Once finalized, HWIR "exemption levels" may provide opportunities for generators and managers of listed hazardous industrial wastes, to gain exemptions from RCRA Subtitle C requirements by reducing constituent concentrations in wastestreams. We discussed with case study participants, the extent to which generators may have opportunities for reducing waste toxicities through facility process changes, by increasing recycling, or via other available and feasible approaches. We assessed not only whether case study waste generators would be able to reduce toxicities, but also methods they would use, and the criteria they would use to decide whether to pursue incremental waste minimization projects, as a direct result of HWIR.

- **Accuracy of 1995 HWIR Model and Assumptions:** Based on information provided by generators about their typical waste generation patterns, potential waste handling cost savings, and annual quantities of waste potentially eligible for exemption under HWIR, we assessed whether our 1995 HWIR Process Waste Economic Model would be likely to accurately predict the economic impacts of the 1995 proposed HWIR on their facility. In cases where results of the 1995 economic model seemed to differ significantly from generators' expectations, we sought insights about ways to adjust our basic modeling assumptions to increase the accuracy of results.

- **Other Issues:** Attitudes about other aspects of the 1995 proposed HWIR rule and related issues vary significantly across industries, firms, and company individuals. Staff at some firms have strong opinions about specific aspects of HWIR or related issues. These attitudes may reflect a sense that their facility or industry may not benefit enough from HWIR. Some of these issues include: the risk-based exemption levels used to determine HWIR exemptions, the RCRA delisting program, the RCRA "mixture and derived-from" rules, and the influence of other Federal environmental regulations, including the combustion MACT standards.[6]

SUMMARY OF FINDINGS

Personnel from each of the case study facilities provided unique and insightful comments regarding HWIR. While some ideas elicited from the generators were specific to their own facility, a few common themes emerged that may apply more broadly across many facilities and industries. These include:

- The costs associated with implementing HWIR exemptions, in combination with the stringency of HWIR's exemption levels, may discourage some generators from pursuing exemptions for their low-risk hazardous waste under HWIR.

- Despite these and other barriers, large generators may still achieve financial benefits by

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[6] The RCRA "*mixture rule*" states that mixtures of nonhazardous wastes and RCRA hazardous wastes, are to be managed as RCRA hazardous wastes (40 CFR 261.3(a)(2)(i, iii & iv) & (b)(2,3)). The RCRA "*derived from rule*" states that any waste treatment or other handling residual material derived from a RCRA hazardous waste, is also a RCRA hazardous waste (40 CFR 261.3(c)(2)(i)). The RCRA "*delisting*" program is described at 40 CFR 260.22. MACT= *maximum achievable control technology*; the USEPA's waste combustion MACT standards are directed at controlling hazardous air pollutants, such as dioxin and lead, emitted from incinerators, cement kilns and lightweight aggregate kilns, which burn hazardous waste (40 CFR 63 Subpart EEE, 261.38, 265.340, 266.100-101, 270.19, 270.22, 270.62, 270.66). Background information about USEPA's development and finalization of combustion MACT standards, is available via the Internet website: http://www.epa.gov/hwcmact/ . The *Code of Federal Regulations* (CFR) is available via the Internet at: http://www.access.gpo.gov/nara/cfr/index.html

exempting large wastestreams from Subtitle C regulation. Small quantity waste generators[7], however, rarely expect to achieve waste management cost savings through HWIR, significant enough to outweigh HWIR's relatively high implementation costs.

- In addition to traditional cost-benefit analyses, industrial waste generators often examine other indirect issues outside the direct financial realm, in their waste management decisions in general, and of whether to pursue implementation of HWIR in particular, and how they will manage HWIR-exempt wastes. These indirect issues include the threat of potential Superfund[8] (CERCLA) liabilities and public perception of their waste management actions.

Specific results for each of the case study facilities can be found in the Chapters 2 - 7. In addition, Chapter 8 provides a summary of our findings as they relate to key HWIR policy issues. While confirming these expected results, the case studies provided a few surprising findings, including the following:

- In addition to creating costs savings associated with avoided RCRA Subtitle C industrial hazardous waste treatment and disposal, HWIR exemptions may also enable a small subset of large generators to avoid future major capital investments in on-site waste treatment equipment. While this type of cost savings may be limited to only a few very large facilities with on-site Subtitle C treatment units, the magnitude of potential avoided capital investment costs may dominate the total industry cost savings attributable to the HWIR.

- Aversion to potential Superfund liability seems to be an especially strong driver of generator behavior, particularly for larger generators with existing CERCLA liabilities. As a result

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[7] "Small quantity" industrial hazardous waste generators are defined by RCRA (40 CFR 260.10 "Subpart B"), as facilities that generate less than 1,000 kilograms (2,204.6 pounds or 1.1023 tons) of hazardous waste per calendar month (i.e. less than 12,000 kilograms, or 26,455 pounds, or 13.23 tons per year). Conversion factors: 1.0 kilogram = 2.2046 pounds; 1.0 pound = 0.4536 kilograms; (1.0 ton = 1.0 "short-ton" = 2,000 pounds = 907.2 kilograms). However, annual waste quantity does not necessarily correlate with the size of a facility or company business operations; e.g., facilities operated by large companies may generate "small quantity" hazardous wastestreams.

[8] Superfund = The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), commonly known as "Superfund", was enacted by Congress on December 11, 1980. This law created a tax on the chemical and petroleum industries, and provided broad Federal authority to respond directly to releases or threatened releases of hazardous substances, that may endanger public health or the environment. CERCLA established prohibitions and requirements concerning closed and abandoned hazardous waste sites; provided for liability of persons responsible for releases of hazardous waste at these sites; and established a trust fund to provide for cleanup when no responsible party could be identified. Over its first five years (1981-85), $1.6 billion was collected and the tax went to a trust fund for cleaning up abandoned or uncontrolled hazardous waste sites. The Superfund Amendments and Reauthorization Act (SARA) amended CERCLA on October 17, 1986, and expanded the trust fund to $8.5 billion. For background information about Superfund, see the website: http://www.epa.gov/superfund/ .

of their concerns about both the potential business financial impacts of and public reaction to these liabilities, many of these generators would continue to manage wastestreams in the Subtitle C system, and would thereby forgo cost savings associated with using the less expensive Subtitle D system.

ORGANIZATION OF THIS REPORT

The remainder of this report is divided into seven chapters. Chapters 2 through 7 provide the results of individual facility case studies. Chapter 8 summarizes "lessons learned" from the case studies that may be useful for improving or refining certain aspects of the HWIR rulemaking. In addition, we include appendices that support the main text of the report. Appendix 1 provides the site visit interview protocol followed by the contractor. Appendices 2, 3, and 4 provide detailed information about product lines, relevant economic, business and cost data, and environmental initiatives for the chemical and allied products, the petroleum and coal products, and electronics industries, respectively.

FACILITY BACKGROUND

Tennessee Eastman, a division of Eastman Chemical Company (Eastman), is a Fortune 500 manufacturer of specialty chemicals, plastics, and chemical intermediates located in Kingsport, Tennessee. Eastman has approximately 18,000 employees worldwide, and generates annual sales of approximately five billion dollars. Tennessee Eastman Division has 12,000 employees at the Kingsport site, which is located in eastern Tennessee on the South Fork Holston River. Tennessee Eastman manufactures over 300 industrial chemicals, one basic fiber, and three basic types of plastics. In addition to the Kingsport site, Eastman has seven other U.S. facilities with larger U.S. plants located in Texas, Arkansas, and South Carolina. Non-U.S. facilities are located in England, Germany, Argentina, Mexico, Spain, the Netherlands, Singapore, and Malaysia.

During our facility site visit in September 1997, we interviewed the following Eastman staff: Nancy Ekart, Senior Environmental Representative; Janet Evans, Associate Civil Engineer; and Michael Bullard, Senior Civil Engineer. Ms. Ekart and Ms. Evans provided the majority of information and data on Tennessee Eastman's wastestreams and waste management, and other issues related to HWIR. Mr. Bullard provided examples of Tennessee Eastman's waste minimization projects. We also toured various operations at Tennessee Eastman, including the wastewater treatment facility, the treatment facility for biosludge resulting from wastewater separation, and their laboratory for evaluating new waste treatment technologies.

FACILITY AND WASTE PROFILE

Tennessee Eastman's wastestreams result from a wide variety of production processes and other processes that take place at the Kingsport facility. According to USEPA's 1995 *Biennial Reporting System*, Tennessee Eastman's Kingsport site generates 33.2 million tons[9] (i.e. 66.4 billion pounds) of hazardous waste. Of the 33.2 million tons of hazardous waste, 99.3 percent are wastewaters, 0.5 percent is biosludge from wastewater treatment, and 0.2 percent are nonwastewaters. Wastewaters resulting from a variety of production processes and a large biosludge wastestream make up the majority of

[9] Ton = "short-ton" = 2,000 pounds.

Tennessee Eastman's hazardous waste by volume. These wastes are considered hazardous due to the RCRA "mixture and derived-from" rules (referenced in Chapter 1 Introduction to this report).

WASTE TREATMENT AND MANAGEMENT

Eastman considers itself a leader in the specialty chemicals industry for environmental management. In 1996, Eastman spent $173 million on environmental protection and management, which represents almost 4 percent of annual sales ($4.8 billion). The company's waste treatment and management decisionmaking are integrated with the activities of other business units at the site level. While differing somewhat by facility, Eastman's environmental staff assigned to each facility are generally organized into groups responsible for issues related to waste minimization, incineration, solid waste, air, and water. Additionally, at Tennessee Eastman, each major business unit/product division (e.g., Acids) has its own environmental coordinator. In general, environmental management at Eastman is more centralized and integrated than at other firms in the specialty chemicals industry, which is partially attributable to the fact that it has many fewer facilities than some of its competitors.

When an environmental management task arises at Tennessee Eastman, for example, renewing their RCRA Part B incinerator permit, a cross-media team forms to address the issue. Similarly, cross-media teams will form to address and to anticipate changes that may result from new product lines. Corporate teams evaluate new federal regulations in the pre-proposal stage and then monitor them throughout their development. Division-level teams evaluate new state regulations. However, these teams exercise some discretion by prioritizing which regulations on which to focus.

Eastman's corporate policy is to first reduce waste through improving process stability and reliability. Eastman then seeks to reuse, recycle, or sell waste material. Finally, Eastman uses high-temperature incineration and landfilling as a final waste management option.

Another key aspect of Eastman's policy is to treat and dispose of waste (hazardous or nonhazardous) on-site whenever possible. Waste is sent off-site only after review and approval from Eastman's corporate environmental management. Additionally, Tennessee Eastman has a preference for avoiding land-based treatment and disposal options in response to Superfund liability concerns. Tennessee Eastman's estimate of waste quantities handled by various management methods in 1994, as shown in Exhibit 2-1, reflects their preference for managing waste on-site and for incineration in lieu of land application. Tennessee Eastman manages the majority of their hazardous waste on-site and uses land disposal minimally (5 percent of total hazardous quantities). The majority of Tennessee Eastman's hazardous wastestreams are combusted; the ash from the combustion process is then deposited on-site in Tennessee Eastman's permitted Subtitle C landfill. In 1995, Eastman opened and received a permit to operate an on-site hazardous waste landfill.

Exhibit 2-1 **TENNESSEE EASTMAN DIVISION (SIC 28, NAICS 325)** **Hazardous Waste Management by Quantity, 1994**		
Treatment & Disposal Method	**Quantity of Hazardous Waste (tons)**	**Percent of Total Hazardous Waste Quantities, by Management Method**
On-site incineration	345,000 tons	85 percent
Off-site landfills	2,000 tons	5 percent
Off-site incineration	2,000 tons	5 percent
Off-site fuel blending & incineration	650 tons	<2 percent
Metals recovery	100 tons	<1 percent
Total	**349,750 tons (699.5 mill.lbs)**	**<97 percent**

Note**:** Total hazardous waste quantities presented in this exhibit represent nonwastewaters and sludge residuals from treatment of wastewaters, which exit to the South Fork Holston River through Tennessee Eastman's NPDES permit. On-site incineration includes waste treated in on-site boilers.
Source: Interview with Janet Evans, Associate Civil Engineer, Tennessee Eastman, September 29, 1997.

RCRA's "Mixture and Derived-from" Rules

USEPA promulgated the "mixture and derived-from" rules as part of the basic RCRA statute in 1980, to close loopholes that allowed generators of hazardous waste to potentially avoid hazardous waste regulations. Under the "mixture rule", generators are not able to avoid Subtitle C requirements by mixing listed hazardous waste with more benign non-hazardous waste to create a new wastestream no longer characterized by the original listing description, but that may still pose hazards. Similarly, the "derived-from" rule is intended to discourage generators and TSDFs from processing or managing waste in a minimal way to avoid a listing, because this waste may also continue to pose hazards. (See 40 CFR 261.3). The mixture rule has been challenged by industry. HWIR is intended, in part, to provide relief to low-risk waste that is hazardous due solely to the "mixture and derived-from" rules.

Tennessee Eastman's primary hazardous waste challenge is the management of a large, biological sludge wastestream. This biosludge, which averages 146,000 tons or 292 million pounds each year (i.e. 400 tons or 800,000 pounds daily), is a composite that results from the treatment of approximately 33 million tons (66 billion pounds) per year of hazardous wastewater. The biosludge is also considered hazardous under RCRA because it is a "derived-from" waste according to the "mixture and derived-from rules".[10]

[10] This wastestream tests positive for detection of the following metals: barium, chromium, nickel, and zinc. Organics in this wastestream include: 1,4-dioxane, chlorobenzene, ethylbenzene, tetrachloroethane, toluene, xylenes, aniline, bis(2-ethylhexy1)phlatate, Di-n-butyl phthalate, diethyl phthalate, Di-n-octyl phthalate, and phenols. Refer to Appendix A-2c for more detailed analytical results for these and other constituents in this wastestream based on tests conducted at Tennessee

Currently, Tennessee Eastman manages the biosludge wastestream to meet RCRA Subtitle C requirements by treating the wastewater biologically, clarifying it, and then discharging the clarified wastewater effluent to the South Fork Holston River under a NPDES permit. The sludge residual is sent through filter presses for further dewatering; the resulting filter cake is then incinerated in Tennessee Eastman's coal-fired boilers.[11,12]

Tennessee Eastman states that their boilers, constructed in the 1940's, will likely not meet anticipated new MACT standards for boilers and industrial furnaces (BIFs). As a result, within the next few years, Tennessee Eastman will explore various options for managing biosludge. These options include, but are not limited to, the following:

- **Option 1: Upgrading boilers to meet the MACT standards —** under Option 1, Tennessee Eastman would invest significantly in capital improvements to their boilers so that they would meet the MACT standards for BIFs, and would then continue to incinerate the biosludge.

- **Option 2: Sending the biosludge off-site to a Subtitle C landfill —** under Option 2, Tennessee Eastman would send the biosludge off-site to a Subtitle C hazardous landfill.

- **Option 3: Installing sludge dryers and modifying boilers —** under Option 3, Tennessee Eastman would install sludge dryers to further reduce the water content of the biosludge, and would modify the boilers to meet MACT and to handle the dried biosludge; they would then burn the biosludge in the modified boilers.

Because the future capital investments and/or operating costs required for each of the options under consideration are significant, and because Eastman believes the biosludge wastestream is low-risk, Tennessee Eastman would like to implement an HWIR exemption for this wastestream. Tennessee Eastman notes that if they must continue to manage the biosludge as hazardous in the future, the option that they will ultimately implement will depend on a variety of factors, including cost.

Eastman's on-site lab over a three-month period.

[11] After dewatering, the water content of the biological sludge is 86 percent.

[12] Refer to Appendix A-2b for a process flow diagram which describes this treatment process in more detail.

POTENTIAL BENEFITS OF HWIR

The majority of Tennessee Eastman's other hazardous wastestreams exhibit toxicities or constituent concentrations that are likely to exceed the 1995 proposed HWIR exemption levels by at least an order or more of magnitude for one or more constituents, and thus are unlikely to be eligible for exemption from RCRA Subtitle C requirements under HWIR as proposed in 1995. However, in addition to the biosludge, Tennessee Eastman has two other wastestreams that may be eligible for exemption under HWIR. These include:

- **Multiderivative incinerator ash:** This wastestream is also a composite resulting from treatment of multiple Tennessee Eastman wastestreams and is considered low-risk.

- **Various leachate wastestreams:** Tennessee Eastman considers these wastestreams much lower in priority than the biosludge and incinerator ash, in terms of seeking an HWIR exemption because they account for much smaller quantities.

Direct Benefits

The primary direct benefit to Tennessee Eastman of realizing HWIR exemptions will be the avoided future costs of managing wastestreams to meet Subtitle C requirements on-site. The annual costs currently (i.e. 1997-98) incurred by Tennessee Eastman to manage the biosludge waste stream are significant, accounting for over five percent of the total environmental management costs at the Tennessee Eastman Kingsport facility. If Tennessee Eastman can realize an HWIR exemption on this wastestream, they can avoid the future costs of upgrading their existing waste management systems to meet upcoming regulatory standards for BIFs.

Tennessee Eastman roughly estimates the potential cost savings resulting from an HWIR exemption on the biosludge wastestream will range from 35.2 percent of total environmental costs (about $61 million) if Option 1 is implemented, to 44 percent of total environmental costs (about $76 million) if Option 3 is implemented (Exhibit 2-2).[13] Because the MACT standards for air emissions from BIFs will likely require equipment upgrades in the future to Tennessee Eastman's current system for managing this wastestream, most of these cost savings result from avoiding future capital expenditures required to continue managing the wastestream as hazardous, rather than avoiding the current costs of managing and disposing of this wastestream.

[13] These capital and operating costs are not annualized. They are also undiscounted, i.e., these figures do not represent the net present value of the required investments.

Exhibit 2-2

TENNESSEE EASTMAN CHEMICAL (SIC 28, NAICS 325)
Potential Avoided Future Costs: Managing Biosludge Wastestream

Management Option	Biosludge Waste Management Costs, As Percentage of Total Environmental Costs
Current Hazardous Biosludge Management	1.5 percent
Option 1: Upgrading boilers to meet the MACT standards	35.2 percent
Option 2: Sending the biosludge off-site to a Subtitle C landfill	43.3 percent
Option 3: Installing sludge dryers and modifying boilers	44.0 percent

Notes: 1. Actual Tennessee Eastman waste management costs are considered confidential business information
2. Total environmental costs include capital expenditures and operating costs.
3. Cost data in Option 2 is based on current (i.e. 1997-98) annual sludge quantities.

Source: Memorandum prepared by Nancy Ekart and Janet Evans, Tennessee Eastman Division, 19 Nov 1997.

If Tennessee Eastman does realize an HWIR exemption on the biosludge wastestream, they can realize the cost savings associated with pursuing one of the three management options currently being explored, but will then incur the costs of managing the wastestream as nonhazardous. Tennessee Eastman would continue to manage the exempt biosludge stream on-site by incineration in their boilers, and would incur some additional analytical costs for testing and sampling under HWIR. However, Tennessee Eastman feels these additional testing costs are insignificant compared to the potential costs of managing this wastestream as hazardous in the future, and they may still pursue an exemption for the wastestream from Subtitle C requirements under HWIR, even if testing costs are significant.

Tennessee Eastman did not provide similar data describing the potential costs savings of realizing HWIR exemptions on other wastestreams such as their incinerator ash. However, Eastman would continue to manage these wastestreams on-site as well, and thus would not realize savings from reduced disposal costs of using non-hazardous industrial Subtitle D units.

Indirect Benefits

Tennessee Eastman asserts that the primary indirect benefit from HWIR exemptions is a public relations benefit gained by reporting a reduction in the quantity of hazardous waste generated by the facility. However, Tennessee Eastman asserts that this is more a perceived benefit rather than a true societal benefit as the actual quantity and type of waste that Tennessee Eastman generates and manages would not actually change.

INCENTIVES FOR WASTE MINIMIZATION

Eastman evaluates potential waste minimization projects on a site-by-site basis. Ideas for projects at the Kingsport site are frequently generated by each manufacturing division or by the central engineering division. Tennessee Eastman then conducts a full evaluation of promising projects on the basis of engineering feasibility, chemicals used, safety concerns, and relevant regulations. In general, Tennessee Eastman considers only projects that have the potential to create value to the firm, based on their projected rate of return on investment. Projects that are required to meet regulatory standards are an exception to this process of evaluation -- these projects are implemented even if not justified financially.

At this point in time, Tennessee Eastman has already implemented the most readily available, cost-effective waste minimization opportunities, such as changing from chlorinated to non-chlorinated solvents. Eastman notes that identifying additional new opportunities for successful waste minimization projects is difficult -- successful and effective projects are usually not obvious, easy to implement, or low in cost. Additionally, decisions that affect production processes at Eastman are extremely complex and are primarily constrained by product specifications and customer needs, limiting the extent to which process inputs and production processes can be adjusted. For example, Tennessee Eastman examined methods to reduce quantities of toluene-based solvents used in the manufacture of photographic chemicals using sophisticated statistical techniques. However, they found that it is not possible to reduce quantities of toluene used while maintaining the product specifications for these chemicals required by Kodak, one of their largest customers.

Tennessee Eastman suggests that at present, it may have more opportunities to reduce non-hazardous waste quantities. Some of Tennessee Eastman's largest and most effective waste minimization projects have addressed non-hazardous waste. For example, Tennessee Eastman recently eliminated some manganese and iron wastestreams entirely. Tennessee Eastman feels their annual hazardous waste generation could technically be 'reduced' through waste accounting changes, but it is difficult to realize true reductions in hazardous waste due to constraints on production processes and intra-firm competition for limited capital.

Tennessee Eastman environmental staff believe that, while HWIR represents an important deregulatory effort, it does not provide generators like Tennessee Eastman with a unique set of incentives for minimizing their hazardous waste. Rather, the overall costs of managing both hazardous and non-hazardous waste combined with the general competitive climate in the specialty chemicals industry provide the greatest incentives for Tennessee Eastman to minimize their waste.

IMPLEMENTATION REQUIREMENTS

In general, Tennessee Eastman does not consider the requirements for implementing HWIR exemptions as a barrier to seeking exemptions. This is because: 1) Tennessee Eastman has an in-house laboratory that will meet HWIR's analytical requirements; and 2) the cost savings associated with exempting certain waste (i.e., the biosludge wastestream) are large relative to the additional testing costs that would be incurred annually.[14]

Sampling and Testing for HWIR Exemptions

Tennessee Eastman staff expressed concern that due to random variation and not to any change to normal variations in mean constituent concentrations, a wastestream that has been exempted from Subtitle C requirements under HWIR may subsequently test as hazardous when using the maximum detected concentration approach in the proposed rule. Under the 1995 HWIR waste eligibility testing protocol, Tennessee Eastman staff feel that certain waste constituents would need to test several standard deviations below the corresponding HWIR exemption level, to give the company confidence that those constituents would consistently meet the exemption level over time.

Tennessee Eastman suggests using long-term average, waste testing data with a maximum daily concentration, if USEPA desires, as the basis for assessing constituent concentrations in waste for the purpose of comparing to HWIR exemption levels. However, Tennessee Eastman staff also suggested that since generators have the best knowledge of their own wastes, the HWIR implementation requirements should allow generators more flexibility in determining their own approach to measuring constituent concentrations. Under a more flexible testing scenario tailored to their waste, they would feel more confident that HWIR exemptions would remain intact.

Other Implementation Issues

Tennessee Eastman feels that failure on the part of a facility to do proper public notification to meet the other paperwork requirements of HWIR should not result in an exemption being revoked. Eastman believes that an exemption should only become invalid because of constituent concentration levels that exceed limits, not because of administrative mishaps. Tennessee Eastman feels these violations could be more effectively discouraged through fines or other financial disincentives.

LIABILITY AND PUBLIC PERCEPTIONS

The threat of potential CERCLA (i.e., Superfund) liabilities is a very strong driver of behavior at Tennessee Eastman.[15] Historically, Eastman considers itself to have been a good actor, and has been

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[14] Tennessee Eastman had in fact been testing this wastestream every 15 minutes for an hour period each month over a nine month period to support a Project XL petition in the event that it does not qualify for an HWIR exemption under the final rulemaking. The Project XL petition has since been withdrawn.

[15] Under the court's interpretation of CERCLA, potentially responsible parties can be held jointly and severally liable for Superfund cleanup costs, regardless of how much waste they contribute to the site. A hazardous waste generator such as Tennessee Eastman, therefore, may be liable for their

identified as a potentially responsible party at relatively few Superfund sites. They consider this to be a competitive advantage, as some of their competitors have substantial Superfund liabilities. Partly as a result of this concern, Eastman has a corporate-wide policy to manage waste on-site to the maximum extent possible. Waste is sent off-site only if it cannot be addressed on site due to its physical properties; all waste sent off-site also requires the approval of an Eastman Vice-President.

In addition to managing the majority of waste on-site, Tennessee Eastman also audits all off-site labs that they contract with, as well as the few Subtitle C and D facilities to which they send their waste, to reduce the likelihood that the waste could eventually become involved at a Superfund site. Tennessee Eastman asserts that the threat of potential Superfund liabilities associated with sending waste off-site is too high relative to the potential cost savings they may accrue from sending their wastestreams to Subtitle D disposal units. In fact, Tennessee Eastman considers discontinuing product lines that require off-site management even if they are highly profitable because of the potential Superfund costs that may be incurred from managing waste that results from their production.

OTHER ISSUES

USEPA Data Collection and Data Quality

Tennessee Eastman expressed concerns that pressure from citizen action and environmental groups may create incentives for generators to under-report their hazardous waste quantities to USEPA. In particular, they note that reported national quantities of hazardous wastewaters in the *Biennial Reporting System* decreased significantly from 1987 to 1995, while production increased significantly during this same time period. While it is difficult to determine to what extent wastewaters are under-reported on a facility basis, Tennessee Eastman feels that this type of inconsistent reporting on the part of generators results in hazardous waste data that may be an unreliable or biased source for USEPA policy analyses

Delisting

Tennessee Eastman views the delisting program as a viable approach for achieving regulatory relief from Subtitle C requirements for low-risk wastestreams. However, in the past, certain impediments have made it difficult for Eastman to realize exemptions under the delisting program. For example, Tennessee Eastman feels that seeking delisting of wastewater streams is sometimes problematic because of typical fluctuations in these wastes. Tennessee Eastman also considered seeking a delisting for one wastewater wastestream after-treatment, but a delisting of this waste would require closure of surface impoundments used to manage this wastestream that are currently permitted under RCRA. Closing these surface impoundments would be very costly, and Eastman would no longer be able to use these impoundments for off-quality effluent holding.

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waste even if they transfer responsibility for management of the waste to a third party by sending it off-site to a permitted treatment, disposal, and recycling (TSDF) facility.

Eastman's Texas facility has made some successful investments in delisting petitions for a few non-wastewater streams in the past (e.g., an ash residual). Tennessee Eastman has tested their biosludge waste to accumulate more data describing constituent concentrations. In the event that this wastestream does not meet HWIR exemption levels, or if the HWIR rulemaking is too prolonged, Tennessee Eastman may pursue a delisting of this wastestream.

Tennessee Eastman feels that USEPA regional offices currently do not have adequate resources to effectively implement the RCRA hazardous waste delisting program. Tennessee Eastman asserts that USEPA should devote more resources to support the delisting program at least until HWIR becomes final, allowing generators with low-risk wastes one approach for regulatory relief from federal hazardous waste requirements.

IMPLICATIONS FOR THE 1995 HWIR ECONOMIC MODEL

Under the decision-rules and analytic logic used in the 1995 HWIR Process Waste Economic Model, the results will not reflect the main financial benefit of HWIR to Tennessee Eastman, which is the potential to realize future compliance costs savings associated with other regulations. Specifically, if Tennessee Eastman's biosludge wastestream qualifies for an HWIR exemption, they may then realize significant savings on capital investments to upgrade their existing boilers to meet the anticipated MACT standards for boilers and industrial furnaces. The 1995 HWIR economic model calculates only two categories of potential cost savings associated with HWIR exemptions -- industry cost savings due to avoided Subtitle C waste treatment, and avoided Subtitle C disposal cost savings. The 1995 economic model is thus likely to bias downward the estimate of total savings that Tennessee Eastman will realize due to an exemption for their biosludge waste.

In addition, Tennessee Eastman states that they would be reluctant to send exempt waste to Subtitle D units due to concerns about potential liability. If this is the case, the 1995 HWIR economic model will overstate the actual cost savings that Tennessee Eastman can expect if they continue to manage exempt waste in the Subtitle C system.

FACILITY BACKGROUND

Novartis Crop Protection Inc., formerly Ciba-Geigy Corporation, is a wholly-owned subsidiary of the U.S.-based Novartis Corporation. The facility, which we visited in October 1997, is located in St. Gabriel, Louisiana, on the Mississippi River south of Baton Rouge. As a major chemical manufacturer, Novartis' core business sectors include healthcare, nutrition, and agribusiness. The Novartis Crop Protection St. Gabriel facility manufactures herbicides, fungicides, insecticides, and seed treatments. As Novartis' largest manufacturing plant in the United States, the facility is also a leading producer of triazine herbicides, used to control weeds and grasses in crops. In addition, Novartis produces benoxacor, a protective seed covering, and is one of the few U.S. manufacturers of cyclopropylamine, an ingredient used in preparation of other crop protectants. The site also houses Novartis' U.S. headquarters for agribusiness chemical development.

FACILITY AND WASTE PROFILE

Novartis generates a significant amount of hazardous waste as by-products of the production of concentrated chemicals that protect crops from a variety of pests. In 1996, the company generated over 629,000 tons (1.258 billion pounds) of hazardous and non-hazardous waste from 270 industrial wastestreams, excluding non-hazardous wastewaters sent to treatment facilities permitted under the Clean Water Act.[16] Exhibit 3-1 details waste generation data for Novartis for 1995 and 1996.

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[16] Source: Richard B. Boudreau & Casey Crow, of the St. Gabriel Environmental Team, 1996 Pollution Prevention Report, September 1997, Part III, Attachment III.

The Clean Water Act (CWA) is a 1977 amendment to the Federal Water Pollution Control Act of 1972, which set the basic structure for regulating discharges of pollutants to waters of the United States. The CWA gave the USEPA authority to set effluent standards on an industry basis (technology-based), and continued the requirements to set water quality standards for all contaminants in surface waters. The CWA makes it unlawful for any person to discharge any pollutant from a point

Exhibit 3-1
NOVARTIS CROP PROTECTION, INC. (SIC 28, NAICS 325)
WASTE GENERATION DATA, 1995-1996

Waste Type[3]	Number of Wastestreams[2]	1995 Quantity Generated (tons)			1996 Quantity Generated (tons)		
		WW[1,4]	NWW[1]	Total	WW[1,4]	NWW[1]	Total
Hazardous	134	560,600	10,425	571,025	606,460	12,251	618,711
Nonhazardous	136	--	6,500	6,500	--	9,940	9,940
TOTAL	**270**	**560,600**	**16,925**	**577,525**	**606,460**	**22,191**	**628,651**

Source: Richard B. Boudreau and Casey Crow of the St. Gabriel Environmental Team, 1996 Pollution Prevention Report, September 1997, Part III, Attachment 3, Tables 1-6 and Part IX, Table 15.

Notes: WW- Wastewater; waste that is less than 10 percent TOC (total organic carbon).
NWW- Nonwastewater; solid waste that is greater than 10 percent TOC.

1. To calculate wastewater quantities, we subtracted the nonwastewater quantities in Part IX, Table 15 from the total quantities provided in Part III, Attachment 3, Tables 1-6 of the pollution prevention report.
2. The number of wastestreams reported in Novartis' pollution prevention report refer to waste generated in 1996.
3. This column does not include SARA (Superfund Amendment and Reauthorization Act) reportable emissions. This does not significantly impact the totals we calculated.
4. Industrial non-hazardous wastewaters are not included. These are sent to RCRA-exempt treatment facilities permitted under the Clean Water Act.

A review of Novartis' 1996 Pollution Prevention report suggests that:

- Novartis generates mostly hazardous wastewaters. In both 1995 and 1996, hazardous industrial wastewaters account for more than 96 percent of total waste (hazardous and non-hazardous) generated.[17]

- In 1996, Novartis produced an almost equal number of hazardous (134 streams) and non-hazardous industrial wastestreams (136 streams).

source into navigable waters unless a permit (NPDES) is obtained under the Act. For additional information about the Clean Water Act, refer to the website: http://www.epa.gov/region5/defs/html/cwa.htm .

[17] Non-hazardous wastewaters sent to CWA-permitted facilities were not included int he company's Pollution prevention Report.

- The average quantity per hazardous wastestream in 1996 was approximately 4,600 tons (9.2 million pounds); however, the median quantity per wastestream appears to be much lower than this.

- The most prevalent USEPA waste codes carried by Novartis' hazardous wastestreams include F005 and F003 (spent non-halogenated solvents) and U220 (benzene or toluene).

- Total reported waste generation increased almost nine percent from 1995 to 1996, mainly due to lower sales of by-products, clean-out of surface impoundments and drainage ditches, and increased manufacturing of products characterized by high hazardous waste generation to production ratios.

Almost all of the hazardous waste generated at the St. Gabriel plant is from the development, manufacturing, and services related to the company's three main products -- triazine herbicides, benoxacor, and cyclopropylamine. While triazine herbicides account for approximately 90 percent of plant production, their manufacture generates only a small percentage of hazardous waste. In contrast, the manufacture of benoxacor and cyclopropylamine generates the majority of hazardous waste but accounts for only 10 percent of production capacity. According to Novartis personnel, benoxacor and cyclopropylamine, two relatively new products, are in great demand and are highly profitable.

WASTE TREATMENT AND MANAGEMENT

Novartis' Environmental Regulatory Affairs Group (ERAG) directs the company's waste management activities. This group ensures wastes are handled according to the company's management plan from the point of waste generation through the treatment, storage, and disposal phases. Appendix A-2d displays a flow chart detailing the management of waste from generation through treatment at Novartis. ERAG is involved early in the process to ensure that all wastestreams are properly characterized, logged into the data collection system, tested in the laboratory, and sent to the proper destination.

Waste produced by the various manufacturing processes at Novartis may be recycled, forwarded to a storage area, or sent to an on-site treatment unit. Exhibit 3-2 presents data on the various methods Novartis used to manage both hazardous and nonhazardous waste in 1996. The hierarchy of waste management options preferred by Novartis, from highest to lowest priority, include source reduction, recycling, physical or chemical treatment, incineration, and landfilling.[18] The company manages the majority of the hazardous waste it generates in one of two RCRA-permitted on-site incineration units or a NPDES-permitted carbon adsorption and biological activated sludge wastewater treatment facility. All of these units are equipped to treat significant quantities of liquid waste. As Exhibit 3-2 indicates, Novartis incinerated twice as much industrial waste on-site in 1996 (16,827 tons or 33.654 million pounds), as they treated or disposed of off-site (9,193 tons or 18.386 million pounds), not including hazardous and non-hazardous industrial wastewaters treated in RCRA-exempt units.

[18] Ibid., Part III, Attachment II.

Exhibit 3-2

NOVARTIS CROP PROTECTION, INC. (SIC 28, NAICS 325)
WASTE MANAGEMENT, 1996

Treatment Method	Waste Type	Number of Wastestreams	Quantity Generated (tons per year)
On-site incineration	Hazardous	126	10,903
	Non-hazardous	114	5,924
Off-site[1]	Hazardous	18	1,348
	Non-hazardous	22	7,845
Management in RCRA-exempt units[2]	Hazardous	9	606,188
TOTALS		**289**	**632,208 (1.264 bill.lbs)**

Source: Richard B. Boudreau and Casey Crow of the St. Gabriel Environmental Team, 1996 Pollution Prevention Report, September 1997, Part III, Attachment III, Tables 1-6.
Notes: 1. Waste is sent off-site to a landfill or land farm if it is not amenable to incineration or treatment.
2. Non-hazardous wastewaters are not included.

According to company policy, Novartis favors on-site management of its waste for two reasons. The primary reason is the company's "cradle to grave" philosophy, which requires taking responsibility for the entire production and product distribution process, from selecting process inputs to managing all process waste by-products and product distribution waste. Novartis considers it easiest to implement their philosophy of responsible care and product stewardship by managing its waste on-site.

The second reason Novartis manages its waste on-site is that incineration is one of the preferred methods of treatment. Due to the influence of RCRA's Land Disposal Restrictions[19], Novartis has adopted a policy of reducing the amount of waste that it ultimately sends to landfills. Incineration is an effective approach for destroying toxics in their waste, and it allows Novartis to send smaller quantities of ash to landfills. In addition, the facility has invested in two incinerators that can manage residue from

[19] Land Disposal Restrictions (LDRs) are referred to as the "land ban", and the hazardous industrial wastes affected are called "restricted wastes". Facilities with wastestreams subject to LDRs must provide notification and certification that the wastes meet the applicable technology-based, industrial waste treatment standards of 40 CFR 268.40 "Subpart D". Restricted wastes must meet treatment standard levels prior to placement in a RCRA disposal unit (i.e. landfills, wastepiles, land treatment units, or surface impoundments). For additional information on LDRs, refer to the USEPA website: http://www.epa.gov/region09/waste/rcra/ca/ldr.htm .

the company's other treatment units such as the wastewater treatment facility.[20, 21]

POTENTIAL BENEFITS OF HWIR

Of the 134 hazardous wastestreams generated by Novartis in 1996, Novartis' management emphasizes that, with proper monitoring in place, four medium- to large-quantity wastestreams pose low risk to human health and the environment, and thus could be eligible for exemption under HWIR. Exhibit 3-3 provides data on these wastestreams. Potentially eligible non-wastewater wastestreams include sludge that results from wastewater treatment and incinerator ash/slag. A potentially eligible wastewater wastestream is the incinerator scrubber water.[22] By pursuing HWIR exemptions for these streams, Novartis hopes to achieve both direct and indirect financial benefits. They currently predict, however, they will potentially gain more indirect benefits than direct cost savings from the rulemaking.

Direct Benefits

Novartis has the potential to accrue direct financial benefits from gaining HWIR exemptions for these wastestreams. Exhibit 3-4 summarizes the potential cost savings Novartis hopes to achieve through HWIR exemptions. These benefits will mainly result from avoiding Louisiana state taxes on hazardous waste currently sent to Louisiana Subtitle C landfills. In 1996, the landfill tax in Louisiana was approximately $40 per ton of hazardous waste. As summarized in Exhibit 3-2, gaining exemptions for these wastestreams could result in annual savings of approximately $74,000.[23]

Additional savings could be generated by sending exempt wastestreams to less restrictive Subtitle D rather than Subtitle C landfills. Subtitle D landfills that Novartis would consider using charge approximately $60 per ton while Subtitle C landfills cost about $160 per ton. We calculate potential annual cost savings associated with sending these wastes streams to RCRA-exempt facilities to be approximately $185,000. Novartis personnel believe that sufficient Subtitle D landfill capacity exists to accept any waste they may choose to ship there.

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[20] The on-site incinerator currently (i.e. 1997-98) handles biological solids and primary solids removed from the wastewater treatment unit.

[21] Appendix A-2e provides a flowchart detailing the rotary kiln incineration process.

[22] Op cit., 1996 Pollution Prevention Report, Part III, Attachment 3, Tables 1, 2, and 6; and public comments dated April 22, 1996.

[23] While other states, such as Oklahoma, charge lower taxes on hazardous waste sent to landfills, freight and transport costs involved with shipping waste to out-of-state destinations would most likely offset any potential cost savings achieved through lower state taxes.

Exhibit 3-3

NOVARTIS CROP PROTECTION, INC. (SIC 28, NAICS 325)
POTENTIALLY EXEMPT WastestreamS, 1996

Wastestream Description	Wastestream Physical Form	Waste Quantity Generated (tons per year)
Ash from hazardous waste incineration landfilled off-site in a RCRA permitted facility	Non-wastewater	594
Waste solids from precipitation and filtration of incinerator scrubber water	Non-wastewater	687
Equalization tank clean-out	Non-wastewater	~500
Liquid incinerator scrubber blowdown	Wastewater	188,947 (37.789 mill.lbs)

Source: Richard B. Boudreau and Casey Crow of the St. Gabriel Environmental Team, 1996 Pollution Prevention Report, September 1997, Part III, Attachment III, Tables 1,2, and 6.

Whether Novartis will actually realize these cost savings, however, remains unclear. Despite potential savings, Novartis currently plans to maintain their existing waste management strategy of disposing waste in RCRA Subtitle C landfills. In order for Novartis to realize the cost savings achieved by managing waste in the RCRA Subtitle D system, a risk evaluation would have to show that large enough cost savings are earned to justify the additional risks associated with sending such waste to less protective industrial Subtitle D units.

Indirect Benefits

Novartis believes the primary indirect benefit from HWIR exemptions is positive publicity associated with generating less waste designated as hazardous. By realizing exemptions on these low-risk wastestreams, the company's total quantity of hazardous waste could decrease by over 190,000 tons (380 million pounds), or 30 percent of total waste generated in 1996. Novartis would likely derive greater benefit from recycling the waste solids from the incinerator scrubber water than from realizing an HWIR exemption on this wastestream.[24] The total quantity of waste generated by Novartis, however, will not change because this waste will merely shift from the hazardous to the non-hazardous waste category.

[24] This would not be feasible, however, if the wastestream is considered hazardous due to the "derived-from" rule.

Exhibit 3-4 NOVARTIS CROP PROTECTION, INC. (SIC 28, NAICS 325) Potential Annual Cost Savings Through HWIR Exemptions			
Avoided Costs	**Cost Savings Per Ton**	**Quantity Affected[1] (tons per year)**	**Annual Total Potential Cost Savings**
(A) Louisiana State tax costs	$40	1,848	$73,920
(B) RCRA Subtitle C disposal costs	$100	1,848	$184,800
Total cost savings (A+B) =	$140	1,848	$258,720

Source: Discussion with Richard B. Boudreau, Novartis Crop Protection, October 1997.
Note:[1] One of the treated wastewater effluent tanks requires clean-out every other year for "derived from" incinerator scrubber water solids (600 to 1,000 tons). This adds another 300 to 500 tons per year of waste. We calculate the total quantity affected as the amount of hazardous waste sent off site (1,348 tons) plus the high-end of the annual amount of incinerator scrubber water solids (500 tons).

INCENTIVES FOR WASTE MINIMIZATION

Novartis personnel state that waste minimization or pollution prevention activities are an integral part of their manufacturing process. The majority of waste that Novartis generates from the production of its two main products -- benoxacor and cyclopropylamine -- are hazardous wastewaters. In 1996, the company documented almost sixty initiatives designed to minimize waste, half of which were devoted to reducing hazardous waste.[25] In the following section we examine Novartis' waste generation, discuss the pollution prevention programs and annual report, and evaluate the potential impact of the 1995 proposed HWIR, on the company's waste minimization efforts.

Implementing Waste Minimization Projects

Novartis solicits ideas for reducing waste from all areas of the facility and monitors the progress of each pollution prevention initiative in an annual pollution prevention report. One hazardous waste minimization program, for example, reduced the use and disposal of acetone solvent, resulting in an annual waste reduction of almost 60 tons (120,000 pounds).[26] Novartis' philosophy is to fund projects that effectively reduce waste, thereby improving productivity and efficiency.

In order to remain cost competitive in its market, Novartis has had to rigorously implement such waste minimization projects. The company includes the costs for these projects in its budget for normal

[25] Ibid., Part V, Section 2, Table 8.

[26] Ibid., Part V, Section 1, Table 7, "Summary of Pollution Prevention Initiatives Continuing Through 1996."

operations of the plant, rather than designating a specific amount of funds each year for waste minimization efforts across the facility. Because various company initiatives compete for limited funding, engineers and other personnel have to decide which programs to pursue. Novartis uses the following criteria to make these decisions, rather than strict of rate of return requirements or other measurements. Novartis implements projects that share two common characteristics:

- **Environmental Benefit:** Programs implemented must address issues that affect the local community as well as ensure compliance with regulatory requirements.

- **Cost-effectiveness:** This measure addresses the need to keep waste management costs from escalating beyond a point that drives Novartis out of the competitive market for their products.

According to Novartis staff, it is unlikely that HWIR will have much general impact on the company's waste minimization program. However, it is possible that the company may have additional incentives to reduce their waste in order to gain HWIR exemptions for a few specific types of wastestreams, including:

- High-volume hazardous wastestreams that are currently ineligible for HWIR exemption because a few constituents exceed HWIR exemption levels as proposed in 1995.[27]

- "Borderline" wastestreams, with constituents measuring near HWIR exemption levels, that are generated during processes that require the use of hazardous inputs that could be replaced by functional and affordable substitutes.

Moreover, because the majority of hazardous waste generated at Novartis results from production processes which produce less than ten percent of total saleable product, the company does not have broad flexibility to change manufacturing processes to minimize hazardous waste.

IMPLEMENTATION REQUIREMENTS

Novartis staff predict that a variety of the HWIR implementation requirements will influence their ability to pursue HWIR exemptions. The main requirements that affect the company are the sampling and testing requirements, notification requirements, and the criteria used to determine whether a generator is in compliance with HWIR requirements.

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[27] Under the 1995 proposed HWIR rule, a wastestream is not eligible for exemption from Subtitle C waste management requirements, unless all constituents contained in the waste meet the corresponding HWIR exemption level.

Sampling and Testing for HWIR Exemptions

Novartis uses both on-site and off-site laboratories to test their wastestreams, both for their own internal characterization and to meet regulatory requirements. Of Novartis' three on-site environmental laboratories, one tests for RCRA wastes, and the other two labs are used to examine water and air samples. Novartis uses these three on-site testing centers in the initial phase of waste management. The primary role of the RCRA lab is to characterize existing and new wastestreams, verify the characteristics of approved wastestreams upon receipt, and to define the characteristics of waste that will be incinerated on-site. Novartis also employs an off-site or contract laboratory to fulfill certain testing requirements they lack the capability to perform on-site. Due to high variability in the quality of laboratory work and the high turnover of companies in the market, Novartis chooses to use one contract lab exclusively.

Regardless of whether waste is tested on-site or off-site, the company remains concerned about the extensive list of constituents that require testing under HWIR. Novartis does not believe that generators should be required to test for the approximately 400 constituents that USEPA proposed in 1995 for HWIR eligibility evaluation. The company supports the idea that only those constituents "reasonably expected to be present in the waste" should be analyzed in subsequent years, especially if a full analysis of all the constituents is performed initially. Novartis personnel estimate that costs associated with testing for the full list of 1995 HWIR constituents, are approximately five times greater than testing only for those expected to be present.

In addition, many of these constituents cannot be analytically detected at the 1995 proposed HWIR risk-based exemption levels. Novartis' contract laboratory could only test between 180 and 200 hazardous constituents to the 1995 HWIR exemption levels, due to these technological testing constraints. Since no tests exist that can accurately detect the presence of these constituents at the 1995 proposed levels, Novartis encourages USEPA to reduce the number of constituents that must be evaluated.

Waste Testing Costs

Because Novartis does not keep track of its on-site laboratory costs on a per analysis basis, it is difficult to compare on-site and off-site laboratory costs directly. The company, however, recently made a large capital investment in equipment to test for RCRA metals. While they plan on performing more of the routine metals tests in-house, Novartis will continue to contract with an outside laboratory to analyze TCLP and organic hazardous constituents. Their estimate of the cost for an outside laboratory to analyze one sample from a typical hazardous wastestream that contains 24 organics and 16 metals is approximately $2,300.[28] To ensure high-quality control standards, Novartis estimates that it will have to perform a minimum of four analyses per wastestream for a total cost of $9,200.[29] Despite high sampling and testing cost estimates, Novartis claims they will likely pursue an HWIR exemption for wastestreams that meet the exemption level criteria.

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[28] Appendix A-2f provides a quote for the cost of analyzing one of the facility's wastestreams.

[29] USEPA waste testing requirements determine the number of times a waste generator must test each hazardous wastestream for quality assurance and quality control purposes.

Notification Requirements

Novartis also believes that the HWIR notification requirements impose an unnecessary additional burden on generators who may implement the rulemaking. The company believes it is their responsibility to properly classify their wastestreams, meet recordkeeping requirements, and maintain proper supporting documentation; however, Novartis personnel feel that the company should not be submitted to a long waste classification process that involves the public. In the absence of such a process, Novartis would continue to make their records available to USEPA and the public for regulatory oversight and enforcement purposes.

Criteria for Voiding HWIR Exemptions

Novartis personnel also take issue with two criteria that USEPA proposes using to void a generator's exemption under HWIR: one-time exceedance of an exemption level and recordkeeping errors. The company recommends that USEPA specify in the rulemaking that if a comprehensive quality control program exists, a batch of waste that does not meet the exemption levels should be able to withdraw from HWIR and still be managed as hazardous waste. In addition, Novartis feels that paperwork or recordkeeping errors should not cause a wastestream exemption to be revoked. The company believes HWIR exemptions should only be voided because of improper waste management practices or testing practices that do not meet USEPA specifications.

Data Requirements

Novartis also supports flexibility in selecting which data to use to determine constituent concentrations in their wastestreams. The company tests each wastestream at least once each year and maintains an extensive database containing detailed historical information about each wastestream.[30] Novartis would like greater flexibility in the choice of the data evaluation technique that best suits their ability to document the achievement of HWIR exemption levels. If USEPA allows flexible limits on the age of the data used to characterize constituent concentrations in hazardous waste, Novartis could use historical data from their database and avoid conducting additional tests.

HWIR EXEMPTION LEVELS

Another aspect of the proposed rule that Novartis is concerned about is the exemption levels for determining whether a wastestream qualifies for an HWIR exemption. The company reiterates a common concern that the 1995 proposed exemption levels are too stringent to allow low-risk wastes to exemption the Subtitle C system. Novartis believes the conservative 1995 proposed levels are not realistic, because they are based on pessimistic scenarios that over-estimate the effects of hazardous waste on various

[30] Novartis has generated and collected extensive data on all wastestreams since 1985. Since they re-characterize each wastestream at least once each year, Novartis personnel can determine whether such enduring wastestreams continue to fit the previously defined content of the waste. If the waste falls outside the historic range of data, it is considered a new wastestream.

ecological and human health endpoints. Novartis is also concerned that USEPA may use exemption levels as the basis for other regulatory initiatives.

In addition, Novartis does not find the 1995 proposed HWIR exemption levels flexible enough to account for the variability expected in waste testing and sampling results. Novartis is not a proponent of a single, numerical exemption level, because they feel it does not allow for sampling analysis variability related to using different laboratories, sampling equipment, testing methods, or sampling waste matrices. Instead, the company endorses basing HWIR exemption levels on measurements developed using a rolling average in which the average concentration of a constituent must remain below the regulatory levels. In summary, Novartis suggests that more practical and detectable HWIR exemption levels be adopted.

LIABILITY AND PUBLIC PERCEPTIONS

To minimize the risk of the potential liability under Superfund, Novartis, as a corporate policy, has historically managed most of its waste on-site. Due to past involvement in Superfund litigation, the company's culture and philosophy advocate complete responsibility for its products--from obtaining quality raw materials to using effective management practices for production process wastes.

As previously mentioned, Novartis' waste management program uses on-site incineration to treat the majority of its nonwastewaters. The residual waste ash from these incinerators is currently transported to RCRA Subtitle C landfills. Despite the potential cost savings that could be achieved by sending waste to less expensive and less regulated Subtitle D facilities, Novartis expects to continue to manage their process wastes in Subtitle C facilities regardless of their HWIR exemption status. Novartis does not anticipate changing their waste management practices based on the HWIR proposal without first seriously investigating all of the costs and benefits surrounding any changes to the risks they would incur. Even though Novartis may forego business financial benefit by not changing their waste management practices, they predict they will still pursue HWIR exemptions for the positive public relations benefit.

OTHER ISSUES

Other regulations and rulemakings play a role in how Novartis effectively manages wastes, from generation through treatment, storage, and disposal. These rules can affect a variety of decisions, from how a waste is initially characterized as hazardous or non-hazardous to where the waste is sent for final disposal. Some of the other regulations that may affect Novartis include the RCRA "mixture and derived-from" rules, the waste combustion MACT standards, and the RCRA waste delisting program.

"Mixture and Derived-from" Rule

None of the wastestreams we examined at Novartis would be eligible for exemption under HWIR at the point of generation. During the treatment stage, a few of Novartis' wastestreams become RCRA hazardous waste because they are "mixed or derived-from" other RCRA hazardous wastestreams.

Novartis officials believe four such wastestreams that are hazardous because of the "mixture and derived-from" rules -- the precipitated solids from the incinerator scrubber water, the clean-out of the equalization treatment tank, incinerator ash, and incinerator scrubber water -- could all be eligible under HWIR. These wastestreams are currently landfilled in a RCRA-permitted unit, but could be exempt from Subtitle C regulations through HWIR. Novartis feels the RCRA "mixture and derived-from" rules are over-regulatory and do not properly identify hazardous waste; therefore, the facility endorses that waste be managed for constituent concentration levels and protection of human health and the environment, rather than for exposure to other wastestreams through production or treatment processes.

<u>Combustion MACT Standards</u>

Although Novartis uses incinerators to treat the majority of their waste, Novartis does not anticipate that the impending combustion MACT standards will affect management of their wastes. Both of Novartis' incinerators are fairly new and incorporate recent technological innovations. Managing waste on-site is one of Novartis' highest environmental and corporate priorities, and therefore they anticipate complying with the combustion MACT standards.

<u>Delisting</u>

In the event that Novartis does not implement HWIR, they may pursue a delisting petition as a last resort for regulatory relief for hazardous wastestreams they feel pose low risks to human health and the environment. Their environmental management group will not undertake the effort to delist hazardous wastestreams until they exhaust their options regarding HWIR. Novartis feels delisting is not an optimal solution because the company has already invested resources in learning about HWIR. In addition, other companies have spent hundreds of thousands of dollars on delisting proposals which have not been acted upon by USEPA. Finally, many generators currently perceive that USEPA regional office resources are insufficient to process RCRA hazardous waste delisting petitions in a timely or efficient manner.

IMPLICATIONS FOR THE 1995 HWIR ECONOMIC MODEL

Applying the decision-rules and analytic logic used in the 1995 HWIR economic model, the model results will overstate the cost savings Novartis would realize for the wastestreams they feel could potentially be exempt. Because Novartis has expressed hesitation regarding the use of Subtitle D units for exempt waste, they may not realize disposal cost savings of approximately $100 per ton, which represent the benefits of using Subtitle D rather than Subtitle C disposal units. Another source of cost savings to Novartis that are not addressed by the 1995 economic model, are avoided Louisiana state taxes of $40 per ton of exempt waste. To add precision to estimates of cost savings for individual facilities, the HWIR model could incorporate an additional assumption for avoided taxes for waste exemptions that occur in states with significant hazardous waste taxes.

FACILITY BACKGROUND

Occidental Chemical Corporation (OxyChem) is a Fortune 500 producer of organic and inorganic chemicals, including industrial and specialty chemicals and plastics. OxyChem is the largest manufacturer of chrome-based chemicals in the U.S. Other products manufactured by OxyChem include alkalies, chlorine, caustic soda, ethylene, propylene, butylene, polyvinyl chloride resins, and other plastics and resins. In 1997, OxyChem employed 8,300 employees worldwide, including 4,000 in the U.S. Annual worldwide sales in 1997 were $4.3 billion. In addition to the Houston Chemical Complex visited for this study, other OxyChem facilities located in the U.S. include five more facilities in Texas plus facilities in Alabama, Louisiana, South Carolina, Pennsylvania, New York, Ohio, Georgia and Illinois.

OxyChem's Houston Chemical Complex consists of three separate facilities — the Deer Park facility, built in 1948; the Vinyl Chloride Monomer (VCM) facility, originally built by Shell Oil in 1971, and acquired by OxyChem in 1987; and the Battleground facility, built in 1974.[31]

During our visit to the Houston Chemical Complex in September 1997, we interviewed Sean Maconaghy, OxyChem's Environmental Engineer for Solid Waste. Mr. Maconaghy is responsible for supervising OxyChem's hazardous and non-hazardous solid waste operations at the VCM, Battleground, and Deer Park facilities.[32] In addition, we met with Paul Green and Vic Rebecek, who manage waste treatment, including incineration operations. We also conducted a phone interview with Jeannie Schrader-Norsworthy in OxyChem's corporate headquarters to discuss OxyChem's use of financial criteria in setting waste minimization priorities

[31] Each of these facilities has a unique USEPA identification number.

[32] OxyChem also has environmental engineers on staff for their air and water operations.

FACILITY AND WASTE PROFILE

The majority of OxyChem's hazardous wastestreams generated at the Houston Chemical Complex result from the production of ethylene dichloride (EDC), a primary input to the production of vinyl chloride monomer (VCM), and from the production of VCM itself, and the mercury cell chloro-alkali production process. At the Deer Park and VCM facilities, there are 33 hazardous and 27 non-hazardous wastestreams resulting from these three production processes. OxyChem generates approximately 15,000 tons (30 million pounds) of hazardous industrial non-wastewaters each year. The breakdown of these industrial process non-wastewaters, by quantity, consists of the following:

- **Filter cake:** approximately 300 tons (600,000 pounds) per year from on-site mercury retorting (two percent of total);

- **VCM heavy ends:** 12,000 to 13,000 tons (24 to 26 million pounds) per year from EDC and VCM production (87 percent of total);

- **Miscellaneous hazardous waste:** approximately 1,000 tons (2 million pounds) per year of waste oil, paint, solvents, filter cartridges, mercury contaminated debris, incinerator ash, acid brick, and residues from a limestone "rockbox" (7 percent of total).

OxyChem's hazardous wastewaters consist primarily of process waters, and wastewaters from a steam stripper used during EDC recovery and from OxyChem's HCl absorber column. The HCl absorber wastewaters are then sent through a limestone "rockbox" for neutralization.

WASTE TREATMENT AND MANAGEMENT

OxyChem manages hazardous waste (heavy ends) from EDC and VCM production by incinerating these wastestreams on-site, and then sending the incinerator ash off-site to a permitted Subtitle C landfill. The total quantity of hazardous incinerator ash sent off-site is approximately eight to twelve drums per year. Filter cake residuals from OxyChem's on-site mercury retorting unit are also sent off-site.

Process water used in EDC purification is sent through a steam stripper; this stripper recovers some organics, which are then reused in production. Hazardous wastewaters from both OxyChem's steam stripper and the limestone rockbox are discharged through the NPDES permitted waste water treatment plant after being neutralized. Total wastewater generation at Shell's Deer Park chemical complex is two million gallons per day, or about 730 million gallons a year.

OxyChem has a corporate policy to incinerate hazardous waste rather than land apply it whenever possible. For example, although some of their chloride waste meets Universal Treatment Standards (40 CFR 268.48) set by the Land Disposal Restrictions, OxyChem chooses to incinerate these wastestreams. Unlike some large generators in the chemicals industry, OxyChem does not have a corporate-wide policy prohibiting or otherwise restricting or prohibiting off-site disposal of hazardous waste. However, they exercise due diligence to determine which permitted Subtitle C treatment facilities are qualified to accept their wastestreams. New or additional TSDFs are added to the limited list of approved and eligible facilities, only after their corporate audit group evaluates candidates using criteria similar to those in

Subtitle C requirements (e.g., groundwater monitoring, double-liners, leachate collection systems).[33] OxyChem's audit group reevaluates approved facilities every four years.

As an example of their procedures, OxyChem indicated that a new TSDF in Texas, Waste Control Specialists, offered to manage OxyChem's filter cake waste from their mercury retorting unit for a savings of $20,000 per year. While the company recognizes it would be a prudent business decision to use this TSDF, they cannot use it until it is audited and approved by OxyChem's Corporate Environmental group.

Costs of Waste Management

OxyChem's total annual costs of managing both hazardous and nonhazardous waste range from $2.3 million to $2.9 million. Of this total, the costs of managing hazardous waste are $1.5 to $2.0 million.[34] Only one-quarter of OxyChem's wastes are sent off-site for management. Because unit costs of off-site treatment are generally higher than on-site, however, these costs account for over one-third of OxyChem's total waste management costs.

As shown in Exhibit 4-1, managing residuals from the mercury retorting unit is OxyChem's most expensive waste management activity, on both a per unit basis and in total. Due to intense competition and overcapacity in the market for commercial RCRA Subtitle C waste treatment and disposal services, OxyChem's corporate purchasing department has been able to arrange generous price concessions from various TSDF's for industrial hazardous waste they send off-site. As long as this remains the case, the financial incentives to OxyChem to use the RCRA Subtitle D system under HWIR eligibility will remain low.

Influence of MACT Standards

OxyChem will also take action to assure that their on-site combustion units comply with the upcoming MACT standards. Because OxyChem burns such large quantities of heavy ends from EDC and VCM production each year, OxyChem will definitely make a capital investment to upgrade the incinerators at the Deer Park facility to meet MACT. This retrofit will require a lump-sum capital investment of over $3 million. OxyChem estimates that the upgrade will provide a good financial return on investment to the company, because they currently face unit costs for offsite, commercial incineration of industrial waste, that are almost 50 percent higher than the costs of incinerating on-site.

Of the three permitted incinerators at OxyChem's other US facilities, one unit will be decommissioned when the MACT standards take effect. One other unit in addition to the Deer Park

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[33] For more information on these requirements for specific unit types, see "USEPA Regulations for Owners and Operators of Permitted Hazardous Waste Facilities," *40 CFR 264*, U.S. Environmental Protection Agency.

[34] These cost figures include the cost of transporting waste.

incinerator will be retrofitted to meet the USEPA's waste combustion MACT standards.[35]

Exhibit 4-1 OCCIDENTAL CHEMICAL CORPORATION (SIC 28, NAICS 325) HAZARDOUS WASTE DISPOSAL COSTS			
Waste Disposal	**Subtitle C Disposal Cost**	**Quantity of Waste Residuals[2] (tons/yr)**	**Total Subtitle C Disposal Cost (per year)**
Filter cake from mercury retorting	$275 per ton	300	$82,500
Incineration ash from VCM heavy ends[1]	$155 per ton	10	$1,550
Totals		**310 (620,000 lbs)**	**$84,050**

Notes: 1. In addition, OxyChem must pay Texas a fee of $22,500/month for generating heavy ends.
2. Quantities of waste residuals are estimated using the product of quantities of as-generated waste and typical residual factors. For incineration, we assume a residual factor of 0.25; for mercury retorting, we assume a residual factor of 1.0.

Source: Based on discussions with Sean Maconaghy, Environmental Engineer, OxyChem, September 1997.

Waste Aggregation

It is hypothetically possible that some industrial waste generators could potentially reduce the unit costs of waste treatment and disposal, by aggregating or combining their wastes, with similar wastestreams from other generators. As a corporate policy, OxyChem will not aggregate or otherwise accept wastes from other firms due to the threat of potential Superfund liabilities.[36] At Deer Park, one exception to this policy is a wastestream generated by Shell Oil during refining operations. OxyChem accepts this wastes as part of an agreement made upon acquiring Shell's facility in 1987. OxyChem considers the risks of potential Superfund liability associated with this wastestream as manageable, however, because it is not considered OxyChem's wastes until immediately prior to incineration.

POTENTIAL BENEFITS OF HWIR

OxyChem generates two large-quantity wastestreams at the Deer Park and VCM facilities that they feel may be eligible for HWIR exemptions. These wastestreams include:

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[35] OxyChem's Niagara Falls, New York facility will meet MACT standards in its current state.

[36] OxyChem was named a potentially responsible party under CERCLA due to hazardous waste sent off-site to a Marine Shale management facility in Mississippi.

- **Limestone "rockbox" sludge residue:** OxyChem has already submitted a RCRA delisting petition for this wastestream. This waste exhibits concentrations of arsenic, barium, chromium, copper, lead, tin, vanadium, zinc, and several other organic constituents, that have met RCRA waste delisting levels. Concentrations of these constituents also meet the 1995 proposed HWIR exemption levels, with the exception of zinc and vanadium, which currently exceed the 1995 proposed HWIR exemption levels by an order of magnitude.[37]

- **Filter cake from mercury retorting:** Filter cake from OxyChem's on-site mercury retorting unit equals 300 tons (600,000 pounds) per year. The concentration of mercury in this K106 filter cake exceeds the 1995 proposed HWIR exemption level for mercury.[38]

OxyChem is certain that no wastestreams generated at OxyChem's Battleground facility are likely to be eligible for exemption under HWIR -- because most wastestreams generated there result from the production of highly toxic chloralkalides. Similarly, heavy ends from EDC and VCM production are unlikely to be eligible for HWIR exemption because of high chloride content.

Direct Benefits

Management of these two wastestreams accounts for about 80 percent of OxyChem's Houston Chemical Complex annual off-site hazardous waste management costs, so HWIR exemptions on either or both wastestreams will result in direct financial benefits. Because OxyChem would continue to manage the VCM heavy ends wastestream on-site in their permitted incinerator and will definitely implement capital upgrades to the incinerator to meet the combustion MACT standards, they are unlikely to realize avoided treatment costs or avoided capital costs as a result of an HWIR exemption for this wastestream. Hence, the cost savings associated with avoiding Subtitle C disposal costs this exemption are not likely to account for more than a relatively small percentage of OxyChem's total hazardous waste management costs.

Financial benefits associated with an HWIR exemption of the filter cake from mercury retorting could be much more significant, since this is currently Houston Chemical Complex's largest hazardous solid wastestream sent off-site. The unit costs of Subtitle C disposal of filter cake from mercury retorting are higher -- $265 per ton -- than average cost of Subtitle C waste disposal (about $155 per ton). Exhibit 4-2 displays the calculation of annual cost savings associated with this wastestream

[37] Appendix A-2g contains whole waste concentrations of these constituents used to support OxyChem's RCRA waste delisting petition.

[38] The 1995 HWIR proposed exemption level for mercury in whole waste is 0.06 ppm for wastewaters, and 0.6 ppm for non-wastewaters (source: USEPA, "Hazardous Waste: Identification and Listing; Proposed Rule," *FR 66448*, December 21, 1995); ppm= parts-per-million.

Exhibit 4-2 OCCIDENTAL CHEMICAL CORPORATION (SIC 28, NAICS 325) BUSINESS FINANCIAL BENEFIT OF HWIR EXEMPTION: K106 FILTER CAKE WASTREAM	
Calculation of Potential Cost Savings:	
Quantity of filter cake from mercury retorting in baseline (tons/year): times: Difference in Subtitle C and D disposal costs (dollars/ton): equals:	300 tons $205/ton
Estimated Annual Cost Savings:	**$61,500 per year**
Note: Calculation assumes Subtitle C disposal cost of $265 per ton and Subtitle D disposal cost of $60 per ton.	

Assuming OxyChem could reduce the concentration of mercury in the K106 filter cake wastestream and achieve an HWIR exemption, they could potentially reap estimated annual cost savings of over $61,500.

IMPLEMENTATION REQUIREMENTS

Sampling and Testing for HWIR Exemptions

OxyChem feels that the requirements for analyzing exempt wastestreams are definitely the most onerous aspect of implementing HWIR exemptions. The requirement to test for all HWIR constituents, including those that are highly unlikely to occur in the waste, is expected to drive the overall costs of testing and sampling eligible wastestreams, to levels that will limit generators' participation without adding protectiveness. OxyChem feels strongly that USEPA should rely more on generators' knowledge of their own waste, and that the requirement to test for all HWIR constituents reflects USEPA's general distrust of generator's judgement.

OxyChem is not greatly concerned that random variability in analytic results for certain constituents may compromise their ability to maintain an HWIR exemption — in general, their analytical results are consistent and variability typically results only from an unusual system upset, such as inefficient destruction during incineration.

Waste Testing Costs

OxyChem estimates that the costs of performing a comprehensive scan of a wastestream for HWIR eligibility, would range from $8,500 up to $40,000 when performed by an external lab. OxyChem estimates that it could cost up to $90,000 to perform scans of their wastestreams twice a year for all HWIR constituents. Although OxyChem does not agree, in principal, with testing for all HWIR constituents, they would prefer to do a full initial scan to test for all constituents, rather than incur repeated fixed costs associated with multiple partial scans.

Due to the potential magnitude of these costs, OxyChem feels that, for most generators, annual cost savings for HWIR-exempt wastestreams must equal at least $200,000 per wastestream to justify these analytical costs. OxyChem feels it is difficult for generators to find effective methods for reducing these waste testing costs. Prices for waste analysis at contract labs are generally based on waste quantity and frequency of testing. However, contract labs typically do not offer discounts to generators based on waste quantity. Additionally, there are few economies of scale in testing even for facilities that conduct lab analysis on-site, and it is difficult for facilities to store waste in an effort to accumulate larger quantities.

Frequency of Waste Retesting

OxyChem feels that testing HWIR-exempt wastestreams once or twice per year for constituents expected to be present, would represent a reasonable burden for most generators, and would be protective of health and the environment. If more frequent testing is required, the company feels that implementing exemptions would be prohibitively expensive. Additionally, these same generators face high analytical costs. These two factors will limit the number of generators that will seek exemptions for wastestreams that require repeated testing.

Other Implementation Issues

OxyChem feels that requiring generators to notify USEPA of process changes will not add value to the Agency's or to the public's knowledge about exempt wastestreams, nor would it increase protectiveness or mitigate the threat of potential liability. Additionally, they assert that it is likely that the types of process changes implemented now or in the future are more likely to reduce toxicities or hazardous waste quantities. OxyChem doesn't feel the other implementation requirements (e.g., public notification) would require much effort or resources.

INCENTIVES FOR WASTE MINIMIZATION

OxyChem makes decisions about waste minimization projects based on the financial, environmental, and safety merits of each project. In terms of ranking projects that have environmental merits, OxyChem ranks projects that result in reductions of Toxic Release Inventory (TRI) reportables as a higher priority than comparable projects without reductions in TRI reportables. A few projects may be passed exclusively on their environmental or safety merits, but generally waste minimization projects must compete with others within the corporation for limited capital budgeting, so the business financial return on a project must be competitive.

To assess the financial attractiveness of waste minimization projects, OxyChem's local environmental management group in Houston performs a financial cost assessment and then sends it to the corporate level for evaluation. The company's financial return on investment, or payback, on successful projects at OxyChem is typically two to three years. OxyChem has stated a goal of reducing their total solid waste quantities by another 5 percent by the year 2000. Accruing further reductions in hazardous waste quantities relative to the current baseline to meet this goal will be difficult, however, because projects currently under consideration do not meet this competitive, return-on-investment hurdle.

As noted previously, HWIR could provide OxyChem with some additional incentives to minimize toxic concentrations in residuals from its mercury reduction operations. With respect to other wastestreams, HWIR incentives for waste minimization are not likely to be effective. For example, significant reductions in quantities of characteristic wastewaters (i.e., carrying a D009 code) would provide OxyChem with a large additional benefit. To reduce process wastewaters by one percent, however, requires a reduction in process water inputs of 10 million gallons. This is difficult because many of their production processes are water-intensive.

In general, OxyChem feels that the Agency's approach to setting risk-based exemption levels below which waste become exempt (i.e. as a threshold), rather than a numerical range, actually creates disincentives for generators to make the necessary up-front investments for seeking exemptions (e.g., waste minimization projects, analytical costs). This is because a generator could lose all financial benefits if their waste tests above these exemption level thresholds Additionally, OxyChem's general perception is that USEPA would pursue enforcement actions on exempt wastestreams that test above these exemption levels even once. If these actions resulted in fines or penalties, a facility could actually experience a negative return on their initial investment in seeking an exemption.

LIABILITY AND PUBLIC PERCEPTIONS

OxyChem concurs with the view expressed by the Chemical Manufacturer's Association (CMA) with respect to how USEPA defines or limits the liability of generators if HWIR exempt waste subsequently re-enters Subtitle C, i.e., tests above the risk-based exemption levels for one or two constituents. They feel that USEPA needs to account for the fact that, under the 1995 proposed HWIR rulemaking, generators do not have assurances that they will not be subject to enforcement actions for these wastestreams.

OxyChem's own existing CERCLA liabilities are extensive, and include sites at Hyde Park in New York; a Rollins unit in Louisiana (OxyChem waste mismanaged by Rollins); in Mississippi (OxyChem waste mismanaged by Marine Shale); and at Love Canal in New York. OxyChem's initial liability for Love Canal alone is over $200 million and will be higher when complete.

As a result of these extensive liabilities, OxyChem is extremely averse to incurring additional CERCLA liabilities. The company considers the downside potential of new liabilities, in terms of the public's negative perceptions and the press coverage, too high relative to potential cost savings associated with Subtitle D disposal. Their aversion is due in part to the fact that they feel OxyChem and other firms do not receive coverage or credit for being good operators in the baseline, and that they typically only receive coverage for liabilities or other negative impacts of their manufacturing activities.

OxyChem stated that they or other firms could possibly build on-site Subtitle D units at their facilities to accommodate HWIR exempt wastestreams to avoid the liability risks associated with sending waste offsite, but most generators probably face various practical barriers to this, including a lack of available space and insufficient quantities to make such an investment worthwhile

OTHER ISSUES

RCRA Waste Delisting

OxyChem has used the delisting program extensively to pursue deregulation of RCRA waste they consider to pose low risks to human health and the environment. In 1997, OxyChem invested $150,000 to $200,000 for a delisting petition for the sludge from their limestone rockbox. The petition is still pending; however, the company is confident it will be successful since they received a delisting of an almost identical rockbox stream at their Ingleside, Texas facility.

Interestingly, the company has had good experiences with USEPA's administration of RCRA waste delisting petitions in USEPA Region VI (Dallas office, consisting of the states AR, LA, NM, OK, TX), and feel this process may have actually improved recently. Region VI is currently (i.e. 1997-98) processing petitions in the required time (i.e., six months) or slightly longer. OxyChem will continue to pursue delistings for waste unlikely to meet eligibility requirements under HWIR, i.e., wastestreams that have a few constituents in excess of the 1995 proposed HWIR exemption levels.

Furthermore, thus far OxyChem's investments in delisting petitions have met their stringent criteria for financial return on investment. The company's investment in the RCRA hazardous waste delisting petition for the rockbox sludge, for example, will pay for itself within two to three years. However, OxyChem acknowledges that there is a small risk of future liability associated with successfully delisted wastestreams.

HWIR Exemption Levels

OxyChem's view of the risk-based exemption levels also concurs with that of the CMA -- they feel that many of the 1995 HWIR exemption levels are based on overly conservative risk analysis assumptions and as a result, many are unnecessarily stringent (i.e. low concentration numerical values). OxyChem cites the example of the 1995 HWIR exemption levels for vanadium and zinc -- the concentrations of these two constituents in their delisted rockbox sludge exceed the 1995 HWIR exemption levels by an order of magnitude. These exemption levels are also lower than concentrations found in naturally occurring limestone. Hence, OxyChem feels that many truly low-risk wastestreams could not become exempt if HWIR were the only mechanism for deregulatory relief.

"Mixture and Derived-from" Rules

OxyChem feels that the provisions of the "mixture and derived-from" rules should 'cut both ways' -- that is, in the event of an HWIR exemption or delisting, wastestreams considered hazardous because they are mixed with or "derived-from" an exempt or delisted waste should likewise become exempt. For example, OxyChem is currently considering a delisting of a steam stripper RCRA hazardous wastewater from the direct chlorination process, but feels that since this wastestream is downstream from the rockbox sludge, it should also become exempt if the rockbox sludge is successfully delisted.

IMPLICATIONS FOR THE 1995 HWIR ECONOMIC MODEL

The 1995 HWIR Process Waste Economic Model is likely to understate the cost savings to OxyChem associated with an exemption of their mercury retorting filter cake wastestream. This is because the actual unit costs of Subtitle C disposal for mercury retorting wastes are higher, at $265 per ton, than the national Subtitle C average unit cost of $130 per ton used in the model. This example suggests that further research about unit costs of disposal for special waste types, such as mercury-based waste, could add precision to estimates of cost savings for individual wastestreams. Even using the lower national average unit cost ($/ton), however, the 1995 economic model estimates cost savings that are significant enough that OxyChem would still be likely to pursue an exemption after netting out the costs of HWIR implementation, under the terms and conditions prescribed in the 1995 HWIR proposal.

FACILITY BACKGROUND

We visited Amoco's petroleum refinery in Whiting, Indiana in October 1997.[39] The company, headquartered in Chicago, manufactures approximately 300 products at some of the oldest and largest refineries in the country. In addition to its primary product gasoline, Amoco refines kerosene, propane, butane, diesel fuels, various oils, waxes, and lubricants. The company has over 42,000 employees among 67 domestic and international business units.[40]

While a competitive market caused the company to close several refineries in the 1980's, the Whiting facility remains active. The site spans three municipalities and is adjacent to Lake Michigan. Operations at the Whiting facility are extensive. Due to its geographical layout, the facility carries five different USEPA identification numbers. Two of the five main refinery areas, the refinery and the Lakefront facility, consistently maintain USEPA large-quantity generator status. The Lakefront facility, which is a TSDF, is the site of the refinery's wastewater treatment plant and fluid bed incinerator.

Due to overcapacity in the petroleum refining market, companies have consolidated operations in an effort to maintain their competitive edge and generate profits. Additional factors, such as high costs to keep infrastructure in compliance with environmental regulations, may further reduce the number of refineries. While the structure of the industry is split almost in half between large and small facilities, the large refineries comprise over 85 percent of the United States' total crude distillation capacity.[41]

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[39] As a manufacturer in the petroleum refining industry (SIC 2911 or NAICS 32411), Amoco also collaborated closely with the American Petroleum Institute (API) to provide extensive public comments on the 1995 HWIR proposal. This chapter summarizes our findings based on both our discussions with Amoco's waste management personnel as well as the industry's public comments.

[40] Number of employees reported in the 1997 Dun & Bradstreet report for Amoco Oil Corporation.

[41] Small refineries are defined as having the capacity to produce less than 50,000 barrels of crude oil per day.

Amoco was ranked sixth in the nation for sales in 1993, reporting sales of over $22 million. The top five firms, in order from highest sales, were Exxon, Mobil, E.I. du Pont de Nemours, Texaco, and Chevron. Other national competitors include Shell, Atlantic Richfield, and BP America.[42]

FACILITY AND WASTE PROFILE

The main production process at a refinery involves converting crude oil, which is a mixture of hydrocarbons and impurities, into various consumer products.[43] Amoco receives a steady supply of crude oil from Texas, Wyoming, and many foreign sources. The company then pumps this raw material through three production areas. During the separation phase, the crude oil is first heated and distilled by boiling point. In the second phase, the hydrocarbon molecules are split, rearranged, and/or recombined by cracking, coking, reforming, and alkyation processes.[44] In the final stage, the components are treated by various processes and blended into different products.

Two of the five Amoco facilities at the Whiting Refinery consistently generate large volumes of hazardous waste. We present a summary of 1995 hazardous waste generation data for these two sites in Exhibit 5-1. Non-wastewater residuals from wastewater treatment account for most of the waste at the Lakefront facility. After filtering out hazardous residuals, Amoco then treats the residual non-hazardous wastewaters, and discharges them to Lake Michigan under their NPDES permit.[45] The solid residuals are treated further on-site or are sent off-site for treatment and disposal.

Amoco's refinery and Lakefront operation generate both listed waste and characteristic only waste. Amoco's listed wastes predominantly carry petroleum refinery waste codes, including: K048 (dissolved air flotation sludge), K051 (API separator sludge), F037 (primary oil/water/solids separation sludge), and F038 (secondary emulsified oil/water/solids separation sludge).

[42] USEPA, Office of Enforcement and Compliance Assurance, Profile of the Petroleum Refining Industry, September 1995, pp. 6-10.

[43] Appendix A-3b provides a printout from Amoco's Web page that shows the conversion of crude oil into products.

[44] Op. cit., USEPA, p. 15.

[45] The majority of waste non-wastewaters reported by Amoco in their 1995 waste summary are non-wastewaters, many of which are residuals of wastewater treatment. Therefore, we are unable to determine as-generated quantities of wastewaters from this report.

Exhibit 5-1 AMOCO OIL CORPORATION (SIC 29, NAICS 324) Hazardous Waste Generation Data, 1995						
Whiting Refinery Site/ USEPA ID	**5 Largest Wastestreams**		**1995 Waste Quantity**	**Wastewater/ Non-wastewater[1]**	**Listed or Characteristic Waste**	**Waste Codes Present**
Refinery Wastes (IND074375585)	1	4TP Bender catalyst	236 tons	Non-wastewater	Characteristic	D008
	2	Sewer Sludge	161 tons	Non-wastewater	Listed	F037, F038
	3	Spent Carbon	135 tons	Non-wastewater	Characteristic	D018
	4	Boiler Fly Ash	64 tons	Non-wastewater	Characteristic	D006
	5	Spent Treating Clay	30 tons	Non-wastewater	Characteristic	D008
Total Waste Quantity of 5 Wastestreams			626 tons			
Total Waste Quantity at Refinery[2]			636 tons (4.3 tons are wastewaters)			
Lakefront Wastes (IND000810861)	1	Scrubber Slurry	323,910 tons	Wastewater	Listed	K048, K051
	2	DAF Sludge	49,869 tons	Non-wastewater	Listed	K048
	3	API/DAF Feed to Fluid Bed Incinerator	20,959 tons	Non-wastewater	Listed	K048, K051
	4	API Separator Sludge	2,925 tons	Non-wastewater	Listed	K051
	5	Incinerator Wet Scrubber Solids	1,657 tons	Non-wastewater	Listed	K048, K051
Total Waste Quantity of 5 Wastestreams			399,320 tons			
Total Waste Quantity at Lakefront[2]			399,917 tons (799.83 million lbs)			

Source: Amoco Oil Corporation, 1995 Annual Waste Summary.
Notes: 1. We converted wastewater quantities from gallons to tons for comparison purposes.
2. The Whiting Refinery generated twelve hazardous wastestreams in 1995. The Lakefront site generated nine hazardous wastestreams in 1995.

WASTE TREATMENT AND MANAGEMENT

Amoco manages their industrial hazardous waste both on-site and off-site. Due to the relatively large size of the Whiting Refinery production facilities, and the high demand for supporting waste treatment facilities, the company invested in on-site facilities to manage some of their waste. Because they generate large quantities of waste that vary greatly in composition, however, Amoco also sends some of their waste off-site for treatment.

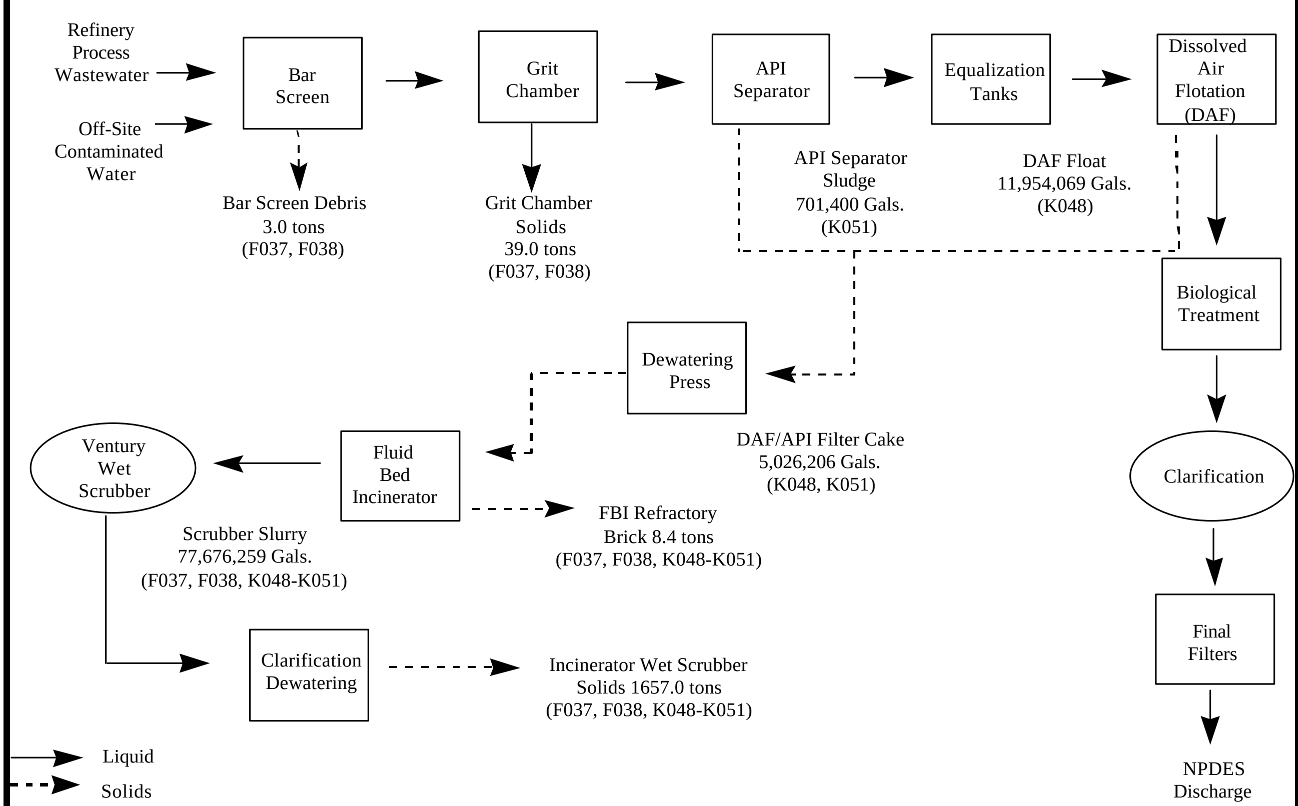
On-Site Treatment

Amoco's on-site waste management plan contains two major components. The Lakefront wastewater plant treats and discharges process wastewaters. Any residual solids are then sent to a fluid bed incinerator for further treatment.

The wastewater treatment plant process is exhibited in Figure 5-2. Amoco's treatment plant receives wastewaters from the refinery and from other Amoco facilities. First, wastewater is routed through a bar screen and centrifuge to remove large debris and solids. The wastewater is then sent to an API oil/water separator. Oil is then removed and sent back to the refinery for reprocessing. Then, the wastewater is sent to a dissolved air flotation unit to remove suspended solids and finally to biological treatment, clarification and filtering, before it is discharged to Lake Michigan under the refinery's NPDES permit. Wastewater treatment sludges removed from the bottom of the API separator and from the DAF unit are filter pressed and then sent to the fluid bed incinerator.

Exhibit 5-2

AMOCO OIL COMPANY - WHITING LAKEFRONT FACILITY
WASTEWATER TREATMENT PROCESS, 1995



Flue gas from the fluid bed incinerator is scrubbed to remove particulates using a wet scrubbing process. The resulting scrubber water is sent to a clarifier to separate solids from the wastewater. The solids are filter pressed and then sent to an off-site landfill. Clarified water is routed to the refinery's wastewater treatment plant and discharged to Lake Michigan under the refinery's NPDES permit.

Off-Site Treatment

In addition to on-site management of waste, Amoco also sends waste off-site for landfilling, recycling, and storage. Amoco also uses commercial incineration for wastes which cannot be fed directly into the on-site fluid bed incinerator because of variability in their physical properties.

Due to concerns about potential Superfund liabilities, Amoco carefully evaluates each off-site TSD through its corporate Waste Alliance Program. Through this program, the company created a list of approved facilities, all of which have been audited, to whom they are willing to send hazardous waste. The Whiting Refinery currently (1997-98) has a contract with Clean Harbors to handle most of their off-site waste management needs. The refinery chose this waste treatment company because they are large enough to handle Amoco's waste quantities and, more importantly, Clean Harbors offers indemnification for third-party CERCLA liabilities.

The Whiting Refinery does not usually accept wastes from off-site sources. The refinery is constrained by community pressure not to receive waste. In addition, the facility does not currently have the infrastructure necessary to feed outside waste into the treatment system; most of the waste generated on-site is pumped through pipes directly to the wastewater treatment plant.

POTENTIAL BENEFITS OF HWIR

Amoco considers two wastestreams potentially eligible for exemption from RCRA Subtitle C requirements — the scrubber slurry and wet scrubber solids from the fluid bed incinerator. The company is currently trying to delist both of these wastestreams. However, in case this effort is not successful, Amoco would pursue HWIR as an alternative method to relieve these wastestreams from RCRA Subtitle C requirements. While Amoco has both financial and non-financial incentives for seeking regulatory relief for these two particular wastestreams, they assert that none of the company's wastestreams would be eligible for exemptions under the 1995 proposed HWIR requirements. As a result, the financial benefit they may accrue due to HWIR depends on the selection of exemption levels.

Direct Benefits

Wet scrubber solids account for approximately 75 percent of hazardous waste sent off-site from the Lakefront facility. Amoco believes they will achieve significant cost savings by exempting this wastestream under HWIR. The company currently sends this waste to a Subtitle C landfill that charges approximately $125 per ton (or between $150 to $200 per ton including transportation costs). If the wastestream becomes exempt under HWIR, Amoco would send it to a Subtitle D landfill for special industrial waste for $35 per ton.[46] The company feels that this wastestream, which contains few metals and no organics, presents low risk to the environment and would be managed safely at a special industrial waste site in Indiana. As a conservative estimate, Amoco would save over $149,000 per year by disposing of this wastestream (1,657 tons or 3.314 million pounds) in a special Subtitle D landfill.

While cost savings of almost $150,000 per year appear significant, Amoco and API are concerned that USEPA may be overestimating benefits that generators will likely achieve through HWIR. By using optimistic assumptions, such as low implementation costs, they feel that the Agency is not addressing the realistic concern that administrative and implementation costs may outweigh any financial benefits HWIR achieves for waste generators.

Indirect Benefits

Amoco believes there are indirect benefits to realizing HWIR exemptions. For example, Amoco's incinerator scrubber water, defined as hazardous because it is "derived from" other hazardous waste fed to the incinerator, does not test characteristically hazardous and poses a low risk to human health and the environment. If Amoco could obtain an HWIR exemption of this wastestream they would have the option to recycle this water back to the treatment plant and the refinery. In addition, an exemption of the scrubber slurry, the largest wastestream at the Lakefront facility, would create additional indirect benefits. If this wastestream becomes exempt, Amoco could inform the public that a large portion of their waste is considered low risk and that they have successfully minimized hazardous waste.

INCENTIVES FOR WASTE MINIMIZATION

Due to intense competition in the petroleum refining market, Amoco considers waste minimization projects on financial as well as environmental merits. While the company implements compliance-related projects regardless of company financial cost, most other waste minimization efforts compete with other projects for limited capital funding. A successful waste minimization project at Amoco typically produces a high rate of company financial return (i.e., 25 percent).

Amoco systematically evaluates potential projects on a facility basis through a program called Amoco Common Process. Through a series of inquiries, Amoco's staff gather information about a proposed project by reviewing financial cost estimates, and interviewing customers and engineering department staff. Amoco bases decisions about projects on the results of this process. Some projects are funded because they enhance safety, others are funded because of their potential high financial value. The amount of capital available to fund projects is determined at the business unit level.

Amoco has made progress reducing the amount of waste they generate. The Whiting Refinery exceeded an Amoco goal to reduce the disposal of wastes by 50 percent by year-end 1994. This was accomplished through source control, recycling and reuse, improved operations, and the efforts of a waste minimization coordinator to promote pollution prevention throughout the refinery. Amoco is constrained

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[46] Indiana categorizes industrial nonhazardous waste as "special industrial waste."

from further minimizing waste through source control because the quantity and type of crude oil required in the refining process is relatively fixed. In spite of having little flexibility to modify production processes, the company maintains a goal of reducing generation of waste from these processes.

IMPLEMENTATION REQUIREMENTS

Amoco and the petroleum industry feel that USEPA should modify HWIR implementation requirements to make them less burdensome to generators and to align them more realistically with the low-risk nature of exempt waste. In order to accomplish this goal, Amoco recommends making HWIR self-implementing and allowing generators to use their extensive knowledge of wastestreams. The company believes that self-regulation of HWIR would be most efficient if USEPA and generators were able to reach a balance between characterizing the low-risk status of exempt waste and maintaining flexibility.

Sampling and Testing for HWIR Exemptions

Testing Costs

Amoco suggests that USEPA allow generators to use their process knowledge to determine HWIR eligibility. They oppose testing for constituents that a generator reasonably expects are not present in a wastestream because they feel it creates additional costs without providing commensurate value. For example, the Agency developed for the 1995 HWIR proposal, a list of 150 constituents of concern that are regularly present in petroleum refining waste. Amoco estimates that sampling and analyzing even this relatively small subset of HWIR constituents would cost at least $5,400 per wastestream using a contract laboratory.

Frequency of Testing

Due to the high cost of waste testing and analysis, Amoco believes that requirements to re-test exempt should be limited to every three to five years. Amoco believes that the 1995 implementation requirements are very resource intensive, and that virtually no oil industry wastes would be eligible to exit Subtitle C requirements under HWIR. In addition, the company believes that the frequency of testing should not be directly connected to the quantity of the wastestream, since wastestream quantity is often not correlated with the hazardous properties of the waste.

Other Implementation Issues

In general, Amoco also believes HWIR can be improved if its requirements are designed to be less burdensome to generators. According to Amoco, the 1995 HWIR proposal does not comply with the Office of Management and Budget guidelines for streamlining regulations, as set forth in the

Paperwork Reduction Act.[47] Amoco also believes generators should only be required to notify the Agency of process changes that result in new constituents or that substantively change the concentration of hazardous constituents already present in the wastestream. In order to maintain the competitive advantage of generators, Amoco feels that the Agency should also respect Confidential Business Information (CBI) requests.

Furthermore, Amoco believes that generators should have the opportunity to respond to any efforts by the Agency to void an HWIR exemption because of paperwork errors. Amoco asserts that committing a paperwork error does not change a low risk waste into a hazardous waste. However, generators may be deterred from seeking HWIR exemptions if committing such errors results in voided exemptions.

HWIR EXEMPTION LEVELS

Amoco also feels that the 1995 proposed HWIR exemption levels do not realistically reflect the level of risk posed by waste. They believe that the exemption levels proposed in 1995 are too stringent for most constituents; they also feel they are not realistic because, in some cases the 1995 HWIR exemption levels are lower than detection limits, or are below levels that result from application of current treatment technologies. In addition, Amoco supports waste testing and sampling methods that measure constituent concentrations based on a rolling average of measurements taken over the course of a year. Amoco feels this procedure will ensure that a representative sample is selected, since hazardous constituents are not always evenly distributed throughout a wastestream. The company also believes that wastestreams with "outlier" constituents should require additional testing only when generator knowledge cannot explain their occurrence.

OTHER ISSUES

Other USEPA rules also affect Amoco's decision regarding how to manage their low risk wastes. These rules include RCRA hazardous waste “delisting”, the RCRA “mixture and derived-from" rules, and the waste combustion MACT standards.

RCRA Waste Delisting

Amoco is currently seeking RCRA delistings for two industrial wastestreams. Alternatively, as mentioned previously, Amoco may instead pursue exemptions for these wastestreams under HWIR. The company's delisting effort has been very lengthy and resource-intensive. Amoco submitted their delisting

[47] The Paperwork Reduction Act of 1995 (44 U.S.C. 3501 et seq.) is available via the Internet websites: http://www.nara.gov/fedreg/legal/ and http://www.rdc.noaa.gov/~pra/pralaw.htm. Section 3501 of the PRA contains 11 purposes to the Act, of which the first listed is to “minimize the paperwork burden for individuals, small businesses, educational and nonprofit institutions, Federal contractors, State, local and tribal governments, and other persons resulting from the collection of information by or for the Federal Government”.

petition approximately five years ago. Due to USEPA regional office resource constraints, USEPA did not respond to the petition until last year. While Amoco feels that delisting regulations are not as involved as HWIR requirements, the process has also been very expensive. Amoco estimates that it has spent at least $300,000 for labor, consulting, and testing costs related to the delisting effort. Because these represent sunk costs, the company will complete their efforts to exempt these wastestreams under this program. However, because of the obstacles Amoco has encountered in seeking these delistings, they state that in the future, they will not pursue delistings for hazardous waste.

"Mixture and Derived-from" Rule

Amoco feels that the RCRA "mixture and derived-from" rules are too broad to accurately reflect the true risks potentially posed by industrial waste. The company argues that instead of defining waste as hazardous under the RCRA definition (i.e., waste that presents substantial risk to human health or the environment), these rules categorize waste based solely on its history, rather than of the current composition or constituent concentrations of the waste.

Influence of MACT Standards

Amoco also believes they will be greatly affected by the anticipated combustion MACT standards. The company's fluid bed incinerator is an integral component of their waste management system. Currently, Amoco burns only refinery wastewater treatment sludges in this incinerator. Under the anticipated MACT combustion standards, the fluid bed incinerator would require retrofitting. However, the upgrades required for the company to remain in compliance are prohibitively expensive. In addition, there is no physical space for the necessary equipment. As a result, Amoco anticipates they would stop using this incinerator. Because their incinerator treats mainly water-based wastes with little energy recovery value, they will instead send the waste to an off-site incinerator at a higher cost. The company does not prefer sending waste off-site because they feel the risk associated with shipping hazardous waste is high. In addition, concerns about Superfund liability have made Amoco much more concerned about allowing wastes to leave their direct control. As a result, Amoco predicts they will spend more resources ensuring that off-site treatment facilities manage waste responsibly

IMPLICATIONS FOR THE 1995 HWIR ECONOMIC MODEL

The 1995 HWIR economic model is likely to generate a relatively accurate estimate of the direct financial cost savings impacts of the 1995 proposed HWIR on the Amoco Company. Amoco generates two wastestreams that may become exempt after treatment. Amoco, which is somewhat unique among the sample of facilities included in this case study -- in that they use Subtitle D units frequently -- would then potentially realize disposal cost savings on the management of these two streams. The 1995 HWIR model may understate cost savings realized by Amoco to some degree, because the national Subtitle C average cost of $130 per ton, is somewhat lower than the actual Subtitle C costs that Amoco incurs.

Based on our interviews, it appears that Amoco's decision about whether to seek an HWIR exemption will be sensitive to the implementation costs of the rule. As such, it would be useful to develop more precise methods for estimating implementation costs for individual wastestreams. For example, if the economic model could generate a cost of implementation that accounts for the actual sampling and testing Amoco would perform on their HWIR-eligible waste, this would provide better information to evaluate whether Amoco is likely to break-even by pursuing an HWIR exemption. Most facilities with borderline wastestreams like Amoco may not pursue exemptions unless they at least financially break even.

FACILITY BACKGROUND

Texas Instruments is among the top five manufacturers of semiconductors in the United States, along with Motorola, Intel, National Semiconductor, and Advanced Micro Devices. Semiconductors make up only a small portion of total sales within the electronics industry, but they are a crucial component used in many products manufactured by the industry, which has grown faster than any other major industry sector over the past 20 years.[48, 49]

Headquartered in Dallas, Texas Instruments is a global semiconductor company employing approximately 36,000 people worldwide. Texas Instruments is a leading designer and supplier of digital signal processing solutions (DSPs), the semiconductor devices that are key components used in digitized electronics. Texas Instrument's businesses also include materials and controls, educational and productivity solutions, and digital imaging. The Texas Instruments Sherman facility, located near Dallas, manufactures integrated circuits on silicon wafers. These circuits, known as "chips," are used in a variety of electronic and consumer products such as computers, telecommunications, and video equipment.

The Texas Instruments Sherman site was originally constructed in 1965 on approximately 600 acres of land. Recently, Texas Instruments has divested certain business activities at the Sherman site to Raytheon Systems Company, MEMC Southwest, and Air Liquide; these companies continue to operate in space leased from Texas Instruments. During our visit to the Sherman plant in September 1997, we met with Ken Zimmerman, who is an Environmental Protection Engineer. Mr. Zimmerman works in Texas Instruments' Site Facilities Group, and is responsible for all environmental compliance activities at the Sherman site.

Texas Instruments and these other firms currently (1997-98) conduct multiple production

[48] $17.4 billion worth of electronics products were consumed in the US in 1990.

[49] USEPA, Office of Enforcement and Compliance Assurance, Profile of the Electronics and Computer Industry, September 1995, pp. 9-11.

operations at the Sherman plant. Texas Instruments' primary manufacturing activity at the site is the production of integrated circuits on silicon wafers.[50] ALChem operates a small inorganic chemical manufacturing process. Raytheon Systems Company, formerly Texas Instruments's Defense System and Electronics division, performs metal finishing and fabrication.

FACILITY AND WASTE PROFILE

The production processes used by electronics companies to manufacture semiconductors are highly sophisticated.[51] Unlike other industries with fairly mature products, production processes in high-tech companies change frequently, typically once every few months, based on the unique chip specifications of their customers. Each stage of these manufacturing processes generally creates a variety of hazardous and non-hazardous wastes.

The Sherman facilities generated over 3,000 tons (6 million pounds) of industrial waste in 1997. Most of this waste is found in small-quantity, characteristic-only wastestreams which will not be affected by HWIR.[52] Exhibit 6-1 displays detailed annual waste generation data for 1997.

- The largest quantities of waste generated were characteristic-only, hazardous wastewaters, accounting for 86 percent of the total quantity of waste generated.
- Nonwastewaters account for 94 percent of all wastestreams. The average size of these wastestreams, however, is extremely low, 16 tons (32,000 pounds), compared to the average wastewater stream of 1,380 tons (2.76 million pounds).
- The most prevalent waste types are characteristic waste carrying waste codes D001, D002, and D007 (chromium). Each of the remaining waste types (9 characteristic codes and 6

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[50] In the interest of sharing investment and increasing manufacturing costs, Texas Instruments and MEMC Electronic Materials formed a joint venture, MEMC Southwest, which manufactures polished and epitaxial silicon wafers.

[51] Steps involved in creating a "chip" include: 1) designing an electrical circuit; 2) producing silicon wafers from polysilicon crystals; 3) fabricating integrated circuits using (a) oxidation, chemical vapor deposition, and/or ion implantation to provide protective coatings and/or specific electrical properties; (b) etching electrical circuitry on the wafer surface via photolithography, (c) cleaning to remove impurities and particles which would cause electrical failures; 4) typically repeating step 3 several times, building layers of circuitry; 5) cutting completed wafers into "chips"; 6) and finally, attaching wire leads to chips and encapsulating them to become a completed "semiconductor device." (Based on correspondence with Ken Zimmerman, Texas Instruments, September 1997.)

[52] The majority of these wastestreams, including the chromium sludges, are generated by metal fabrication operations that are now owned by Raytheon. Hence, this waste is no longer reported by Texas Instruments.

listed codes) account for two or fewer wastestream.

C Two wastestreams account for 85 percent of hazardous non-wastewater quantities. One wastestream is a characteristic-only bulk spent solvent mixture weighing 136 tons (272,000 pounds). The second wastestream is a listed and characteristic chromium sludge filter cake weighing 48 tons (96,000 pounds).

C One wastestream accounts for 85 percent of the hazardous wastewater quantities. This wastestream, resulting from metal fabrication operations, is a characteristic-only chrome-bearing waste of 2,358 tons (4.716 million pounds).

Exhibit 6-1
TEXAS INSTRUMENTS, INCORPORATED
Waste Generation Data, 1997

Number of Wastestreams							
Listed Only	**Listed and Characteristic**	**Characteristic Only**	**Total**	**Physical Form[1]**	**Waste Type**	**Annual Waste Quantity (tons)**	**Average Quantity per Waste (tons)**
2	3	9	14	Nonwastewater	Hazardous	216	15
0	0	2	2	Wastewater	Hazardous	2,759	1,380
N/A	N/A	N/A	15	Nonwastewater	Non-hazardous	234	16
Total Wastestreams			31		**Total Waste Quantity**	3,209	

Source: Texas Instruments, Inc., 1997 Annual Waste Summary, January 28, 1997.
Notes: 1. We characterized waste as wastewaters or nonwastewaters based on the assumption that all wastestreams reported in tons in the Annual Waste Summary are wastewaters. We converted the nonwastewaters from pounds to tons for comparison purposes.

Characteristic-only wastewaters dominate the hazardous waste category because the multi-phase production process of semiconductor manufacture uses very large quantities of water to clean and rinse the wafers. After these process rinsewaters come in contact with hazardous chemicals used during the oxidation and photolithography stages of production, they are defined as hazardous from mixing with these chemicals. This production process is common to most semiconductor manufacturers; as a result, most chip manufacturers generate similar types of wastewaters that are regulated as hazardous mainly because of the presence of hazardous characteristics.[53]

[53] Characteristic RCRA waste exhibits at least one of the following four properties: toxicity, ignitability, corrosivity, or reactivity. Characteristic waste can be treated to remove the hazardous

WASTE TREATMENT AND MANAGEMENT

The companies at the Sherman plant have used a variety of methods over the past fifteen years to treat and manage their waste. They currently rely on on-site wastewater treatment, off-site commercial incineration, and fuel blending to treat the majority of hazardous waste or to recover energy. In the late 1980's, however, Texas Instruments seriously considered on-site incineration.

In the previous decade, Texas Instruments applied for and received a RCRA permit to build an incinerator in Sherman that would accept waste from all Texas Instruments facilities in the U.S. However, due to successful waste minimization efforts and closure of other company facilities, Texas Instruments significantly reduced the amount of waste expected to be incinerated. As a result, the company determined that it would not be cost-effective to build and maintain an incinerator. At a lower quantity of waste generation, Texas Instruments determined the new incinerator would only be cost-effective after a ten year pay-back period. As a result, they voluntarily gave up their permit for the incinerator.

Currently, each of the companies at the Sherman facility is officially responsible for treatment and disposal of their own waste. Despite the close proximity and similar nature of some waste, both wastewaters and non-wastewaters are managed separately by Raytheon, MEMC, and Texas Instruments.

Wastewater Treatment

Texas Instruments generates nearly all of its hazardous waste in the form of wastewaters. Wastewaters from Raytheon, MEMC, and Texas Instruments are managed on-site in a wastewater treatment facility that is connected to the municipal treatment system. The three firms buy water for their manufacturing processes from the City of Sherman. Industrial waste from the three companies undergoes a neutralization process before it is mixed with sanitary waste and discharged to the City of Sherman. The flow meter in the treatment plant gauges how much water is returned to the City of Sherman to be discharged under Texas Instruments publicly-owned treatment works (POTW) discharge permit. Texas Instruments and MEMC use large quantities of water to rinse and clean the microchips during production, which helps to preserve the quality and purity of the wafers. In total, the water treatment plant discharges approximately 2.5 million to 3.0 million gallons per day. Of this, Texas Instruments generates 700,000 to 1 million gallons per day and MEMC produces between 1.5 and 2 million gallons per day. Raytheon discharges a much smaller quantity, about 50,000 gallons per day, to the City of Sherman.

One of Texas Instruments' concerns related to wastewater treatment is the definition used in the proposed rule of the point of generation. Company waste management personnel remain unclear on the use of this term in the proposed regulation. Texas Instruments feels that the "point of generation" should begin after waste has left temporary or satellite storage areas. Stricter interpretation of the regulation would, for example, require Texas Instruments to sample and test individual contaminated rags rather than allowing them to accumulate a group of rags for testing.[54]

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characteristic and may then be managed as nonhazardous, whereas listed wastes cannot change their hazardous status despite undergoing hazardous treatment.

[54] Texas Instruments, Inc. Public Comment WHWP-00187.001, April 19, 1996.

Non-Wastewater Treatment

Each firm operating at the Sherman site manages their non-wastewaters separately. Texas Instruments sends its largest non-wastewater wastestream, the bulk solvent, directly to an off-site TSDF for energy recovery. Texas Instruments has also used other commercial incinerators in Texas and Oklahoma. The company has considered sending the bulk solvent to a fuel blender to achieve some energy recovery; however, they feel it is less expensive to continue incinerating the waste.

Currently, Raytheon treats the non-wastewater chromium sludge wastestream to remove the chromium component. They neutralize the wastestream with sulfuric acid, which converts the chromium into a precipitable form, then filter it through a press into a solid filter cake and send it off-site for to a landfill. This wastestream contains less than one percent chromium, which is too low for cost-effective recycling.

POTENTIAL BENEFITS OF HWIR

The Sherman facilities consider two non-wastewater wastestreams as possible candidates for HWIR exemptions. These are the bulk solvent wastestream, which is sent off-site to an incinerator, and the chromium sludge filter cake. Texas Instruments' management feels that the small quantities typical of semiconductor waste may be a limiting factor that will affect whether they, and other semiconductor manufacturers, pursue exemptions under HWIR. The two wastestreams under consideration for possible HWIR exemption are relatively small when compared to those generated by industries that are also considering exemptions under HWIR. Because the quantity of these wastestreams is not very large, totaling only 185 tons (370,000 pounds), Texas Instruments expects few direct financial benefits if they dispose of waste in state-regulated Subtitle D instead of more stringently regulated Subtitle C units. The financial impact of changing management units will be small because disposal costs for these two types of units differ only slightly in Texas.

INCENTIVES FOR WASTE MINIMIZATION

Texas Instruments has made significant investments in pollution prevention initiatives at the Sherman plant. The company's philosophy is that in addition to reducing waste costs, pollution prevention projects usually need to be accompanied by reductions in chemical costs or other benefits in order to be justified, since these projects typically provide a lower rate of return than other investments. As a general guideline, Texas Instruments usually funds only those capital investments that provide a financial return to the company within 12 to 15 months.

Texas Instruments' approach to tracking waste management costs in their company cost accounting system, may pose barriers to meeting this internal company-wide hurdle for return on financial investments. The cost of certain hazardous waste inputs, such as solvents, are charged directly to the manufacturing cost center that requires their use. However, some one-time waste management costs, such as construction projects, are charged to the Site Facilities Group, and are then allocated to the different sites through a line item for facility overhead. Hence, these one-time costs are allocated or linked less directly to the activity and manufacturing center responsible for generating the waste. As a result, some waste minimization projects may appear less financially attractive, than if Texas Instruments calculated its financial rate-of-return, based on direct activity-based cost accounting.

In spite of this potential barrier to new projects, waste minimization projects which the company has implemented in the past, have proven successful. The Sherman facility is voluntarily participating in the Clean Texas 2000 Program. Under this program, Texas Instruments has set a goal of reducing their RCRA hazardous waste generation by 50 percent by the year 2000, from a baseline year of 1987. By 1996, the Sherman entities already achieved a reduction in quantities of hazardous waste of 60 percent, even though wafer production has remained at high quantities.

Waste reduction is a priority for each of the firms operating at the Sherman site. Raytheon is constructing a new wastewater treatment plant for treating chrome-bearing wastewaters. The lump-sum capital investment cost for this project, including permitting, is estimated between $600,000 and $800,000. The treatment process employed at the plant will implement a change from the current continuous system to a batch process, in which solids will settle to the bottom of the waste tank and will then be filtered out. This process will reduce the quantity of sludge generated by one-third to one-quarter and will increase the concentration of recyclable materials by two to four times, making the sludge more attractive to recyclers.

The other firms at the Sherman site also have made investments to recycle or otherwise reduce the amount of waste they generate. Texas Instruments is in the process of installing a phosphate removal system that required an investment of approximately $50,000. In addition, the company plans on using treated wastewater in the cooling towers and exhaust scrubbers. Texas Instruments anticipates making a capital investment of $250,000 to $300,000 for collection basins and for transporting water to the cooling towers.

Each of these investments in new treatment methods will result in the reduction of wastewater generated and used in the treatment process. Raytheon will use 10,000 to 15,000 gallons per day instead of the 50,000 gallons they currently use daily. Texas Instruments hopes to reuse 500,000 gallons of after-treatment wastewater that has been neutralized and does not contain phosphate. This will amount to approximately $600,000 in annual savings associated with avoided water intake from the City of Sherman and reduced wastewater discharge costs.

IMPLEMENTATION REQUIREMENTS

Texas Instruments finds the HWIR implementation requirements to be somewhat confusing and potentially resource intensive. The company believes some of the 1995 proposed HWIR waste testing and sampling requirements are overly burdensome and expensive, while some of the 1995 proposed HWIR exemption levels are restrictive and cannot be measured given current detection limits. Through public comments and our discussions with waste management staff, Texas Instruments has proposed recommendations to address their concerns and simplify the rulemaking.

Sampling and Testing for HWIR Exemptions

HWIR requires generators to test eligible wastestreams multiple times each year. Texas Instruments is concerned that the cost of testing HWIR-eligible wastestreams at a frequency of four times per year, may offset any financial benefit the company achieves. In order to comply with HWIR's waste sampling and testing requirements, Texas Instruments would incur the cost of sending their waste to an off-site contract laboratory. The Sherman facility does not perform enough analytical testing of waste to justify investing in an on-site laboratory.

Testing Costs

In Texas Instruments' experience, using a contract laboratory raises two issues -- variability in lab results and cost. Texas Instruments has noted that for the same types of waste, different laboratories report results that vary greatly. As a result, the company has contracted all of their sampling analyses with one laboratory. Texas Instruments faces analytical costs ranging from a few hundred dollars (i.e., testing for the presence of certain metals) to over $5,000 per wastestream (i.e., testing to characterize new wastestreams), depending on the type of waste and the number of wastestreams being analyzed. A typical laboratory report for one wastestream including scanning for solvents, similar to the sampling required by HWIR, costs between $1,200 and $1,500. For the two wastestreams potentially eligible for HWIR exemption at the Sherman facility, sampling and testing costs could run over $10,000 annually.

In order to lessen the direct financial and administrative burden on generators who remain in compliance with HWIR, Texas Instruments recommends that USEPA require testing for exempt wastestreams only once per year, or every two years, to ensure they remain eligible. The company feels that testing should be reduced further for eligible wastestreams that have not undergone process changes, or if process changes do not affect classification of the waste.

Notification Requirements

Texas Instruments recommends that HWIR's notification requirements be simplified. In particular, their suggestions are aimed at avoiding duplication of effort, making the retention time of documentation more realistic, and maintaining positive public relations.

They feel that the requirement to submit a complete exemption package to USEPA, as well as to maintain a full set of the documentation on-site, is unnecessary. Texas Instruments feels that substituting a certificate of submittal to the Agency would avoid this duplication of effort. In addition, a three-year retention limit for HWIR documentation is unrealistic, since most generators retain waste data for much longer periods of time. Because of litigation concerns, most generators keep documentation of their wastes indefinitely.

Finally, Texas Instruments does not endorse the requirement to notify the public through a newspaper ad of their intention to pursue an HWIR exemption. Such notification, the company feels, excessively emphasizes the generation of low risk waste and may cause negative public reaction. Information about Texas Instruments' waste is public information and is reported annually in the Texas Natural Resource Conservation Commission's annual waste summary.

HWIR EXEMPTION LEVELS

In addition to sampling and testing requirements, Texas Instruments also suggests revisions to HWIR's threshold-type exemption levels. The company supports averaging test results over time to account for normal wastestream variations, when the results are compared to the exemption levels. Another method that Texas Instruments endorses to account for realistic variations in waste is to allow test results for HWIR eligibility purposes to fall within an 80 percent confidence interval of the exemption level. Finally, Texas Instruments feels that the 1995 proposed exemption levels are too conservative. The company recommends that exemption levels should be detectable and measurable.

OTHER ISSUES

HWIR may be the most promising avenue for Texas Instruments to gain regulatory relief for their low-risk wastes in the future. In the 1980's, Texas Instruments also pursued the delisting process as a way to exempt these wastes from RCRA Subtitle C requirements. The company delisted a chromium sludge wastestream at another Texas Instrument site, but due to high waste testing and sampling costs, they allowed the delisting exemption to lapse. Texas Instruments feels that both the delisting process and HWIR implementation are characterized by cumbersome documentation requirements and high waste constituent testing costs.

IMPLICATIONS FOR THE HWIR ECONOMIC MODEL

Texas Instruments, similar to many semiconductor manufacturers, generates mostly small-quantity wastestreams that are generally not large enough to realize significant net cost savings under HWIR. Hence, the company's cost savings under HWIR will be limited to avoided treatment and disposal costs associated only with wastestreams for which they seek exemptions. Because Texas Instruments is a straight forward case, the 1995 HWIR economic model accurately calculates potential financial impacts (i.e. direct cost savings) for this facility.

In addition to the five facility site visits, we conducted telephone interviews with environmental management staff at an additional hazardous waste generator in the chemical industry. The facility, owned by PPG Industries, did not feel that HWIR would affect them significantly but provided many comments on certain aspects of the rulemaking.

PPG INDUSTRIES — LAKE CHARLES, LOUISIANA

Facility Profile

PPG Industries is a major producer of commodity chemicals located in Lake Charles, Louisiana. We interviewed Mr. Gerald Perry, PPG's Environmental Engineer and the primary staff person at PPG responsible for following the HWIR rulemaking and for assessing the potential impacts of the proposed rule on PPG's Lake Charles facility.[55] PPG estimates that unless exemption levels in the 1995 proposed rule change substantially, no wastestreams generated at the Lake Charles facility are likely to be eligible for exemption. PPG generates only four hazardous wastestreams that HWIR could *possibly* affect. According to the 1995 BRS database, almost 65 percent of the facility's wastestreams are hazardous, the majority of which are non-wastewaters and solvents. The facility generated over 619,000 tons (1.238 billion pounds) of industrial waste in 1995.

Incentives for Waste Minimization

For PPG, the direct financial incentives for investing in waste minimization projects that would reduce waste toxicities and possibly create additional wastestream exemptions under HWIR, are especially weak right now -- the difference between Subtitle C and Subtitle D treatment and disposal costs is simply not significant enough. PPG states that the commercial industrial waste incineration market in the southern US is quite depressed (as of 1997), and as mentioned above, the Lake Charles facility faces low waste transportation costs. If the unit costs of commercial waste incineration were an

[55] PPG's Lake Charles facility produces only chlorine derivatives.

order of magnitude higher, additional waste minimization or pollution prevention projects might make financial sense for PPG.

PPG has, however, implemented waste minimization projects in response to regulation. For example, in response to the Third Thirds LDR rule on mercury, PPG invested in mercury recovery units that reduced quantities of mercury-bearing wastes from their facilities by 80 percent. This project required a one-time capital investment of about $7 million. PPG is still evaluating other waste minimization opportunities. These opportunities are focused more on a goal of reducing to zero the quantity of wastes carrying potentially recoverable materials, e.g., wastes that may be used as feedstocks, than on creating new HWIR exemptions by reducing toxicities. Again, PPG emphasizes that potential cost savings attributable to additional HWIR exemptions are not large enough to warrant assuming even marginal additional risk.

Generally, PPG does their capital budgeting or break-even analysis of waste minimization projects on a per facility basis. However, operations between PPG's facilities that produce chlorine-based products are so closely integrated that it can be difficult to separate out the cost of waste minimization projects by individual facility.

Liability and Implementation Issues

PPG is a relatively conservative firm that actively manages risk, especially with respect to potential environmental liabilities. Despite the fact that a few wastestreams at the Lake Charles facility may be close to qualifying for HWIR exemptions, "...PPG already has enough Superfund sites," and thus is not willing to send any wastestreams that may exhibit significant variability in constituent concentrations to Subtitle D facilities for treatment or disposal.[56] They have concerns about the potential liability associated with HWIR exempt waste. For example, the ash residuals from PPG's mercury recovery units which are tested once a year for mercury, could potentially meet the 1995 proposed HWIR exemption level for mercury in non-wastewaters of 0.6 ppm. If the actual concentration of mercury in the exempt waste subsequently tested at 1.0 ppm, PPG feels they would be fully liable for any adverse impacts resulting from disposal of these wastes in a Subtitle D unit. PPG feels that testing wastestreams just once a year would not provide sufficient protectiveness.

For PPG's Lake Charles facility, the costs of transporting hazardous waste to the nearest Subtitle C facility are currently quite low; thus they estimate that the potential cost savings attributable to avoiding Subtitle C disposal costs under HWIR, are too insignificant to justify taking on the additional risks associated with Subtitle D disposal of exempt wastes.[57]

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[56] Mr. Perry noted that PPG's single largest liability is a Superfund liability associated with a chrome waste site in northern New Jersey. The magnitude of PPG's liability for this site is in "...the tens of millions of dollars...."

[57] PPG has developed a close partnership with a landfill company located within one half-hour of the Lake Charles facility.

Other Issues

Influence of MACT Standards

PPG has three to four on-site industrial waste incinerators that may be affected by the combustion MACT standards.[58] These incinerators use 20-year old technology and may not meet the more stringent MACT standards; installing scrubbers may be the best alternative for these incinerators.

[58] PPG also has the only incinerator permitted under the Toxic Substances Control Act in Louisiana.

According to the generators we interviewed, HWIR is a potentially powerful tool for creating a more rational and efficient system of hazardous waste regulation. However, these generators feel that HWIR, as proposed in 11995, has many limitations that will inhibit its effectiveness as a deregulatory tool, and they provided many suggestions for improving the rule. This chapter provides a summary of these suggestions, as well as other "lessons learned" from generators' experiences with HWIR and the RCRA program.

It is important to note that the group of facilities that participated in the industry case studies are not representative of the universe of hazardous waste generators. On average, they are much larger, in terms of both firm size and quantities of waste generated, than the vast majority of generators. Additionally, they have spent considerable time and resources researching the rulemaking, understanding its potential impacts on their facility, and providing commentary to industry associations. Thus, they have formulated in-depth understandings and strongly held views about many aspects of the rule. The extent to which their views are representative of other generators is uncertain; however, their concerns strike a number of common themes and appear equally applicable to both small and large generators. We present these themes below as outstanding questions or issues, and also present generator attitudes about these issues.

1. Do generators face substantial barriers to demonstrating achievement of the 1995 proposed HWIR exemption levels?

- A key concern expressed by many interviewees is that the waste eligibility sampling and testing requirements, in conjunction with the 1995 proposed threshold-type HWIR exemption levels, are not designed to account for variability in wastestreams, constituents, sample matrices, and testing methods. As a result, generators feel that only wastestreams that consistently measure well below HWIR exemption levels could be assured of maintaining an exempt status, and would avoid potential liability from testing at constituent levels regulated under RCRA Subtitle C at a later point in time.

- Based on this concern, generators interviewed advocate that USEPA provide them with more flexibility in terms of sampling and testing. They provided the following as example of approaches that may give them more flexibility while maintaining protectiveness:

— Using measurements of constituent concentrations that are based on a rolling average or a confidence interval to certify exemptions.

— Using engineering knowledge about what constituents are likely to be present in their wastestreams to reduce the amount of testing required, rather than testing for the full list of constituents.

- Large-quantity generators seem somewhat less concerned with the overall frequency of waste sampling and testing required, compared to smaller facilities and facilities that primarily generate small-quantity wastestreams. For one large facility in particular, the upside direct financial benefit of realizing one or more HWIR exemptions, may be significant enough such that seeking an HWIR exemption is a good financial investment, regardless of HWIR waste testing costs.

2. Despite these barriers, will generators find financial benefits to support their decision to seek HWIR exemptions for wastestreams that qualify?

- The primary anticipated impact from HWIR once it is finalized, is in the form of financial benefits to industry, from avoiding RCRA Subtitle C industrial waste treatment and disposal costs. By realizing HWIR exemptions on certain wastes, however, a small subset of generators may also avoid requirements to upgrade existing and future on-site Subtitle C treatment units. In particular, extensive capital upgrades may be necessary for some facilities with on-site incinerators to meet USEPA's anticipated combustion MACT standards. If HWIR allows even a few facilities to avoid this type of capital upgrade, cost savings attributable to this may be large.

- Although HWIR is deregulatory, gaining an HWIR exemption can be a costly investment. Expenditures for sampling and testing of waste, especially for large or complex wastestreams, could be significant and thereby reduce cost savings associated with HWIR wastestream exemptions. For many generators, if the cost savings associated with exemptions do not meet certain thresholds for financial return on investment, they will not pursue them.

- An interesting related point is that the cost accounting systems used by firms, are not always designed to provide information about the true direct costs of waste management. For these firms, the direct costs of waste management or environmental management activities are often lumped into corporate or facility overhead. As a result, projects that would create reductions in waste management costs to a company, appear less financially attractive, because they are not credited with some of these costs savings. A few of the firms interviewed are just beginning to explore refinements to these systems to account for environmental management activities.

3. ***Even if it's financially attractive to seek an HWIR exemption, are there other concerns that might influence the likelihood that generators will pursue exemptions?***

- Due to concerns about potential future Superfund liabilities, some firms — particularly those that generate significant quantities of hazardous waste or especially toxic waste — state that they would not treat or dispose of HWIR exempt waste in the Subtitle D non-hazardous waste system. These generators assert that they will continue to use Subtitle C units for waste treatment and disposal indefinitely. In addition, a number of generators mentioned that the price of Subtitle C incineration in their regional market is currently so low, such that the opportunity cost of using this marginally more expensive option is not significant, relative to the risks associated with using Subtitle D disposal for waste previously defined as hazardous.

- Because of liability and other concerns, there is a trend among very large generators, particularly in the Chemicals and Allied Products industry, towards maximizing the quantity of waste managed on-site. These firms generally exhibit a very strong preference for managing waste on-site, and perform extensive due diligence and auditing of any off-site TSDFs and contract laboratories that receive their wastes. This trend suggests that the upper-bound of treatment and disposal cost savings associated with HWIR exemptions may be lower than initially anticipated because on-site costs are typically lower than the off-site prices used in the HWIR economic model.

- Most large generators interviewed consider the ability to claim a reduction in their rate of hazardous waste generation as a result of an HWIR exemption, to be a significant and tangible, albeit non-financial, benefit.

4. ***Does HWIR substantially increase incentives for pursuing additional waste minimization projects (i.e., toxicity reductions)?***

- In the last decade, many generators have implemented the most cost-effective waste minimization projects at their facilities. Achieving further reductions in waste toxicities or quantities, even for individual constituents, is often very difficult. Facilities have limited flexibility due to a myriad of constraints such as physical limits on production processes, customer needs, other federal and state environmental regulations, and public perceptions.

- In general, generators feel that the relatively high costs of implementing exemptions make many HWIR waste minimization projects less attractive than initially anticipated. As a result of strict capital budgeting thresholds, generators may choose to not pursue HWIR exemptions if the net financial benefit is less than that of other investment opportunities within the corporation.

5. ***How does the delisting program affect generators' decisions about pursuing exemptions under HWIR?***

- Generator attitudes about the efficacy and value of seeking a delisting for low-risk wastestreams vary significantly based on their own experiences with USEPA regional offices during the RCRA hazardous waste delisting process. There is a general sentiment that USEPA has pulled back on resources devoted to processing delisting petitions. Nonetheless, some generators stated that they will seek delistings for their wastestreams if the final HWIR rule does not provide relief for the wastestream they consider to pose low risks to human health and the environment.

6. What do our findings imply about USEPA's 1995 approach to the HWIR rule?

- A small-quantity generator interviewed feels that the 1995 proposed HWIR rule is too complex, and in particular, that the implementation requirements are difficult to understand and to apply. Unlike many larger generators that are Fortune 500 firms, they have few resources to devote to monitoring the status of the HWIR rulemaking. At these types of firms, one staff person or engineer is often responsible for all other environmental management issues in addition to solid waste issues. Smaller generators such as the one interviewed sometimes seek information regarding important USEPA rulemakings informally from other, larger facilities, industry associations, or other industry contacts.

- In addition, many generators interviewed consider the public notification requirement for implementation to be of little value, and feel that it may indeed cause undue concern among the public, which typically reacts strongly to issues dealing with hazardous waste.

- Finally, there is general sentiment among small generators that HWIR in its 1995 proposed form is primarily designed to benefit large facilities that generate large wastestreams.

7. What do our findings imply about the assumptions and decision rules used in the 1995 HWIR Process Waste Economic Model, developed for estimating economic impacts?

- The assumptions and decisions used in the 1995 HWIR economic model will generate reasonably accurate estimates of economic impacts for most generators seeking HWIR exemptions. For large generators and wastestreams that will account for a large proportion of cost savings nationally, however, the 1995 model probably can be improved. In particular, the model could first be refined to account for specific facilities that may avoid significant capital investments to upgrade on-site treatment units as a result of HWIR. While there may be only a few such facilities nationwide, they may account for large cost savings. Second, the model could incorporate an assumption to address generators' concerns regarding potential future liabilities associated with exempt wastestreams. A reasonable approach to modeling this trend may be to assume that some proportion of generators continue to manage exempt wastestreams in the RCRA Subtitle C system, to avoid perceived waste management liabilities.