# HAZARDOUS WASTE CHARACTERISTICS
# SCOPING STUDY

**U.S. Environmental Protection Agency**
**Office of Solid Waste**

**November 15, 1996**

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# HAZARDOUS WASTE CHARACTERISTICS
# SCOPING STUDY:
# EXECUTIVE SUMMARY

# EXECUTIVE SUMMARY

The U.S. Environmental Protection Agency (EPA), Office of Solid Waste has investigated potential gaps in the current hazardous waste characteristics promulgated under the federal Resource Conservation and Recovery Act (RCRA). This report, the Hazardous Waste Characteristics Scoping Study, presents the findings of that investigation.

## THE SCOPING STUDY: AN EARLY STEP

This study is a first step for the Agency in fulfilling a long-standing goal to review the adequacy and appropriateness of the hazardous characteristics. The study also fulfills an obligation in a consent decree with the Environmental Defense Fund (EDF).

The study is by design a scoping study and, therefore, does not conclusively identify particular chemical classes for regulation, or fundamental flaws in the overall regulatory framework requiring immediate regulatory action. However, the study does identify several key areas that merit further analysis due to the significant potential for improving hazardous waste management practices and protection to health and the environment. Thus, the scoping study provides a catalogue of potential gaps in the hazardous waste characteristics.

The Agency considers that this study is one very critical component of a broader array of efforts underway to review and improve the RCRA program, to ensure that regulation is appropriate to the degree of risk posed by hazardous wastes and waste management practices. Efforts involve both regulatory and de-regulatory actions, as appropriate for specific wastes and waste management practices.

## STUDY PROCESS AND FINDINGS

### Review of Current Characteristics

The review of the current characteristic regulations evaluated the protectiveness of the characteristics against the risks they were intended to address and also risks they were not specifically intended to address. For example, EPA evaluated risks that are now addressed by the Toxicity Characteristic (TC), e.g., direct ingestion of groundwater, by considering new groundwater modeling techniques that have been in use since the promulgation of the current TC levels, as well as any changes to the toxicity values on which the original levels were based. In addition, EPA evaluated risks from other exposure pathways and to ecological receptors, which are both risks not intended to be protected by the original TC.

**The review of the current TC regulatory levels suggests that: (1) further analysis of the current TC regulatory levels should be conducted using new groundwater modeling techniques, as well as considering changes to toxicity values for specific constituents; and (2) non-groundwater pathways and ecological receptors--not currently addressed by TC provisions--may be of potential concern.** The study included some screening analyses of potential air releases from surface impoundments and land application units.  The Agency found that inhalation risk levels for a significant number of current TC constituents at the fenceline (under certain exposure conditions) exceeded the allowable risk levels upon which the TC is based.

**Waste piles and land application units may be of special concern for ecological receptors due to surface runoff.** Thirteen TC constituents have regulatory levels that are 10,000 or more times higher than Ambient Water Quality Criteria concentrations, with four of these being at least 100,000 times higher, suggesting that the level of protectiveness of the TC may not be very high for ecological receptors.

**The study also identifies the need to examine a broader array of leaching procedures, in addition to the Toxicity Characteristic Leaching Procedure (TCLP), to better predict environmental releases from various waste types and waste management conditions.** Notable examples are the inability of the TCLP to predict significant releases under highly alkaline conditions or to media other than groundwater, or to serve as a leaching procedure for oily wastes.

**The most obvious potential gap identified for the ignitability and reactivity characteristics is the reference to outdated DOT regulations.** Other potential gaps identified for these characteristics include the exclusion of combustible liquids and lack of specific test methods for non-liquids for ignitability; exclusion of corrosive solids, not addressing corrosion of non-steel materials and solubilization of non-metals, and whether pH limits are adequately releases were found from facilities in 15 (2-digit) Standard Industry Classification (SIC) industries. The top four categories were: SIC 49: Electric, Gas, and Sanitary Services (refuse-side only); SIC 26: Paper & Allied Products; SIC 28: Chemical & Allied Products; and, SIC 20: Food & Kindred Products.

**Over 90 percent of the releases were from landfills or surface impoundments and nearly all (98 percent) involved groundwater contamination.** This is most likely because groundwater monitoring is the most common method for detecting releases from waste management units.

**Many of the chemical constituents most commonly detected above a regulatory level are already addressed in the current TC, even though the release occurred from non-hazardous waste management.** The 20 constituents most commonly detected above a regulatory level are inorganics. The constituents that exceeded state groundwater protection standards or health-based federal drinking water standards most frequently were lead, chromium, cadmium, benzene, arsenic and nitrates. All of these, with the exception of nitrates, are current TC constituents. Organic constituents, both TC and non-TC, were also identified in the case studies, however, they were detected less frequently than the inorganic toxicity characteristic constituents.

**This collection of release descriptions is not statistically representative of problem industries nor intended to identify particular problem facilities.** The Agency believes that the case studies are indicative of the type of releases associated with the management of non-hazardous wastes in the types of facilities identified. The Agency also believes that information on releases from past waste management practices is useful in demonstrating the potential for human health or environmental damage.

### Non-TC Chemical Constituents

**In reviewing chemicals and chemical classes not currently regulated by the TC, EPA found in excess of 100 constituents that potentially occur in waste and may pose significant risks.** EPA reviewed 37 regulatory or advisory lists of chemicals to identify possible constituents of non-hazardous wastes. EPA also compiled a list of chemicals which are “known” to be constituents of non-hazardous wastes because they were identified in the environmental release case studies or other Agency data sources on non-hazardous industrial wastes. EPA screened these chemicals and narrowed the list to possible constituents of non-hazardous waste that, by virtue of their toxicity, fate and transport properties, or exposure potential, could pose significant risks to human health and/or the environment.

**These chemicals were both inorganics and organics, and include volatiles, non-volatile organics, PAHs and pesticides.** Because of the large number of constituents identified as candidates and the limited time available for the scoping study, no risk analyses were conducted. However, it may be a reasonable next step to assess the potential risks for a subset of these constituents.

### Natural Resource Damages/Large-Scale Environmental Problems

**The Agency examined the potential for broad environmental impacts from non-hazardous waste management.** These impacts may include damages to natural resources which diminish the value and usability of a resource without threatening human health, as well as possible contributions to regional and global environmental problems.

**With respect to groundwater contamination, over 80 percent of the facilities identified in the case studies discussed earlier had releases exceeding secondary drinking water standards (non-health based standards).** These releases were identified because exceedence of secondary standards may reduce the useability and, therefore, the value of the groundwater. Iron, chloride, sulfate and manganese were among the most frequently detected constituents exceeding secondary standards.

In reviewing air deposition of toxic constituents to great waters, the Agency found a number of TC constituents, as well as some other chemicals identified in the study. However, it was not possible to assess the importance of waste to air deposition of toxics to the great waters.

### State-Only Hazardous Waste Regulations

**Some states have adopted hazardous waste identification rules that are broader or more stringent than federal RCRA Subtitle C regulations. These expansions reflect state judgements about gaps in the federal program.** Data on hazardous waste regulations from eight states, California, Michigan, New Hampshire, Oregon, Rhode Island, Texas, Washington, and New Jersey were considered. Several states regulate additional constituents beyond the TC list ( 25 for California, 9 for Michigan, and 1 for Washington). California also applies a more aggressive leaching test, the waste extraction test (WET) to wastes. California also has a test for combinations of hazardous constituents, in which a combined concentration of the listed constituents cannot exceed 0.001 percent as a total in the waste. Four states also apply acute toxicity values (LD50 or LC50) for human or ecological toxicity to the whole waste.

## NEXT STEPS

The potential gaps and areas of health and environmental concern identified here will require further, more detailed examination before regulatory action can be undertaken. For example, the study highlights risks to ecological receptors and possible inhalation risks to humans as potential gaps, as well as further evaluation of the adequacy of the TCLP. These topics were found to be potential gaps in more than one area of the study and will likely be specific areas of further investigation.

Following release of this report, the Agency will engage in a variety of outreach activities in identifying apng apn apng apn apri cond0087i-0.0092 ddit,jiil3 and will likely beexample, the stu3e

## Agreement for Hazardous Waste Characteristics Scoping Study

The Administrator shall perform a study of potential gaps in the coverage of the existing hazardous waste characteristics. The purpose of the study is to investigate if there are gaps in coverage, and the nature and extent of the gaps identified. The potential gaps in coverage to be addressed in the study [shall] incorporate both waste management practices and possible impacts to human health and the environment. With respect to waste management practices, the study shall, at a minimum, address releases from non-hazardous waste surface impoundments; waste piles; land treatment units; landfills; and various forms of use constituting disposal such as road application, dust suppression or use in a product applied to the land. Human health and environmental impacts to be addressed by the study shall include, but not be limited to: (a) impacts via non-groundwater exposure pathways, both direct and indirect, to human and ecological receptors; (b) impacts via the groundwater pathway to ecological receptors; (c) the potential for formation of non-aqueous phase liquids in groundwater; and (d) impacts via the groundwater pathway to human receptors caused by releases of toxic constituents not included in the current toxicity characteristic, such as EPA-classified carcinogens, priority pollutants identified in the Clean Water Act, and solvents used for purposes other than degreasing. The Administrator shall complete the study by November 15, 1996, and shall provide the plaintiff with two copies of the study immediately upon completion.

Environmental Defense Fund, Inc. v. Browner

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This report focuses on wastes that are not currently regulated as hazardous (by virtue of being listed or exhibiting a characteristic). Industrial wastes are classified either as "hazardous waste" and managed under Subtitle C of the Resource Conservation and Recovery Act (RCRA) or as "non-hazardous waste" and managed under

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[1] 45 *Federal Register* 33084, May 19, 1980.

[2] 58 *Federal Register* 46049, August 31, 1993.

[3] 55 *Federal Register* 26987, June 29, 1990.

[4] 58 *Federal Register* 46049, August 31, 1993.

research were presented in a draft report entitled "Hazardous Waste Characteristics Scoping Study: Environmental Release Descriptions" (September 24, 1996). EPA held a public meeting on October 10, 1996 to explain and obtain comments on the draft report. EPA has considered and, where appropriate, incorporated these comments in preparing this Scoping Study. Chapter 2 summarizes these investigations and Appendix A presents the individual environmental release descriptions.

### Step 2: Categorize Risks Associated with Non-Hazardous Industrial Waste Management

This step identifies categories of risks to human health and the environment that may result from non-hazardous industrial waste management. The underlying premise of this step is that a gap in the hazardous waste characteristics is any significant risk to human health or the environment associated with non-hazardous industrial waste management that could be, but is not, addressed by the current characteristics. Thus, this assessment deals with both:

- Hazards that the current hazardous waste characteristics were intended to address, namely physical hazards such as fire and explosion and toxic groundwater contamination near waste management facilities; and

- Hazards that the characteristics were not intended to address, such as non-groundwater pathway exposures to toxins, damages to ecological receptors, and natural resource damages.

EPA identified risks by types of receptors, types of toxic effects and physical hazards, exposure pathways, and time and spatial scales, as described in Section 3.1. The search for potential risks used broad definitions of risk and adverse effects and addressed all aspects of non-hazardous industrial waste management, without any prejudgment as to the likelihood that a risk was significant, whether it could be best addressed by the characteristics, or whether it was already addressed by other regulations. The results of this risk classification step were used in identifying and evaluating potential gaps, as described below.

### Step 3: Review the Existing Characteristics

The identification of potential gaps continues with a review of the existing definitions of the characteristics. This step is next for two reasons. First, limitations in the characteristics' effectiveness in reducing the risks they were intended to address may constitute imns 008tut,mvf toxi0.96 3.6075 0.96 c 2.8875 0.96 2.2737

**Insert Exhibit 1-1 Scoping Study Approach**

constituents as being among the most important waste management risks. Reducing these risks remains an important goal of the characteristics. Second, this analysis lays the groundwork for evaluating other potential gaps.

Step 3 begins by examining the definitions and test methods of the ignitability, corrosivity, and reactivity (ICR) characteristics, which are essentially unchanged since they were promulgated in 1980. EPA reviewed the assumptions and approaches used to develop these characteristics and compared the characteristics to approaches taken to controlling similar hazards under other federal and state regulatory schemes. Step 3 also examines the definition of the toxicity characteristic (TC), which was designed to protect against human health risks from exposure to hazardous waste constituents released to groundwater. EPA reviewed new information on the toxicity, fate, and transport of the TC constituents and improvements in groundwater modeling since the TC was revised in 1990. The Agency also examined the potential risks from TC constituents through inhalation, surface water, and indirect pathways and to ecological receptors. Chapter 3 describes these analyses.

### Step 4: Identify Gaps Associated with Non-TC Chemicals

Potential gaps in the hazardous characteristics from non-TC chemicals are identified by, first, identifying two groups of constituents:

- **"Known" non-hazardous industrial waste constituents:** constituents "known" to be present in non-hazardous industrial wastes, based on the data gathered in the environmental release descriptions in Step 2, EPA's 1987 Telephone Screening Survey of non-hazardous industrial waste management facilities, EPA effluent guideline development documents, and recent hazardous waste listing determinations.

- **"Possible" non-hazardous industrial waste constituents:** constituents on various regulatory or advisory lists, which were screened for their toxicity, fate, and transport properties and for a proxy of their occurrence in non-hazardous industrial waste, using available environmental release data from the 1994 Toxics Release Inventory.

Then, these two lists of constituents are evaluated and compared and chemicals are classified by physical properties, chemical composition, use, and origin. Finally, potential gaps were identified by applying multiple hazard-based screening criteria to specific chemicals and chemical classes. Chapter 4 describes these analyses.

### Step 5: Identify Potential Gaps Associated with Certain Natural Resource Damages and Large-Scale Environmental Problems

As discussed above, steps 3 and 4 respectively examine potential gaps inherent in the current hazardous waste characteristics and associated with adverse human health or localized ecological effects from constituents not addressed by the toxicity characteristic. Step 5 addresses a third set of risks associated with non-hazardous industrial waste management: damages to natural resources that may not have direct human health or ecological effects, and large-scale environmental problems. The specific risks addressed are:

- Pollution of groundwater by constituents that diminish the value and usability of the resource without threatening human health;

- Air pollution through odors that harm the quality of life but may not have severe health effects; and

- Large-scale environmental problems, including air deposition to the Great Waters, damages from endocrine disruptors and airborne particulates, global climate change, red tides, stratospheric ozone depletion, tropospheric ozone and photochemical air pollution and water pollution.

Chapter 5 presents these analyses.

**Step 6: Review State Expansions of TC and State Listings**

Several states have expanded their hazardous waste management programs to regulate as hazardous certain wastes or waste constituents that are not hazardous under the federal program. Step 6 examines how states have expanded their toxicity characteristics and have listed as hazardous certain wastes that are not listed under the federal program. (Step 3 examines how states have regulated additional wastes by expanding their ICR characteristics.) These expansions beyond the federal hazardous waste identification rules reflect state judgments about gaps in the federal hazardous waste program and thereby constitute potential gaps that may merit further investigation. Chapter 6 presents this analysis. (Chapter 7 summarizes the potential gaps identified in Chapters 3 through 6.)

**Step 7: Evaluate the Industries and Waste Management Practices Associated with Potential Gaps**

The evaluation of potential gaps asks two basic questions: (1) What do the qualitative and quantitative indicators of risk show about the potential gaps? and (2) To what extent are the risks associated with the potential gaps addressed by other regulations? Steps 7, 8, and 9 address these questions. Step 7 addresses aspects of the first question. Specifically, it assesses the following:

- The amount of non-hazardous industrial wastes generated by various industries;

- The frequency with which various chemicals were detected or reported in releases from various industries;

- The management methods associated with the major non-hazardous industrial waste generators; and

- The management practices associated with documented environmental releases of non-hazardous industrial wastes.

Because of data limitations, EPA could not evaluate all potential gaps against all of these criteria. Instead, this step focuses principally on the potential gaps identified in Steps 3 and 4. Chapter 8 presents this analysis.

**Step 8: Assess Regulatory Programs' Coverage of Potential Gaps**

The second major issue in evaluating potential gaps is the extent to which the risks are controlled by existing regulatory or other environmental programs. As noted above, risk-related gaps were identified solely in terms of their relationship to non-hazardous industrial waste management, and not with regard to whether they might be controlled under regulatory or other programs. Chapter 9 discusses how major federal and state regulatory programs may address some of the risks represented by the potential gaps. To the extent that they are already addressed or could be addressed more effectively by programs other than the hazardous waste regulations, the potential gaps may not merit further attention by the RCRA Subtitle C program.

**Step 9: Present Integrated Evaluation of Nature and Extent of Potential Gaps**

In the final step of the methodology, which is presented in Chapter 10, EPA integrates and summarizes all of the lines of evidence relating to particular potential gaps in the hazardous waste characteristics. The summary is presented in the form of several tables. This section also reviews the major data gaps and uncertainties of the analysis.

## 1.4 Report Outline

This Scoping Study is organized in the same order as the methodology outlined above.

| | |
|---|---|
| Chapter 2 | characterizes releases from non-hazardous industrial waste management; |
| Chapter 3 | categorizes risks associated with potential gaps in the characteristics and reviews the existing characteristics to identify potential gaps; |
| Chapter 4 | identifies potential gaps associated with non-TC chemicals; |
| Chapter 5 | identifies potential gaps associated with certain natural resource damages and large-scale environmental problems; |
| Chapter 6 | identifies potential gaps in the characteristics by reviewing how selected states have expanded the TC and listed wastes that are not listed as hazardous under the federal program; |
| Chapter 7 | summarizes the potential gaps identified in Chapters 3man.Cough 6 |

# CHAPTER 2. RELEASES FROM NON-HAZARDOUS INDUSTRIAL WASTE MANAGEMENT UNITS

This chapter presents the methodology and results of the Agency's efforts to identify contamination resulting from the management of non-hazardous industrial wastes. The Agency prepared a draft report entitled "Hazardous Waste Characteristics Scoping Study: Environmental Release Descriptions" which was released for public comment on September 25, 1996 (see 61 *Federal Register* 50295). This chapter summarizes the revised report, incorporating relevant comments on the draft report.

This chapter is composed of three sections:

- Section 2.1 discusses the criteria, information sources, and methodology used to select releases to include in the report;
- Section 2.2 summarizes the release descriptions and presents findings of the study; and
- Section 2.3 presents the major limitations of the study.

The environmental release descriptions described in this chapter are presented in Appendix A of this Scoping Study.

## 2.1 Methodology

Based on 1985 data, 7.6 billion tons of non-hazardous industrial waste are generated and managed on-site not from a waste management unit (e.g., was a product spill); or (3) was from a combination of non-hazardous industrial waste unit(s) and municipal, special, or hazardous waste unit(s).

c. The source of contamination was industrial wastewater discharges that are point source discharges regulated under Section 402 of the Clean Water Act, as amended.

d. The management method employed would be illegal in most states today. (Facilities were included if management practices would be legal today, even if no longer employed at a particular facility.)

2. **Evidence of Damage.** For purposes of the study, "damage" is considered to be a release exceeding one of the levels described below. All exceedences were examined for purposes of this scoping study. Exceedences may not actually represent significant risks. To be included in the Study, a release from a waste management unit must have caused contamination at levels of potential concern for that contaminated medium. Levels of potential concern used for this criterion were often based on federal or state drinking water standards for groundwater contamination and exceedences of background concentrations for soil contamination. Federal drinking water

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[1] SMCLs are based on aesthetic considerations (e.g., taste and odor) and are not federally enforceable.

### Public Involvement

In the limited time available for preparing this Scoping Study, the Agency implemented a number of measures to involve the public in this aspect of the data collection effort.wApu6 2 0 i86w (the data coll 2-3) Tj 98

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[2] "Issue Paper: Potential Damage Cases From On-Site Disposal of Non-Hazardous Industrial Waste," August 1995.

[3] "Damage Cases: On-Site Disposal of Non-Hazardous Industrial Waste," September 1995.

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[4] California Code of Regulations, Title 23, Section 13273.

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[5] Environmental Law Institute, "An Analysis of State Superfund Programs: 50-State Study, 1993 Update," prepared for U.S.

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Conditionally exempt small quantity

- There was documented evidence of groundwater contamination, surface water contamination, or ecological damage at the site. "Contamination" was defined as an increase in chemical constituent concentrations above background or an exceedence of an applicable regulatory standard or criterion attributable to releases from the site.

In preparing the May 1995 report, the Agency searched for C&D landfills meeting these criteria using four information sources: existing studies of C&D landfills, materials available through the federal Superfund program, representatives of EPA Regions, and representatives of state and county environmental agencies.

The Agency identified 11 environmental releases in the May 1995 report. Although one of the Agency's criteria, as listed above, was to eliminate C&D landfills that received significant quantities of municipal or hazardous wastes, 5 of the 11 landfills received municipal, special, or hazardous wastes. Therefore, for purposes of this report, the Agency eliminated these five C&D landfill cases. Eliminating the landfills that managed even small quantities of municipal, special, or hazardous waste, ensures that the reported damages were caused by the non-hazardous industrial wastes, thereby meeting the Agency's selection criteria for the source of the release.

### 2.1.3 Release Profile Preparation

The release profiles presented in Appendix A to the Scoping Study were prepared using a standard format. This format is discussed below. Because the release profiles were prepared under significant time constraints using readily available data, detailed descriptions of the facility, wastes, and waste management practices could not be developed. The data often provided only a brief description of the facility and focused primarily on the

## 2.2 Results

This section discusses the findings of the review of release data. It begins by summarizing the 112 documented release descriptions using the following five categories:

- Number of cases by state;
- Number of cases by industry;
- Number of cases by type of waste management method;
- Type of media affected; and
- Type and level of contaminants.

Later chapters of this report also present these and additional release description data.

### 2.2.1 Number of Cases By State

The 112 releases described in this chapter were found in 12 states. Because this report is a Scoping

[redacted]

[redacted]

[redacted]

[redacted]

**Exhibit 2-2 (continued)**
**Number of Management Units & Volume of Waste Managed On-Site, by State (1985)**

| Rank by Number of Units | State | Number of Management Units in 1985[a] | 1985 Volume Waste Managed (Million tons/yr.)[a] | Number of Release Descriptions |
|---|---|---|---|---|
| 12 | Virginia | 800 | 150 | 6 |
| 13 | Michigan | 785 | 210 | 4 |
| 14 | New York | 740 | 30 | 8 |
| 15 | Florida | 740 | 310 | 7 |
| 21 | Tennessee | 510 | 245 | 9 |
| 41 | New Mexico | 140 | 10 | 7 |

[a] Source: "Telephone Screening Survey," U.S. Environmental Protection Agency, 1987.

of on-site management units and the volume of waste managed on-site in states. (See Chapter 8 for further discussion of waste generation by industry.)

### 2.2.2 Number of Cases By Industry

The releases documented in this report were from facilities in 15 2-digit Standard Industry Classification (SIC) codes. (Industry data are presented at the two-digit level because more specific classification were not readily available for many facilities.) Over 31 percent of the cases involve Electric, Gas, and Sanitary Services facilities (SIC 49). All of these facilities are in the refuse system sector (SIC 4953). The top four SIC codes are SIC 49: Electric, Gas, and Sanitary Services, SIC 26: Paper & Allied Products, SIC 28: Chemical & Allied Products, and SIC 20: Food & Kindred Products. These four industry groups represent nearly 75 percent of the releases studied or evaluated in this report. Exhibit 2-3 identifies the number of cases by industry.

**Exhibit 2-3**
**Number of Case Studies by Industry (SIC)**

| | |
|---|---|
| Electric, Gas, & Sanitary Services (49) | 35 (31%) |
| Paper & Allied Products (26) | 27 (24%) |
| Chemical & Allied Products (28) | 11 (10%) |
| Food & Kindred Products (20) | 10 (9%) |
| Primary Metal Industries (33) | 6 (5%) |
| Nonmetallic Minerals, Except Fuels (14) | 4 (4%) |
| Petroleum & Coal Products (29) | 4 (4%) |
| Fabricated Metal Products (34) | 3 (3%) |
| Transportation Equipment (37) | 3 (3%) |

**Exhibit 2-3 (continued)**
**Number of Case Studies by Industry (SIC)**

| | |
|---|---|
| Agricultural Production - Livestock (02) | 2 (2%) |
| Electronic & Other Electric Equipment (36) | 2 (2%) |
| Stone, Clay, & Glass Products (32) | 2 (2%) |
| Apparel & Other Textile Products (23) | 1 (1%) |
| Instruments & Related Products (38) | 1 (1%) |
| Industrial Machinery & Equipment (35) | 1 (1%) |

These findings are generally consistent with the Agency's previous finding that four industries, Paper and Allied Products (SIC 26), Chemicals and Allied Products (SIC 28), Petroleum Refining & Related Industries (SIC 29), and Primary Metal Industries (SIC 33), generated more than 68 percent of the 7.6 billion tons of Industrial D waste managed on-site in 1985.[7] Although these case studies were identified based on available data and other selection criteria, the number of cases identified per industry and the volume of waste generated per industry appear to be positively correlated.

### 2.2.3 Number of Cases By Type of Waste Management Unit

Four major types of land-based treatment and storage units were identified in the case studies: landfills, surface impoundments, land application units, and waste piles. Exhibit 2-4 presents the number of case studies by waste management unit. Several cases studies discuss more than one unit, therefore, the total number of units is higher than the total number of case studies. Approximately 93 percent of the case studies involved landfills and/or surface impoundments. This finding may partly reflect the greater regulatory attention these units receive from the states, rather than necessarily imply that these units have more frequent releases than other types of waste management units. Over 90 percent of the landfills and 80 percent of the surface impoundments included in the case studies are unlined and over 70 percent of the units are no longer being used to manage non-hazardous industrial wastes.

All 50 states have developed regulations for surface impoundments. Approximately 90, 46, and 18 percent of the states have developed regulations specifically for landfills, land application units, and waste piles, respectively.[8] The large number of surface impoundments identified in this report is consistent with a finding of EPA's 1987 Telephone Screening Survey that slightly more than half of the facilities that generate and manage on-site non-hazardous industrial waste managed their wastes in

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[7] U.S. Environmental Protection Agency, Office of Solid Waste, "Non-Hazardous Waste Management: Priority Industries," draft, July 1993.

[8] U.S. Environmental Protection Agency, Office of Solid Waste, "State Requirements for Non-Hazardous Industrial Waste Management Facilities, September 1995.

| | |
|---|---|
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| | |
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[9] "State Regulation of Waste Piles, EI Digest Industrial and Hazardous Waste Management," April 1996, pages 16 to 21.

[10] "Nonhazardous Industrial Surface Impoundments: State Regulations and the Environmental Marketplace," Environmental Information, Ltd., 1996, pages 3 to 7.

"State Requirements

### 2.2.5 Types of Contaminants Released

The number of and types of contaminants routinely analyzed for in groundwater and other types of samples varies among states and facilities. Although most facilities included in the case studies were monitored for a wide range of constituents, the 20 constituents most commonly detected to exceed regulatory levels were inorganics. Approximately 50 constituents were detected three or more times, and 70 constituents were detected fewer than three times. Exhibit 2-5 identifies all of the TC constituents that were detected in the case studies, Exhibit 2-6 presents all of the constituents with SMCLs that were identified in the case studies, and Exhibit 2-7 identifies the other constituents that were detected in at least three case studies. The exhibits also identify the number of cases where each constituent was detected, the number of times the constituent was detected above at least one regulatory level, the regulatory levels, the average maximum and the highest maximum detected concentration identified in the case studies, and the range of the ratio of the highest detected constituent concentrations to regulatory standards. Note, only constituents with regulatory standards are included in Exhibits 2-5, 2-6, and 2-7.

Many inorganic constituents were elevated in groundwater monitoring wells. Constituents that exceeded state groundwater protection standards or federal drinking water standards most frequently were:

- Iron (49 detections)
- Chloride (32 detections)
- Manganese (34 detections)
- Sulfate (29 detections)
- Lead (22 detections)
- Chromium (21 detections)
- Cadmium (17 detections)
- Benzene (16 detections)
- Arsenic (15 detections)
- Zinc (13 detections)
- Aluminum (12 detections)
- Nitrate (12 detections)

Six of the constituents identified above (iron, chloride, manganese, sulfate, zinc, and aluminum) have drinking water standards that are based only on SMCLs.

A total of 25 TC constituents have been detected in the release descriptions. Exhibit 2-5 identifies 20 of the 25 TC constituents detected. Five TC constituents (2,4,6-trichlorophenol, 2,4-dinitrotoluene, o-cresol, p-cresol, and methyl ethyl ketone) were not included in Exhibit 2-5 because there were no federal or state standards established for them. All but 2 of the 20 TC constituents identified in Exhibit 2-5 (carbon tetrachloride, 1,4-dichlorobenzene) were detected above a federal or state standard. The majority (85 percent) of the TC constituents detected above a federal or state standard exceeded the standards by at least 1 time, 60 percent exceeded by 10 times, 50 percent exceeded by 100 times, 20 percent exceeded by 1,000 times, 10 percent exceeded by 10,000 times, and none exceeded by at least 100,000 times. The average maximum detected concentrations for five of the TC constituents (arsenic, benzene, selenium, vinyl chloride, and lindane) exceeded the TC

[redacted]

## Exhibit 2-6
## Contaminants with SMCLs Detected in Case Studies

| Constituent/ Property | Case Studies With Detected Constituents | Case Studies with Detected ConcentrationsAbove Federal/State Standards | Range of Federal/State Standards (mg/l) | Average Maximum Detected Concentration (mg/l) | Highest Maximum Detected Concentration (mg/l) | Ratio of the Highest Detected Concentration to Federal/State Standards |
|---|---|---|---|---|---|---|
| pH | 66 | 24 | 6.5 - 8.5 (unitless) | 5.4 (unitless) | 12.4 (unitless) | 1.5 - 1.9 |
| Iron | 54 | 49 | 0.15 - 0.3 | 244 | 4,400 | 14,667 - 29,333 |
| Chloride | 52 | 32 | 125 - 250 | 1,825 | 37,200 | 149 - 297 |
| Sulfate | 50 | 29 | 125 - 500 | 2,273 | 26,000 | 52 - 208 |
| Total dissolved solids | 48 | 30 | 500 - 1,000 | 7,033 | 98,164 | 98 - 196 |
| Manganese | 39 | 34 | 0.0025 - 0.3 | 10 | 97 | 323 - 3,880 |
| Zinc | 33 | 13 | 0.05 - 5 | 20 | 262 | 52 - 5,240 |
| Copper | 17 | 2 | 0.13 - 1.3 | 0.15 | 0.9 | 0.7 - 7 |
| Aluminum | 12 | 12 | 0.05 - 0.2 | 235 | 1,933 | 9,665 - 38,660 |
| Fluorides | 12 | 4 | 0.44 - 4 | 12 | 98 | 25 - 223 |

## Exhibit 2-7

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regulatory levels established for these constituents and the highest maximum detected concentrations for over half of the identified TC constituents exceed TC regulatory levels.

All SMCLs or similar state standards, except those for foaming agents, color, odor, and corrosivity, were violated by one or more release descriptions. As shown in Exhibit 2-6, the majority (90 percent) of the SMCL constituents exceeded the standards by at least 1 time, 80 percent exceeded by 10 times, 40 percent exceeded by 100 times, 20 percent exceeded by 1,000 times, 10 percent exceeded by 10,000 times, and none exceeded by at least 100,000 times. (Because silver has both a TC level and an SMCL, it is included in Exhibit 2-5 with the other TC constituents.) SMCLs are based on aesthetic considerations (e.g., taste and odor) and are not federally enforceable. Therefore, exceedences of the SMCLs do not necessarily indicate a potential danger to human health or the environment. Sixteen of the case studies (14 percent) were identified based only on an exceedence of an SMCL. This type of contamination is discussed further in Chapter 5.

Exhibit 2-7 identifies 24 other constituents that were detected in the release descriptions. All but four of the constituents in Exhibit 2-7 (1,1-dichloroethane, nitrogen, vanadium, and cobalt) were detected above a federal or state regulatory level. Half (50 percent) of these other constituents exceeded one of the standards by at least 10 times, 13 percent exceeded by 100 times, 4 percent exceeded by 1,000 times, and none exceeded by at least 10,000 times.

Constituents managed in landfills were detected in samples nearly three times more frequently than constituents managed in surface impoundments. All of the constituents presented in Exhibits 2-5, 2-6, and 2-7 are associated with wastes managed in landfills. Approximately 81 percent of the constituents are associated with both landfills and surface impoundments, 33 percent are associated with landfills, surface impoundments, and land application units, 33 percent are associated with landfills, surface impoundments, and waste piles, and 12 percent are associated with all 4 waste management units. The constituents that are associated only with landfills are antimony, beryllium, boron, cobalt, cyanides, silver, and thallium.

Exhibit 2-8 identifies the 10 constituents for each of the 6 industries that were identified most frequently in the case studies. As the exhibit incorporated comments into the report, as appropriate.  Due to the time constraints of the consent decree, the Agency had to carefully prioritize its efforts and, in doing so,

## Exhibit 2-8
## Most Common Constituents By Industry

| Industrial Classification Code (SIC) | Constituent | Number of Case Studies in Which the Constituent Was Detected |
|---|---|---|
| Refuse Systems (495) | pH* | 19 |
| | Iron* | 14 |
| | Manganese* | 13 |
| | Sulfate* | 13 |
| | Lead | 12 |
| | Chloride* | 11 |
| | Magnesium | 10 |
| | Nitrate | 10 |
| | Total dissolved solids* | 10 |
| | Trichloroethylene | 10 |
| Paper & Allied Products (26) | pH* | 22 |
| | Chloride* | 21 |
| | Iron* | 21 |
| | Sulfate* | 20 |
| | Sodium | 15 |
| | Calcium carbonate | 12 |
| | Calcium | 11 |
| | Magnesium | 11 |
| | Zinc | 11 |
| | Total dissolved solids* | 10 |
| Chemical & Allied Products (28) | Benzene | 7 |
| | Chromium | 7 |
| | Iron* | 7 |
| | Lead | 6 |
| | Manganese* | 6 |
| | Sulfate* | 6 |

## Exhibit 2-8 (continued)
## Most Common Constituents By Industry

| Industrial Classification Code (SIC) | Constituent | Number of Case Studies in Which the Constituent Was Detected |
|---|---|---|
| Chemical & Allied Products (28) (Cont.) | Total dissolved solids* | 6 |
| | Zinc | 6 |
| | Arsenic | 5 |
| | Chloride* | 5 |
| Food & Kindred Products (20) | Nitrite | 6 |
| | Nitrate | 5 |
| | Nitrogen | 5 |
| | pH* | 4 |
| | Total dissolved solids* | 4 |
| | Total filterable residue | 4 |
| | Calcium | 3 |
| | Chloride* | 3 |
| | Magnesium | 3 |
| | Sodium | 3 |
| Non-Metallic Minerals, Except Fuels (14) | Arsenic | 4 |
| | Iron* | 4 |
| | Lead | 4 |
| | Manganese* | 4 |
| | pH* | 4 |
| | Cadmium | 3 |
| | Chloride* | 3 |
| | Copper | 3 |
| | Nickel | 3 |
| | Potassium | 3 |

## Exhibit 2-8 (continued)
## Most Common Constituents By Industry

| Industrial Classification Code (SIC) | Constituent | Number of Case Studies in Which the Constituent Was Detected |
|---|---|---|
| Primary Metal Industries (33) | Lead | 4 |
| | Chromium | 3 |
| | Aluminum | 2 |
| | Arsenic | 2 |
| | Barium | 2 |
| | Cadmium | 2 |
| | Chloride* | 2 |
| | Mercury | 2 |
| | Nickel | 2 |
| | Zinc | 2 |

* Constituents with Secondary Maximum Contaminants.

con94 141.6 1.sl (*)rNt25pe unortresentativnd/or addout-of-ante

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exhibit documented damages at present does not necessarily suggest that waste management has not or will not cause damage.  The Agency, however, believes that information on dangers posed by past waste management practices is useful in demonstrating the potential for human health or environmental damages.

The extent to which the findings can be used to draw conclusions concerning the relative performance of waste management practices among states or across industry sectors is also severely limited by variations in recordkeeping, monitoring, and other state requirements.  Recordkeeping and monitoring procedures vary significantly among the states.  Several states have complete and up-to-date central enforcement or monitoring

characteristics in only a general way. The Agency, however, will carefully consider these factors when deciding the appropriate course of action for addressing any potential gaps in coverage that are identified in this Study.

The following sections review the nature of the risks to human health and environment potentially posed by non-hazardous industrial waste management. These risks are associated with physical hazards, acute toxic hazards to humans, chronic toxic hazards to humans, risk to non-human receptors, and other hazards. In the discussion below, risks addressed by the hazardous waste characteristics are distinguished from those risks not directly or adequately addressed. The purpose of this section is to develop a preliminary list of possible gaps in the characteristics. At this stage, few judgments are made as to the nature and severity of any potential gaps. Instead, the remainder of this Report investigates these potential gaps.

### 3.1.2 Risks Associated with Physical Hazards

Physical hazards include agents that cause direct physical harm such as thermal burns, wounds, contusions, or eye injuries, in contrast to agents causing harm through chemical burns or toxic effects. These hazards are controlled primarily through the ignitability, corrosivity, and reactivity (ICR) characteristics. EPA patterned these characteristics after similar regulations promulgated by the U.S. Department of Transportation, the National Fire Protection Association, and other organizations.

The ICR characteristics are intended primarily to protect waste management and transportation workers against hazards often associated with hazardous materials. These hazards include flammability, explosivity, and the propensity to react violently with other wastes, corrode containers, and directly injure skin and eyes during transport or management activities. In addition, these characteristics are intended to prevent the facilitated release and transport of hazardous waste constituents. For example, the corrosivity test is designed, in part, to identify wastes that, because of their acidity or basicity, may facilitate the solubilization of metals from wastes. This solubilization increases the potential impact of metals in groundwater, thereby increasing the likelihood of risks to human health via contaminated groundwater.

For the purposes of this Scoping Study, the question is: What physical risks may arise from the management of non-hazardous industrial wastes that are currently not covered by the characteristics? Several potentially significant physical risks are not effectively addressed by the hazardous characteristics. Some of the potential gaps arise from specific definitions of the ICR characteristics. These potential gaps, which are discussed in more detail in Sections 3.2 through 3.4, include:

- The lack of coverage of corrosive solids;
- The decision not to address liquids with moderate flash points;

- Limitations in the test procedures prescribed for reactivity; and
- Potential limitations of pH as an adequate indicator of corrosivity.

These issues relate to protecting waste management and transportation workers from physical injuries, except where explosions or fire might release toxic particulates that could harm nearby residents. Physical hazards to residents near management facilities are not considered, based on the assumption that the general public has limited access to non-hazardous industrial waste management facilities.

Other physical concerns relate to facilitated pollutant transport. For example, the corrosivity characteristic was not intended to address corrosion to liners or any materials other than steel or to prevent facilitated transport of organic chemicals through solubilization in discarded solvents. EPA considered, and decided to omit, a “solvent override” provision in the 1990 TC rule that would have classified as hazardous wastes with more than a specified concentration of hazardous organic solvents. The Agency, however, left open the possibility that such a provision could be reconsidered if additional data warrant it.[2] A related issue is the potential formation of dense and light non-aqueous phase liquids (DNAPLs and LNAPLs). They are a potential

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[2] 55 *Federal Register* 11809, March 29, 1990.

toxicity data and groundwater fate and transport models have changed or improved in the six years since the TC was promulgated, its expected level of protectiveness may also have changed. Section 3.5 discusses in detail potential gaps associated with the level of protectiveness of the TC in light of recent advances in toxicology and

### 3.1.6 Other Risks Associated with Non-Hazardous Industrial Waste Management

In establishing the existing hazardous waste characteristics, the Agency focused exclusively on human health risks directly associated with local effects of accidents and on chemical contamination of the environment in the near vicinity of the management units. In Chapter 5 of this study, EPA has taken a broader view, and has expanded the scope of the risk identification to include risks other than those originally considered, even indirectly, in establishing the hazardous waste characteristics. These additional categories of risks include damages to natural resources and contributions to large-scale environmental problems.

Non-hazardous industrial waste management has the potential to adversely affect the value or utility of

## Exhibit 3-1. Risks Potentially Associated with Non-Hazardous Industrial Waste Management

| Types of Risks | Risks Intended to be Addressed By Characteristics | Risks Not Intended to be Addressed by Characteristics |
|---|---|---|
| **Physical Hazards** | • Burns and injuries to waste management and transportation workers from fire, explosions, and violent reactions<br>• Skin, eye injury from direct contact with corrosive substances (workers)<br>• Facilitated transport of chemicals (primarily inorganics) in groundwater | • Physical injuries to the general public<br>• Facilitated transport of organics from solubilization<br>• DNAPL/LNAPL generation |
| **Acute Toxicity Risks to Humans** | • Adverse effects from inhalation of toxic gases and particulates (workers) | • Inhalation of toxic gases and particulates by public<br>● Acute health risks from other exposure pathways (direct contact, ingestion of contaminated water or food) |
| **Chronic Toxicity Risks to Humans** | • Risks of cancer and non-cancer effects from consumption of groundwater contaminated by TC constituents (public) | • Chronic health risks to workers<br>• Chronic risks from exposures to non-TC chemicals (public and workers)<br>• Chronic risks associated with non-groundwater pathways:<br>-- inhalation of volatilized materials and particulates other than those released from fire or explosion<br>-- ingestion of surface water contaminated by runoff or groundwater discharge<br>-- risks to public from direct contact with waste, contaminated soil, and in direct pathways (ingestion of contaminated crops, fish, game)<br>• Risks from specific types of toxins:<br>-- reproductive toxins<br>-- endocrine disruptors |
| **Toxic Risks to Nonhuman Receptors** | -- | • Aquatic toxicity<br>• Toxicity to terrestrial organisms<br>• Sediment toxicity<br>• Bioaccumulation/biomagnification<br>• Groundwater exposure |
| **Other Risks** | -- | • Damages to groundwater, surface water, and air affecting their usability or quality<br>• Non-hazardous industrial waste management contribution to large-scale environmental problems, such as air deposition to the Great Waters, damages from airborne particulates, global climate change, potential damages from endocrine disruptors, red tides, stratospheric ozone depletion, tropospheric ozone and photochemical air pollution, and water pollution. |

## 3.2 Ignitability Characteristic

This section describes potential gaps related to the definition of the RCRA ignitability characteristic and its test methods. The basic approach taken in identifying potential gaps for ignitability as well as for

**Potential Ignitability Gaps**

- Excludes DOT Combustible Liquids (liquids with flash point above 140 but below 200 degrees Fahrenheit)
- Excludes Aqueous Flammable Liquids (alcohol solutions of concentrations < 24 percent) that are capable of flashing, but not supporting combustion
- References outdated DOT Regulations
- No test methods for non-liquids

***Liquids with flash point at or above 140 °F not covered.*** The RCRA ignitability characteristic includes liquid wastes with flash point less than 60°C (140°F). When promulgating the original characteristic, EPA acknowledged choosing a definition for ignitable liquid wastes that excluded some potential wastes that would meet

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[3] U.S. Environmental Protection Agency, Office of Solid Waste, Background Document: Resource Conservation and Recovery Act Subtitle C -- Identification and Listing of Hazardous Wastes, Section 261.21-Characteristics of Ignitability, May 2, 1980, p. 10-11.

similar exclusion is found in DOT regulations.  EPA stated that it hoped "to undertake further study to determine

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[4] 45 *Federal Register* 33108.

## Exhibit 3-2
## Materials Formerly Classified by DOT as Combustible Liquids
## (which generally are not RCRA ignitable)

| | |
|---|---|
| "Adhesive" | Ethylhexaldehyde |

Source: Suspect Chemicals Handbook, 1988.
n.o.s. = not otherwise specified.
Note: Current DOT Hazardous Materials Table in 49 CFR 172.101 does not distinguish combustible liquids from flammable liquids. The above list was taken from a 1987 version of DOT regulations that classified some materials as combustible liquids. This list is intended to provide examples of materials "that may be combustible (i.e., liquids with 141ºF < flash point < 200ºF)."

***References to DOT regulations are outdated.*** The ignitability characteristic refers to a DOT definition of ignitable compressed gas (49 CFR 173.300) that has been withdrawn. Current DOT regulations at 49 CFR 173.115 define *flammable gas,* which is any material that is a gas at 20°C (68°F) or less and 101.3 kPa (kilopascals equal to 14.7 pounds per square inch) of pressure. The complete definition includes any material that has a boiling point of 20°C (68°F) or less at 101.3 kPa (14.7 psi)) that (1) is ignitable at 101.3 kPa (14.7 psi) when in a mixture of 13 percent or less by volume with air; or (2) has a flammable range at 101.3 kPa (14.7 psi) with air of at least 12 percent regardless of the lower limit. Likewise, the term *oxidizer* is no longer defined at 49 CFR 173.151. It is now found at 49 CFR 173.127. These out-of-date citations constitute a potential gap because they may cause regulatory confusion and misinterpretation and thereby may impede efficient and effective compliance and enforcement.

### 3.2.3 Potential Gaps Related to Ignitability Test Methods

***No test method is specified for non-liquids.***

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[5] Background Document, supra footnote 2, p. 14.

[6] 45 *Federal Register* 33108.

[7] 60 *Federal Register* 37974, July 25, 1995.

- Is a liquid and corrodes steel (SAE 1020) at a rate greater than 6.35 mm (0.250 inch) per year at a test temperature of 55ºC (130ºF) as determined by the test method specified in NACE (National Association of Corrosion Engineers) Standard TM-01-69 as standardized in "Test Methods for the Evaluation of Solid Waste, Physical/Chemical Methods," EPA Publication SW-846, as incorporated by reference in § 260.11.

The first part of this definition encompasses wastes exhibiting low or high pH, which "can cause harm to human tissue, promote the migration of toxic contaminants from other wastes, react dangerously with other wastes, and harm aquatic life." Specifically, the Agency identified skin and eye damage to transporters who are directly exposed to the waste as a primary focus of this characteristic. The pH limits also were intended to address the potential solubilization of heavy metals allowing migration to groundwater, reactions with incompatible wastes resulting in fires, explosions, generation of flammable or toxic gases, generation of pressure inside vessels, and the dispersal of toxic vapors, mists, and particulates.

The other part of the corrosivity characteristic relates to the corrosivity of waste to steel containers. The Agency identified this aspect of corrosivity as a hazard because "wastes capable of corroding metal can escape from the containers in which they are segregated and liberate other wastes." The consequences of liberating wastes from containers during transportation or storage include harm from direct contact, violent reactions, and the release of waste components to the environment.

### 3.3.2 Potential Gaps Related to Definition of Corrosivity

**Potential Corrosivity Gaps**

- Excludes corrosive non-liquids
- pH limits may not effectively protect against some types of injury
- Corrosion to materials other than steel is not directly addressed
- Solubilization of non-metals (e.g., by organic solvents) is not addressed
- Excludes irritants and sensitizers
- pH test methods may not accurately predict hazards

***Non-liquids are not covered.*** The current RCRA corrosivity characteristic is limited to liquids. Other regulatory programs, however, also cover corrosive non-liquids. For example:

- DOT regulates corrosive liquids and solids as hazardous materials;
- The OSHA definition of health hazard includes all corrosives regardless of physical form;
- The Basel Convention definitions of hazardous materials are not limited to liquids; and
- At least four states (California, New Hampshire, Rhode Island, and Washington) include non-aqueous wastes in their definitions of corrosivity. New Hampshire and Rhode Island specifically include corrosive gases as well as corrosive solids.

The states that include non-liquids in their corrosivity characteristics specify mixing the non-aqueous waste with water and then testing for pH. The rationale for this approach is that the waste is likely to come into contact with water during land-based management. In addition, EPA has developed Method 9045 (Soil and Waste pH), which can be used to test some corrosive solid wastes. Finally, Method 1120 (Dermal Corrosion) may be applied to solids, liquids, and emulsions (see additional discussion below under "potential gaps related to corrosivity test methods").

***pH limits may not cover some hazards.*** EPA originally proposed pH limits of 12.0 or greater and 3.0 or less, and a majority of commenters argued that these limits were too stringent. The commenters argued that the limit of 12.0 or greater would regulate as hazardous many lime-stabilized wastes and sludges, thereby discouraging use of a valuable treatment technique, and that the pH limit of 3.0 or less would regulate a number of substances generally thought to be innocuous (e.g., cola drinks) and many industrial wastewaters prior to neutralization. EPA agreed with these commenters and promulgated pH limits of 12.5 or greater and 2.0 or less in the 1980 final rule.

The more stringent proposed pH limits were based on studies of eye tissue damage. These studies indicated that pH extremes above 11.5 and below 2.5 generally are not tolerated by human corneal tissue.[8] EPA decided that basing pH limits on eye tissue damage was unnecessarily conservative. Thus, eye damage is a hazard not fully addressed by the corrosivity characteristic.

The corrosivity characteristic also was intended to prevent harm to ecological receptors caused by the release of hazardous wastes with high- or low-pH. In discussing aquatic life in the original background document,[9] EPA noted that the optimum pH range for freshwater fish is 6.5 to 9.0 and that an increase or decrease of 2 pH units beyond the optimum range causes severe effects. Levels of pH of 11.0 or greater and 3.5 or less are fatal to all species of fish. EPA also noted that altering surface water pH can reduce the productivity of food organisms essential to fish and wildlife. The pH limits of the corrosivity characteristic (2.0 and 12.5) are well beyond the safe range for aquatic life, but wastes presumably would be significantly diluted before the point of exposure to aquatic life. EPA did not conduct a risk assessment of such potential hazards (e.g., modeling the pathway of waste released to surface water and exposure to aquatic life) and thus it is not known under what circumstances high- or low-pH wastes could cause harm to aquatic receptors.

***Corrosion of materials other than steel is not directly addressed.*** In the second part of the corrosivity characteristic, EPA uses steel corrosion as an indicator of corrosivity. EPA adopted this aspect of corrosivity because "wastes capable of corroding metal can escape from the containers in which they are segregated and liberate other wastes."[10] EPA adopted DOT's corrosion standard, noting that the rate at which a waste corrodes a material commonly used in container construction (low carbon steel) is a suitable measure of its hazardousness.

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[8] U.S. Environmental Protection Agency, Office of Solid Waste, Background Document: Resource Conservation and Recovery Act, Subtitle C-Identification and Listing of Hazardous Wastes, Section 261.22-Characteristic of Corrosivity, May 2, 1980, p. 5.

[9] Id., pp. 9-10.

[10] 45 *Federal Register* 33109.

The reliance on the steel corrosion rate may create a potential gap if there are plausible mismanagement scenarios where wastes are stored, transported, or disposed in containers made from materials more easily corroded than low carbon steel (e.g., plastic by organic solvents) or are disposed in solid waste management units lined with materials such as clay or synthetics. Also, there may be a potential gap in the characteristic if waste management scenarios result in conditions where wastes are subject to higher temperatures than the 130ºF test temperature.

***Solubilization of hazardous constituents.*** The corrosivity characteristic also was intended to address the potential for high- and low-pH materials to solubilize potentially toxic waste constituents. EPA offers the example that a drop in pH from 4.0 to 2.0 increases the solubility of red mercury oxide or chromium hydroxide in water approximately 100 times.[11] The general concern is for inorganic ions that may be converted to more soluble species. This characteristic does not address the potential solubilization of organic constituents by organic liquids such as solvents, nor does it address the formation of non-aqueous phase liquids (NAPLs) by such materials. EPA considered including a solvents "override" in the TC characteristic,[12] but did not do so. The solvents override would have caused wastes with high concentrations of solvents to be classified as hazardous on the basis of potential NAPL formation. The issue of NAPL formation is discussed in more detail in Chapter 5.

***Lack of coverage of sensitizers and irritants.*** At least two types of materials that may pose potential hazards to humans through direct contact are not included in the corrosivity characteristic or any other characteristic: irritants and sensitizers. OSHA includes irritants in its definition of *health hazard* and defines *irritant* as a material that is not corrosive, but which causes a reversible inflammatory effect on living tissue by chemical action at the site of contact. A chemical is a skin irritant if, when tested on the intact skin of albino rabat the site soi0Tw (n,thoderial /FCFR 1500.41rganifouandouas exent 36otheb Tj 0 -matelypt intatechn(NAeoes

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[11] Ibid, p. 6.

[12] 55 *Federal Register* 11809, March 29, 1990.

### 3.3.3 Potential Gaps Related to Corrosivity Test Methods

***Use of pH as an indicator has limitations.*** EPA chose pH as a measure of corrosivity because "wastes exhibiting low or high pH can cause harm to human tissue, promote the migration of toxic contaminants from other wastes, react dangerously with other wastes, and harm aquatic life."[13] The ability of some substances to damage human tissue, however, may not be adequately indicated by a pH measurement. Other regulatory and advisory bodies (e.g., DOT, OSHA, Basel Convention) use criteria based on full thickness destruction of human skin.

Since the original rulemaking in 1980, Method 1120 (Dermal Corrosion) has been developed commercially. The dermal corrosion assay system is an

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[13] 45 *Federal Register* 33109.

- Is readily capable of detonation or explosive decomposition or reaction at standard temperature and pressure; or

- Is a forbidden explosive as defined in 49 CFR 173.51, or a Class A explosive as defined in 49 CFR 173.53 or a Class B explosive as defined in 49 CFR 173.88.

### 3.4.2 Potential Gaps Related to Definition of Reactivity

**Potential Reactivity Gaps**

- Broad, non-specific definitions
- References outdated DOT regulations
- No test methods specified

***The Definition is broad and lacks specificity.*** In discussing the reactivity characteristic in the 1980 final rule, EPA stated that "the definition was intended to identify wastes which, because of their extreme instability and tendency to react violently or explode, pose a problem at all stages of the waste management process."[14] EPA noted that the reactivity characteristic encompasses a diverse class of physical properties and effects and overlaps somewhat with the ignitability characteristic.

Some commenters argued that the definition was vague. They advocated using a quantitative definition accompanied by testing protocol(s). EPA responded that "the prose definition should provide generators with sufficient guidance to enable them to determine whether their wastes are reactive."[15] EPA argued that most generators whose wastes are dangerous because they are reactive are well aware of this property and such wastes usually are generated from reactive feedstocks and/or processes producing reactive products or intermediates. EPA further stated that problems posed by reactivity appeared to be confined to a fairly narrow category of wastes.

Theoretically, the reactivity characteristic could be clarified and made consistent with other programs (especially DOT) by developing more specific definitions of general terms such as "normally unstable," "violent change," "potentially explosive," "reacts violently with water," "readily capable of detonation," and so forth.

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[14] 45 *Federal Register* 33109.

[15] 45 *Federal Register* 33110.

### 3.4.3 Potential Gaps Related to Reactivity Test Methods

***Reactivity characteristic lacks test method(s).*** When the Agency promulgated the reactivity characteristic in 1980, no available tests were identified for use in defining the reactivity characteristic because:

- They were too restrictive and were confined to measuring how one specific aspect of reactivity correlates with a specific initiating condition or stress.
- Testing the reactivity of a sample does not necessarily reflect reactivity of the waste, because reactivity varies with properties including mass and surface area.
- Most available tests required subjective interpretation of results.
- Existing methods were not developed for testing wastes.

Although EPA has identified a test method (Method 9010) for reactive sulfide and/or cyanide bearing wastes, the Agency has not identified suitable test methods to fully define the reactivity characteristic.

## 3.5 Potential Gaps Associated with the Toxicity Characteristic

### 3.5.1 Definition of Toxicity Characteristic

The toxicity characteristic was designed by EPA to reduce risks to public health from chronic exposures to groundwater contamination caused by releases of toxic waste constituents. The Agency found "persuasive evidence that the contamination of groundwater through the leaching of waste contaminants from land disposed wastes is one of the most prevalent pathways by which toxic waste constituents migrate to the environment."[16] The legislative history of RCRA and EPA's case studies of damages from hazardous waste management were cited as support for focusing the toxicity characteristic exclusively on groundwater pathway risks.

EPA originally listed 14 contaminants as part of the toxicity characteristic. Subsequently, EPA added another 26 substances to the list, as shown in Exhibit 3-4. These 40 TC chemicals were selected because:

- The chemicals were included on the 40 CFR Part 261 Appendix VIII list of hazardous waste constituents that have been "shown to have toxic, carcinogenic, mutagenic, or teratogenic effects," and
- Appropriate chronic toxicity information had been developed and adequate fate and transport data were available to allow the modeling of groundwater fate and transport for each constituent.[17]

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[16] 45 *Federal Register* 33110, May 19, 1980.

[17] 55 *Federal Register* 11801, March 29, 1990. In finalizing the revised toxicity characteristic, however, the Agency used a generic DAF of 100 in a subsurface fate and transport model to set the regulatory levels.

**Exhibit 3-4**
**TC Constituents and Regulatory Levels (mg/l)**

| | | | |
|---|---|---|---|
| Arsenic | 5.0 | Hexachlorobenzene | 0.013 |

Source: 40 CFR 261.24.

Thus, EPA found these chemicals to be among those posing the greatest risk to humans from chronic groundwater exposure.

The remainder of Section 3.5 evaluates the TC in five steps:

- Section 3.5.2 examines whether new data on the toxicity and persistence of TC analytes and updated groundwater transport modeling techniques would result in allowable TC leachate concentrations different from those established in 1990.

- Section 3.5.3 presents screening-level exposure and risk modeling methods and results that are used to evaluate whether the current TC chemicals could pose risks to human health and environmental receptors through the inhalation pathway.

- Sections 3.5.4 and 3.5.5 evaluate potential risks from TC chemicals to human health through surface water pathways and indirect pathways, respectively. These risks are

## Advances in Groundwater Modeling

To develop the existing TC regulatory levels, the Agency used the EPAMCL model to estimate the likely extent of dilution after the release of waste constituents from waste management units during their transport to the nearest drinking water wells.[18] These calculations were conducted for municipal solid waste landfills and Subtitle D surface impoundments, taking into account the geochemical properties of the constituents, the size and configuration of the units, the vadose zone and groundwater regimes beneath the units, and the distribution of distances in the downgradient direction to the nearest drinking water well. Groundwater regimes were defined using distributions of transport parameter values typical of conditions throughout the United States. Receptor wells were assumed to be in the groundwater plume at a distribution of distances derived from a Subtitle D facility survey. Simulation methods were used to derive estimates of dilution-attenuation factors (DAFs) for each constituent and each type of waste management unit. After reviewing the results, the Agency elected to calculate acceptable leachate concentrations (regulatory levels) for each TC analyte using a single DAF value of 100.[19] In other words, the threshold leachate concentration of each analyte above which wastes would be identified as TC hazardous was set equal to allowable drinking water concentration or other benchmark ($10^{-5}$ cancer risk or Hazard Quotient (HQ) = 1.0) for the analytes multiplied by 100.

Since the TC was promulgated, the Agency has continued to use the same general approach to evaluate the groundwater transport of pollutants in developing RCRA regulations. The exact techniques used in this modeling, however, have changed significantly. In recent rulemakings, the Agency has used an updated version of the EPAMCL model, known as EPACMTP, to derive constituent-specific DAFs for a wide range of pollutant releases from hazardous and non-hazardous waste management units. This model employs many of the same basic transport algorithms as the EPAMCL, with several important differences, including the following:202.235 7 4656ana72f dc 4 619ana215.48342f 707 re T 707 dc 2.88 T 707 2.273

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[18] A detailed discussion of the groundwater modeling approach used by EPA in support of the TC rule can be found at 55 *Federal Register* 11816, March 29, 1990.

[19] Ibid at 11827.

[20] A detailed discussion of the EPACMTP model can be found in U.S. Environmental Protection Agency, Office of Solid Waste, EPACMTP Background Document, 1995; and EPACMTP Background Document for Metals, Volume 1: Methodology, 1995.

Recent applications of the model also used somewhat different assumptions regarding waste and facility characteristics, hydrogeological regimes, climatology, and receptor locations than those used in the development of the TC. Therefore, it is not possible, except in a very general way, to simply compare the DAF value used in establishing the TC allowable leachate concentrations with the constituent-specific DAF values for the same constituents derived in the subsequent analyses. In addition, DAF values derived for metals using the EPACMTP vary with the initial concentration of the constituent in the waste, because the model incorporates saturable binding and transport phenomena. In contrast, the DAFs derived using the EPAMCL model are concentration-invariant under most conditions.

Recently, EPA has employed the EPACMTP model in two major regulatory development efforts.

- EPA applied the model in its development of proposed risk-based exit levels for the Proposed Hazardous Waste Identification Rule for Process Waste (HWIR-Waste).[21] In that analysis, EPACMTP was used to back-calculate concentrations of constituents in wastes and in waste leachate corresponding to specific risk levels through groundwater exposures. The Agency is currently revising the proposed HWIR-Waste exit level groundwater risk modeling methods in response to comments from the Science Advisory Board and from other technical reviewers. Thus, the results of this modeling presented in this Scoping Study should be regarded as preliminary.

- In the Phase IV LDR regulatory development effort for mineral processing wastes, the model was used to derive constituent-specific DAFs for mineral processing wastes disposed of in surface impoundments and waste piles.[22] The DAFs were then used to derive groundwater pathway risk estimates for exposure to waste constituents.

The results of these analyses have been used to evaluate the extent to which changes in modeling techniques may have affected the assessment of groundwater fate and transport relative to the assessment used to derive the TC regulatory concentrations. As noted previously, a simple comparison of DAF values and/or calculated risk levels from the different modeling efforts is not possible without further analysis since the more recent modeling employs different groundwater transport models and different assumptions regarding facility characteristics, groundwater regimes, and receptor locations. In the case of the mineral processing risk assessment, for example, DAF values were derived specifically for facility sizes representative of the mineral processing industry, rather than Subtitle D management units. In addition, groundwater modeling was performed using climatologic data primarily from drier regions where many mineral processing facilities are located. While Subtitle D facilities were used to calculate releases for the HWIR-Waste proposal, the receptor wells were assumed to be distributed uniformly in the downgradient direction, instead of being confined to the plume. More importantly, the proposed exit levels were derived using a carcinogenic risk target of $10^{-6}$, rather than $10^{-5}$, and the 90th percentile, rather than the 85th percentile, estimates of risk were used. Using the 90th instead of 85th percentile of the risk output results in estimating higher risks for a given receptor for a given constituent concentration and in more stringent (lower) exit levels. Thus, the proposed HWIR-Waste risk calculations, especially for carcinogens, are substantially more conservative in several important respects than those used to derive the TC regulatory levels.

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[21] U.S. Environmental Protection Agency, Office of Solid Waste, Technical Support Document for the Hazardous Waste Identification Rule: Risk Assessment for Human and Ecological Receptors, August 1995.

[22] U.S. Environmental Protection Agency, Office of Solid Waste, Regulatory Impact Analysis of the Supplemental Proposed Rule Applying to Phase IV Land Disposal Restrictions to Newly Identified Mineral Processing Wastes, December 1995.

In the mineral processing risk assessment, DAF values were derived for eight of the TC analyte metals.  For waste piles

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[23] In one of these cases (for endrin), however, the limiting risk, is ecological, rather than human health.

## Exhibit 3-5
## Comparison of TC Regulatory Concentrations and HWIR-Waste Proposed Exit/Leach Levels

| Analyte | Chronic Toxicity mg/l | Level, mg/l | HWIR-Waste Level (mg/l) | Hi2.72 1.2 re f 218.88028 Tc -re f Level |
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# Exhibit 3-5 (continued)
# Comparison of TC Regulatory Concentrations and HWIR-Waste Proposed Exit/Leach Levels

TC0 TD,4elTCo-66.48 TD6 Tf 95HWIR-Tc-0.0

| Analyte | MCL or HBL[a] | TC Regulatory Level, mg/l | HWIR-Waste Exit Level (mg/l) | Level |
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wastes that would otherwise be non-hazardous, while the proposed HWIR-Waste exit levels would relieve wastes previously identified as hazardous from stringent regulatory control.

These issues are discussed in more detail in Sections 3.5.3 and 3.5.4. Other differences in modeling assumptions, such as the retention of constituents in waste management (loss terms) in TC modeling only and the differences in the assumed location of wells relative to the contamination source, influence the results in the other direction.

Summary. Based on the preceding analyses, only general conclusions can be drawn about whether there are any significant gaps in the TC associated with the specific regulatory levels set for individual constituents. The wide range in the mineral processing DAF values illustrates the high degree of variability associated with specific groundwater modeling assumptions, and does not necessarily indicate whether the DAFs should be considered less or more protective than when they were originally derived. The HWIR-Waste proposed exit level calculations, on the other hand, suggest that the application of more recent modeling techniques might result in more conservative transport calculations. Some, but not all, of this greater level of protectiveness reflects a policy decision by the Agency regarding what proportion of receptors should be protected to the target risk level. In addition, advances in modeling techniques and differences in specific input assumptions also affect the differences in the apparent levels of protectiveness.

### 3.5.3 Potential Inhalation Pathway Risks Associated with TC Analytes

This section investigates the general level of protectiveness of the allowable TC concentrations against direct inhalation, a risk that the TC was not specifically intended to protect against. EPA analyzed this issue by performing screening-level risk calculations for long-term air releases of the TC constituents from Subtitle D facilities. EPA used the CHEMDAT8 model using facility characteristic parameters for surface impoundments and land application units (LAUs). Release estimates for all of the organic TC analytes were developed for two scenarios.

- In the first scenario, releases were estimated from the same “high-end” surface impoundments and LAUs that were modeled in the proposed HWIR-Waste exit level modeling.
- The second scenario modeled releases from the "central tendency" impoundments and LAUs, which were considerable smaller and shallower than the high-end units.

In both release scenarios, the concentrations of the organic TC analytes were assumed to be at the TC regulatory level for liquid wastes in surface impoundments and at 20 times the TC levels for nonwastewaters in land application units. The latter assumption roughly estimates the maximum concentration of the TC analyte that could be present without the waste being hazardous, assuming efficient leaching using the TCLP. For analytes that do not

dgfferencsoi8iTw a8tes, 8nd dei,an4sotiboinsra2sdrwe5b12ndowaymp T*Appi985lteinaloe -1eg lalloweleases Tw (sc25.ry) Tj land application units, between approximately 7 percent and 100 percent of the chemicals entering the units are released to the air over the facility life. The average proportion of the analytes released from these units was 81.6 percent, and the calculated releases were greater than 95 percent for two-thirds of the organic TC analytes.

The results were similar for the central tendency LAU. Releases ranged from 27 to 100 percent of the analytes, and the average proportion released was 96.3 percent. The explanation for the predicted higher proportional releases from the central tendency LAU is not clear, but may be related to the shallower tilling depth assumed for the central tendency unit (0.2 compared to 0.3 meters).

The proportions of the TC analytes released from surface impoundments are shown in the final two columns of Exhibit 3-7. The releases ranged from 6 to 77 percent of the applied total per year for the high-end impoundment, with an average release of 55.5 percent per year.[24] Proportionate releases were again higher from the central tendency unit, ranging from 15 percent to 88 percent, with an average of 71.2 percent released annually. Similar to the situation for the LAUs, the higher proportional releases from the central tendency unit may be due to its considerably shallower depth (2 meters) compared to the high-end unit (7 meters).

The limited impact of a chemical's Henry's Law constant on air releases is somewhat surprising in light of the broad spectrum of solubility and vapor pressure reflected in the chemicals modeled. Perhaps it can best be understood as indicating that, in the long run (a year or more), a high proportion of any of these organic chemicals placed in uncovered land management units will be released to the air, provided other removal pathways are not important. In actual practice, some land application units are covered to some extent, and other removal processes, such as leaching, biological and chemical degradation, and binding to soil or sediment, compete to reduce air emissions significantly.

EPA calculated chronic risks from inhalation pathway exposures for all organic TC analytes. To calculate exposure concentrations, EPA multiplied release estimates by the long-term fenceline dispersion coefficients used in the proposed HWIR-Waste exit level calculations for the high-end and central tendency surface impoundments and LAU releases. The fenceline dispersion coefficients are used to represent the nearest credible residential exposure locations, in keeping with the proposed HWIR-Waste risk methodology. Exposure durations are assumed to be 30 years in the high-end exposure release and

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[24] Release from surface impoundments were estimated on an annual basis, rather than on a facility life-time basis because these units receive a constant and continuous flow of wastes throughout the facility life, with liquid flowing out of the unit after an assumed dwell time. In contrast, once a waste is added to an LAU, it is assumed to remain in the facility to volatilize throughout the facility life-span.

**Modeling Procedures**

- Estimate release proportions at TC regulatory concentrations
- Estimate exposure concentrations using fenceline dispersion coefficients from HWIR-Waste model[a]
- Estimate risks using IRIS and HEAST toxicity values (RfCs and Unit Risk values)

**Subtitle D Surface Impoundment from Proposed HWIR-Waste Risk Analysis**

| HIGH-END | CENTRAL TENDENCY |
|---|---|
| ● 40,000 square meters | ● 2,000 square meters |
| ● 40-year lifespan | ● 40-year lifespan |
| ● Depth 7 meters | ● Depth 2 meters |

**"Generic" Land Application Unit from Proposed HWIR-Waste Risk Analysis**

| HIGH-END | CENTRAL TENDENCY |
|---|---|
| ● 900,000 square meters | ● 61,000 square meters |
| ● 40-year lifespan | ● 40-year lifespan |
| ● Tilling depth 0.3 meters | ● |

Evaluation of the proposed HWIR-Waste exit level calculations for the TC analytes confirms the potential concern for nongroundwater pathways. For some of the TC analytes, the HWIR-Waste proposed exit level calculations indicated that non-groundwater pathways are significant. Findings include the following:

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[26] Such releases are likely to be controlled by permit requirements for surface water discharges and through facility design regulations.

- For common waste management practices, surface water exposure cannot be automatically ruled out as insignificant in comparison to groundwater, inhalation, and other indirect pathways.

- The significance of surface water releases depends heavily on the management practices employed by a facility and the specific interactions between surface water and groundwater at the facility.

- Generally, groundwater discharge significantly affects surface water quality only where groundwater constitutes a significant proportion of the total surface water in a water body. This pathway may be important for very large management units that generate large amounts of leachate, but usually significant surface water quality impacts are limited to relatively small streams adjacent to management units and to on-site or adjacent ponds derived mainly from leachate.

- Exposure to volatile contaminants in surface water is generally limited because these contaminants are depleted rapidly from surface water through volatilization. Air releases from surface water may themselves be significant from a health standpoint. Usually, however, volatilization from the management unit itself dominates, unless the unit is covered.

- Incidental ingestion and dermal contact with contaminated sediment tend not to be significant exposure pathways for humans, because of their infrequency and the relatively small amounts of contaminated sediment contacted (but see below).

- Indirect pathway exposures may be of concern, however. The contaminants that persist in sediment and have a high capacity to bioaccumulate and bioconcentrate are often the most significant contributors to human health risks. This capacity may overcome the high 144 385.68 cy and thela

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[27] Preliminary Report on Factors Important to Identifying Risk-Based Entry Characteristics: Analysis of Hazardous Waste Identification Risk Models, Ogden Environmental and Engineering Services, August 1996.

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### 3.5.6 Potential for Acute Adverse Effects of Exposures to TC Analytes

The TC was originally established based on the need to protect individuals from adverse health effects due to chronic exposures to the TC constituents consumed in groundwater. This approach to protecting against groundwater exposure risks is conservative because the relatively long time scale involved in groundwater transport to receptors, under most reasonable assumptions, means that limiting concentrations in any time period to the low chronic risk-based levels also will protect against short-term adverse effects. Short transient exposures to high levels of groundwater contaminants are extremely uncommon. Before the concentration of a pollutant reaches the relatively high level required to cause acute effects, it generally will have exceeded the allowable chronic exposure level for a long period of time.

This relationship may not apply to exposure through pathways not involving slow releases to groundwater. For example, the rapid evaporation of volatile chemicals from a ruptured container, the catastrophic release due to overtopping of a surface impoundment, or runoff erosion from an extreme storm event have the potential to result in short-term acute exposures to humans and environmental receptors. For this reason, EPA has evaluated the potential level of protectiveness of the TC against acute exposures. EPA evaluated the potential for adverse effects associated with acute volatilization of chemicals from land management units. The approach was analogous to the screening-level risk modeling for chronic exposure, except that the short-term releases were calculated and exposure concentrations were compared to short-term exposure standards. This analysis indicates that the short-term concentrations of all of the volatile TC analytes calculated at the fenceline were far below applicable short-term exposure standards (in this case, occupational exposure standards).

This simple modeling does not unconditionally eliminate the possibility of adverse effects from acute exposures to the TC analytes. Unusual release events, such as fires, or explosions, could result in higher exposures than calculated assuming simple volatilization. In addition, high winds or other events could result in high concentrations of particle-bound metals and other non-volatile analytes. The potential for these kinds of release events strongly depends on specific waste characteristics, site conditions, and management practices.

### 3.5.7 Potential Risks to Ecological Receptors from TC Analytes

Risks to non-human receptors are the final category of risks evaluated by EPA. Like the inhalation, surface water, and indirect pathway risks, they were not expressly factored into the derivation of the regulatory levels for the TC analytes. While a substantial number of the TC chemicals are toxic to ecological receptors, the protection of ecological receptors was not a specific concern in the rulemaking. This section discusses potential gaps in the TC characteristic associated with harm to ecological receptors.

Many of the same factors that contribute to potential risks for human receptors also contribute to potential risks for ecological receptors. Generally, harm to environmental receptors requires release of chemicals from containment and transport to sensitive receptors without extensive degradation or extreme dilution, just as in the case of human health risks. Thus, the physical properties of chemicals that contribute to persistence and transport in the environment, as shown in Exhibit 3-9, are indicators of potentially significant risks for ecological receptors. The fact that most of the persistent chemicals with high bioconcentration potentials are also pesticides, which are toxic to certain plants, insects, or other animals, adds to the potential risks.

The degree of protection of ecological receptors afforded by the TC leachate concentrations does not appear very high for many of the most toxic pesticides. Exhibit 3-10 compares the TC regulatory levels to two basic measures of potential aquatic toxicity, the acute and chronic Ambient Water Quality Criteria (AWQC) for the protection of aquatic life. It shows that, for many analytes, the allowable leachate concentrations are many orders of magnitude above the corresponding AWQC.

The shaded boxes in the table identify TC analytes with regulatory levels greater than 1,000 times the AWQC. The chemicals falling into this category again include the chlorinated pesticides, chlorobenzene, lead, mercury, silver, and 2,4,5-trichlorophenol. This ratio indicates that if the TC analytes were released from wastes to groundwater and from there discharged to surface water, a dilution of at least 1,000-fold would be required to reduce the concentration to levels not harmful to aquatic biota. Such a scenario may be unlikely, however, because, as noted above, these chemicals tend to bind strongly to soil and do not move readily in groundwater. (As is discussed in more detail in Chapter 2, however, some of these chemicals were found in

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[30] 45 *Federal Register* 33110, May 19, 1980.

[31] 51 *Federal Register* 21648, June 13, 1986.

## Exhibit 3-10

## Ratios of TC Leachate Regulatory Levels to Ambient Water Quality Criteria for Aquatic Life[a]

53 Ti  127 BT.0955  T-a0.0518  2  9c (5300)0iif

| Chemical | Freshwater AWQC Concentration (ug/l) | | TC RegulatoryLevel (mg/l) | TC Leachate Concentration (ug/l) | Ratio of TC Regulatory Level to AWQC |
|---|---|---|---|---|---|
| | Acute | Chronic | | | |
| Arsenic | 850 | 190 | 5 | 5000 | 26 |
| Barium | -- | -- | 100 | 100000 | NA |
| Benzene | 5300Benzene | | | | |
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application of the TCLP in 1990.[32] In finalizing the TCLP, the Agency intended to improve the leachate test procedure and eliminate some of the analytical difficulties involved in the EP.

The TCLP is used to quantify the extractability of certain hazardous constituents from solid waste under a defined set of laboratory conditions. This test is used to evaluate the leaching of TC metals, volatile and semivolatile organic compounds, and pesticides from wastes. In principle, this procedure simulates the leaching of constituents into groundwater under conditions found in a municipal solid waste (MSW) landfill. The TCLP,

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[32] 55 *Federal Register* 11827, March 29, 1990.

[33] Note that the majority of these data were collected from on-site groundwater monitoring wells and not from drinking water wells, and therefore actual risks likely are lower than would be indicated by these data.

[34] Lester Sotsky, Arnold & Porter, "Reynolds Metal Company's Gum Springs Facility," Memorandum to Steven Silverman, U.S. EPA, September 26, 1996.

residue waste based on TCLP data that showed the target constituents in the TCLP extract to be below treatment standards (which, for the TC constituents, are lower than the TC regulatory levels). When the leachate from the monofill was analyzed, however, levels of arsenic were found to be higher than its TC level. Other hazardous constituents, including cyanide and fluoride, were also found at levels higher than those predicted by the TCLP.

Several technical and practical issues have been raised by the regulated community and others regarding the applicability of the TCLP for identifying hazardous waste. A number of comments were submitted to the Agency in response to the June 13, 1986 proposal to replace the EP with the TCLP. The Agency responded to the comments in the final rule, but also decided to continue to address commenters concerns and further evaluate modifications to the TCLP. The Agency stated that further improvements in the TCLP will be proposed as they are developed. Subsequent to that rulemaking, additional concerns have been raised by commenters during later rulemakings (e.g., rules addressing newly listed or identified wastes).

Some of the key issues regarding the TCLP identified from these comments on various rulemakings and from other sources are outlined below.[35]

***TCLP underestimates leachate from some high alkaline wastes or environments***. The high alkalinity of some wastes may make the TCLP an inappropriate predictor of leachate composition. For example, the addition of acid during the TCLP might not reduce the pH of high alkaline waste to the same level as would occur over time in the environment. Thus, long-term leachate concentrations of constituents that are insoluble at higher pH ranges may be underestimated in the TCLP leachate compared to the actual leachate from the industrial landfills where a long-term acid environment (e.g., from acidic rain water) is present.

Some toxic metal constituents are more mobile at both the higher and the lower pH ranges. For example, studies show that leaching of metals such as cadmium, chromium, and lead typically is limited when the pH is in the range of about 8 or 9, but can increase significantly when the pH either increases or decreases.[36] Thus, if a waste is highly alkaline (e.g., pH >11) and the TCLP acidic leaching medium lowers the pH to only about 8 or 9, then the concentrations of these metals in the TCLP leachate could be significantly lower than would occur from either a highly alkaline or a highly acidic environment (depending on a number of factors, such as characteristics of any co-disposed wastes, type of treatment, and characteristics of the soil and rain water).

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[35] Note, however, that this list of issues is not meant to be comprehensive. Other issues, such as the potential overestimation of the dilution simulated by the TCLP, may need further study.

[36] van der Sloot, H.A., G.J. de Groot, and J. Wijkstra, "Leaching Characteristics of Construction Materials and Stabilization Products Containing Waste Materials," in P.L. Cote and T.M. Gilliam, eds., Environmental Aspects of Stabilization and Solidification of Hazardous and Radioactive Wastes, ASTM STP 1033, American Society for Testing and Materials, Philadelphia, Pennsylvania, 1989; and Willis, et al., "When the TCLP Is Not Enough: Leaching Tests for Solidification/Stabilization Technologies," Hazardous Materials Controls/Superfund 1991, Proceedings of the 12th National Conference, Hazardous Materials Control Research Institute, pp. 385-388, December 3-5, 1991.

Several commenters to the June 13, 1986 TCLP proposal expressed concern regarding the application of the TCLP to alkaline wastes. They noted that no high alkaline wastes were included in the development of the TCLP and, therefore, no conclusions could be made concerning the actual behavior of these wastes. The MEP, described in the text box, is one test that the Agency and others use that may better simulate the long-term leaching behavior of such wastes.

**Multiple Extraction Procedure (MEP)**

The MEP involves an initial extraction with acetic acid and at least eight subsequent extractions with a synthetic acid rain solution (sulfuric/nitric acid adjusted to pH 3). The MEP is intended to simulate 1,000 years of freeze and thaw cycles and prolonged exposure to a leaching medium. One advantage of the MEP over the TCLP is that the MEP gradually removes excess alkalinity in the waste. Thus, the leaching behavior of metal contaminants can be evaluated as a function of decreasing pH, where the solubility of most metals increases. Currently, the MEP is used in the Agency's de-listing program.

***TCLP underestimates the leachate concentrations from oily wastes and some paint wastes***. Several reports indicate that oily and some paint wastes tend to clog the filters used to separate the extract from the solids prior to analysis, resulting in under-reporting of the extractable constituent concentrations.[37] Several commenters on the June 13, 1986 TCLP proposal noted that, in the development of the TCLP, the Agency tested only 11 wastes.[38] These commenters argued that increasing the variety of wastes (to include oily wastes, organic chemical wastes, and municipal wastes) and the number of extractions performed could refine the TCLP and enhance its accuracy.

***TCLP may not accurately mimic conditions commonly found in non-hazardous industrial waste disposal***. A discussed in the 1980 final EP rule, several commenters responding to the proposed use of the EP for evaluating the leaching of hazardous constituents argued that the co-disposal assumption is not applicable to wastes that are never co-disposed with municipal solid wastes and thus do not leach at the aggressive rates characteristic of co-disposal situations. Thus, the commenters stated, the leachate procedure does not simulate the conditions found in industrial waste monofills. In response, the Agency stated that most wastes, even those that are unlikely to be disposed in a municipal landfill, are likely to come into contact with some form of acidic leaching medium during their management histories or could otherwise encounter environments that could cause the wastes to leach comparable levels of toxic constituents.

This same debate occurred during development of the TCLP, and it continues today. For example, the Lead Industries Association Inc., commenting on the Phase IV supplemental proposed rule,[39] cited an EPA study[40] that

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[37] "Preliminary Proposal to Require the TCLP in Lieu of the Waste Extraction Test," Memorandum to James Carlisle, Department of Toxics Substances Control, California EPA, from Jon Marshack, California Regional Water Quality Control Board, December 18, 1995; and U.S. Environmental Protection Agency, Technical Background Document and Response to Comments - Identification and Listing of Hazardous Waste - Method 1311 - TCLP, F-90-TCF-S0004, April 1989.

[38] *Ibid*.

[39] 61 *Federal Register* 2338, January 25, 1996.

[40] U.S. Environmental Protection Agency, "Performance Testing of Method 1312 QA Support for RCRA Testing," p. III, June 1989

stated that acetic acid leaching fluid could selectively solubilize toxicants (specifically lead) and incorrectly classify the material as hazardous when, in fact, no mobilization (leaching) would be expected to occur in the landfill environment. Kennecott Corporation and National Mining Association, also in response to the Phase IV supplemental proposed rule, stated similar concerns. The SPLP (see text box at right) is one test that has been considered for addressing this issue.

***TCLP may underestimate the chelation-facilitated mobility of some waste constituents***. A recent analysis of the TCLP and Cal WET (see text box at right) indicates that the low chelation[41] activity of the acetate buffer used in the TCLP may underestimate the ability of leachate containing chelating agents to mobilize waste constituents.[42] Cal WET uses a citrate buffer that approximates the chelation ability of many other compounds of landfill leachate and, thus, overcomes the constraints of the TCLP test.

***TCLP does not account for the oxidation/reduction reactions occurring in landfills***. A recent study noted that the addition of iron filings to stabilize foundry sand

**Synthetic Acid Precipitation Leach Test (SPLP)**

The SPLP is similar to the TCLP, but the initial liquid-solid separation step has been eliminated and the acetate buffer extraction fluid has been replaced by a dilute nitric acid/sulfuric acid mixture. The TCLP addresses co-management of industrial and non-industrial wastes in an organic acid environment, a scenario that does not match the disposal setting of many treated wastes, while the SPLP simulates disposal in an acid rain environment. The SPLP is currently used by several state agencies to evaluate the leaching of TC hazardous constituents from wastes.

**California Waste Extraction Test (Cal WET)**

Cal WET was developed by the State of California to classify hazardous wastes. This test uses sodium citrate buffer as the leachate, a 10:1 liquid-to-solids ratio, and a testing period of 48 hours. Cal WET applies a soluble threshold limit concentration (STLC) as the regulatory standard. STLC standards for metal concentrations in the leachate are similar to those for the TCLP. Cal WET also develops a Total Threshold Limit Concentration (TTLC), which is equivalent to the Total Waste Analysis (TWA) procedure. Cal WET is a more aggressive test when compared to the TCLP. That is, Cal WET almost always extracts higher levels of contaminants, and the citrate buffer used in this test has greater chelation effect than the acetate buffer used in the TCLP.

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[41] The chelation property of a reagent (such as acetate and citrate) refers to the ability of the reagent to bind with and solubilize metal contaminants. The low chelation ability of acetate buffer might result in fewer metal constituents being leached into the extract.

[42] "Preliminary Proposal to Require the TCLP in Lieu of the Waste Extraction Test," *supra* footnote 37.

wastes[43] seems to mask the potential leachability of lead by interfering with the TCLP.[44] If metallic iron (iron filings) are added to the waste, the lead concentration in the TCLP extract may be decreased by an oxidation/ reduction reaction to levels below the lead TC level. If, however, the waste is placed in a landfill or surface impoundment, the iron oxidizes over time and loses its ability to further reduce the lead ions. This results in the leaching of lead to the environment.

Another recent study reviewed the practice of using iron as an additive in stabilizing paint waste.[45] The study notes that the iron reduces the lead ions in paint waste to the less soluble metallic lead, which is subsequently removed by filtration from the leachate being analyzed. This use of iron allows the lead-containing waste to pass the TCLP. The study notes, however, that repeated leaching of the same waste sample increases the leaching rate to a point where lead is sufficiently solubilized to exceed the TC regulatory level.

Finally, another study showed that oxidation/reduction potential has a significant effect on leaching of metals from stabilized waste materials.[46] This study showed that the leaching of chromium increases significantly under highly oxidizing conditions, and the leaching of arsenic, vanadium, lead, and iron increase significantly under reducing conditions.

***TCLP may not predict long-term mobility of organic contaminants in some treated[47] wastes***. A fairly recent Superfund Innovative Technology Evaluation (SITE) field evaluation examined the long-term performance of stabilization treatment of lead and other metals, oil and grease, and mixed volatile and semivolatile organic compounds.[48] Portland cement and a proprietary additive were used as stabilizing agents. Durability was tested with weathering tests by wet-dry and freeze-thaw cycling and by sampling stabilized treated waste after 9 and 18

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[43] Stabilized waste is a concern for the Scoping Study because some non-hazardous industrial waste either is treated (e.g., using stabilization) to reduce the release of hazardous constituents or is derived from characteristically hazardous waste that has been "decharacterized" via treatment.

[44] Douglas Kendall, "Impermanence of Iron Treatment of Lead-Contaminated Foundry Sand--NIBCO, Inc. Nacogdoches, Texas," National Enforcement Investigations Center--Project PA9, April 18, 1996.

[45] Northwestern University, "Chapter 4 - Evaluation of Procedures for Analysis and Disposal of Lead-Based Paint-Removal Debris," Issues Impacting Bridge Painting: An Overview, Infrastructure Technology Institute, FHWA/RD/94/098, August 1995.

[46] Dusing, D.C., Bishop, P.L., and Keener, T.C., "Effect of Redox Potential on Leaching from Stabilized/Solidified Waste Materials," Journal of Air and Waste Management Association, Vol. 42, N1, p. 56(7), January 1992.

[47] See footnote 36.

[48] U.S. Environmental Protection Agency, Office of Research and Development, Technical Resource Document - Solidification/Stabilization and Its Application to Waste Materials, June 1993.

[49] Perry, K.J, Prange, N.E., and Garvey, W.F., "Long-Term Leaching Performance for Commercially Stabilized Waste," Stabilization and Solidification of Hazardous, Radioactive, and Mixed Wastes, Vol. 2, ASTM STP 1123, T.M. Gilliam and C.C. Wiles, Eds, American Society for Testing and Materials, Philadelphia, pp. 242-251, 1992.

performed on both the raw waste and the treated waste. The treated waste consisted of samples at 28, 90, 200, 470, and 650 days after treatment. The results showed that leachate values for some metallic wastes increased over time.

***TCLP may not be appropriate for some contaminated soil***. The Michigan Department of Natural Resources (MDNR) believes that the TCLP is not appropriate for soils contaminated with cyanides, sulfides, and hexavalent chromium.[50] Furthermore, MDNR reports that the SPLP (see previous text box) more accurately simulates the conditions of contaminated soil and therefore is an appropriate alternative test for soil contaminated with cyanides, sulfides, and hexavalent chromium.

***TCLP does not predict releases to non-groundwater pathways***. As discussed in Section 3.4, the TCLP was designed to simulate the leaching of waste constituents to groundwater and not for releases to non-groundwater pathways. The TCLP does not simulate the release of volatile organic contaminants into air either directly or through entrained dust, nor does it simulate releases through surface runoff.[51]

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[50] Alternate Soil Leaching Procedures, Interoffice Memorandum to the Environmental Response Division Staff from Alan J. Howard, Environmental Response Division, Michigan Department of Natural Resources, January 5, 1995.

[51] The TCLP does account for the loss of volatile contaminants that occur during the liquid/solid separation and extraction process; however, this is only for correcting the leachate concentration, not for simulating releases to air.

CHAPTER 3. POTENTIAL GAPS ASSOCIATED WITH HAZARDOUS WASTE CHARACTERISTICS DEFINITIONS

# CHAPTER 4. POTENTIAL GAPS ASSOCIATED WITH NON-TC CHEMICALS

This chapter identifies potential gaps in the hazardous waste characteristics associated with chemicals not on the toxicity characteristic list. Chemicals and chemical classes are identified as potential gaps based on their hazardous properties such as toxicity to humans and ecological receptors, their fate and transport properties such as persistence and bioconcentration potential, and their potential for occurrence in non-hazardous industrial wastes. This approach to identifying gaps is complemented by the approach discussed in Chapter 5, which identifies gaps in terms of the important environmental risks and their potential association with waste management, rather than focusing on specific chemicals.

## 4.1 Overview of Methodology

EPA identified potential gaps in the characteristics associated with non-TC chemicals through a six-step process, as shown in Exhibit 4-1. Each of these steps is described below.

### Step 1: Identify and Classify Known Non-Hazardous Industrial Waste Constituents

An essential task in this analysis is identifying a universe of chemicals that are either known or likely to be present in non-hazardous industrial wastes, excluding TC analytes (which are addressed in Chapter 3). In the analysis that follows, these two classes of chemicals are referred to as **<u>known</u> non-hazardous industrial waste constituents** and **<u>possible</u> non-hazardous industrial waste constituents**, respectively. As described in Section 4.2, the identification of the "known" non-hazardous constituents is relatively straightforward, although reliable data on the composition of non-hazardous industrial waste are limited. The data sources used to identify these constituents are shown in the top panels of Exhibit 4-1. They are the non-hazardous industrial waste release descriptions (discussed in Chapter 2), the Industrial Studies Data Base (ISDB), Effluent Guidelines Development Documents, and Listing Documents from recent rulemakings for dyes and pigments and solvent wastes. As discussed in Section 4.2, the distinguishing characteristic that makes a chemical a “known” non-hazardous industrial waste constituent is that it has been documented through direct chemical analysis to occur either in non-hazardous industrial waste or in environmental media contaminated by releases from non-hazardous industrial waste management units.

### Step 2: Identify and Screen Possible Non-Hazardous Industrial Waste Constituents

In addition to the chemicals that are known to be present in non-hazardous industrial wastes, EPA identified other chemicals that have a high likelihood of being present in such wastes and could pose significant risks to human health or the environment. Unlike the known non-hazardous industrial waste constituents, however, the possible waste constituents have not been confirmed as non-hazardous industrial waste constituents through direct chemical analysis in any of the data sources used by the Agency. To identify non-hazardous industrial waste

Rather than include all the chemicals on these lists as possible non-hazardous industrial waste constituents, EPA narrowed the list of chemicals to those most likely to pose significant risks to human health and the environment. The screening was performed in two steps, as shown in the upper right-hand panels of Exhibit 4-1. First, chemicals were screened with regard to individual toxicity and fate and transport properties. Then, the resulting high-hazard chemicals were screened against 1994 national Toxic Release Inventory (TRI) release data, serving as a proxy for potential occurrence in waste. Section 4.3 describes the process of compiling and screening possible non-hazardous industrial waste constituents.

### Step 3: Apply Hazard-Based Screening Criteria

In this step, which is described in detail in Section 4.4, EPA compared the lists of known and possible non-hazardous industrial waste constituents and screened them against single and multiple hazard-based screening criteria. In Step 2, individual chemicals that are possible non-hazardous industrial waste constituents were screened on the basis of single indicators of hazard (e.g., a low reference dose or a high bioconcentration factor). This step refines this analysis by examining both the known and possible non-hazardous industrial waste constituents against single and multiple indicators of toxicity, fate, transport, and occurrence in waste, and by reviewing the implications of this screening for classes of chemicals.

exCcreeng aK55 TC 0.0055re inuctNhe Tw (WastIon-hazardoe for deling Results) Tj 0 -25.68 TD /F212.96 TD -0.0662

### Step 4: Review Relevant Multipathway Risk Modeling Results

Section 4.5 reviews the results of the multipathway risk modeling conducted as part of the proposed HWIR-Waste (Hazardous Waste Identification Rule for Process Wastes) determination of exit levels, where available for chemicals on the combined list of known or possible non-hazardous industrial waste constituents. The proposed Hazy Ping as a Acurdo0.0079Risk Modeling Results

In the course of this Scoping Study, the Agency identified four sources of information regarding the composition of non-hazardous industrial wastes:

- The descriptions of environmental releases from non-hazardous industrial waste management facilities, compiled as part of this Scoping Study, which were summarized in Chapter 2;
- The Industrial Studies Data Base (ISDB), which includes information on point of generation constituent concentrations on various industries;
- Chemicals identified as being present in liquid non-hazardous wastes by EPA Effluent Guideline Development Documents, as summarized in the Capacity Analysis for the Phase III Land Disposal Restrictions (LDR) Rule; and
- Chemicals identified as being present in non-hazardous industrial waste that were not listed as hazardous wastes in background documents for recent Agency listing/no-listing proposals for pigments and dyes industries and for solvents.

The first source provides information on chemicals detected in environmental media (primarily groundwater) that were released from non-hazardous industrial waste management facilities, while the other three sources provide information on the composition of non-hazardous industrial wastes. Although not reflected in this Study, in future investigations the Agency will consider examining the constituents present in remediation waste from non-hazardous industrial waste management units.

The descriptions of environmental releases in Chapter 2 identify the constituents found in environmental media near non-hazardous industrial waste management units, their maximum detected concentrations, the types ofituents foun

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[1] U.S. Environmental Protection Agency, Office of Solid Waste, Background Document for Capacity Analysis for Land Disposal Restrictions Phase III - Decharacterized Wastewaters, Carbamate Wastes, and Spent Potliners (Final Rule), Volume 1, February 1996.

[2] U.S. Environmental Protection Agency, Office of Solid Waste, Assessment of Risks from the Management of Used Solvents (Draft), May 3, 1996.

[3] U.S. Environmental Protection Agency, Office of Solid Waste, Listing Background Document: Final Hazardous Waste Listing

## Exhibit 4-2. Known Non-Hazardous Industrial Waste Constituents Found in Case Studies, ISDB, Listings Documents, and Effluent Guidelines by Chemical Class

Less prominent categories of chemicals include the PAHs (18 compounds), volatile hydrocarbons (12), phenolic compounds (8), and phthalate esters (6). The PAHs range from low-molecular weight, noncarcinogenic compounds (such as naphthalene) to the higher molecular weight carcinogens and mutagens (such as benzo(a)pyrene). All but one of the volatile hydrocarbons (styrene) are commonly found as constituents in kerosene, gasoline, and related fuels. Styrene is a monomer used in plastics production. The phenolic compounds include creosote components (cresols) and two nitrophenols. Most of the phthalate esters are found in all the first three data sources, including the suspect carcinogen bis-(2-ethylhexyl)-phthalate. Polychlorinated biphenyls (PCBs) and chlorinated dioxins (represented by 2,3,7,8-TCDD) were found in the ISDB.

The number of compounds in the various categories does not necessarily reflect the relative potential importance of the chemicals or categories. As noted above, some chemicals occur only in one database, while others occur in two, three, or all four. In addition, some chemicals occur in more than one release description, that is, at more than one facility, or are identified as waste constituents from more than one industry group. Except for the chemicals in the release descriptions, there is no indication of the relative concentrations of the chemicals in wastes.

Hazardous Materials Transportation Act (HMTA) Hazardous Materials Registry (HMR) also was used to identify potential gap chemicals, but could not be directly included in the database in time because of format differences in the available machine-readable forms of the list.

Some of the advisory lists that were included are the 1992 EPA Hazardous Substance Task Force's[4] Level 1 and Level 2 hazardous chemicals that were identified as not being controlled under RCRA or DOT regulations, the Focus Chemicals for the Great Waters Study,[5] chemicals identified by Environment Canada under the ARET Toxics Scoring Protocols, chemicals identified by the University of Tennessee Chemical Ranking System, and the Michigan Critical Materials Register. Some lists address specific types of hazards, such as potential endocrine disruptors, acutely toxic chemicals, highly flammable chemicals, and highly reactive chemicals. Brief descriptions of the lists and the selection criteria that were applied to derive them are provided in "Background Document: Identification of Chemicals from Regulatory and Advisory Lists Representing Potential Gaps in the Hazardous Waste Characteristics."[6]

Naturally, there is a high degree of overlap among the chemical lists. Some lists are subsets of, combinations of, or otherwise derived from other lists. Nonetheless, the chemicals identified represent a very broad spectrum of potential hazards. High-volume and highly toxic chemicals appear on many lists, as do acutely toxic, flammable, and reactive chemicals. Several lists specifically seek to include carcinogens, mutagens, and teratogens. Some lists are derived based on considerations of ecotoxicity, persistence, and bioaccumulation potential, or based on specific environmental media or geographical concerns. The overall goal in the Scoping Study was to identify the broadest possible set of chemicals of potential concern, and then to screen them down to the chemicals with the highest potential to pose risks to human health or the environment.

### 4.3.2 Screening Approach

EPA performed the hazard-based screening of potentially hazardous constituents in two steps. First, the entire list of chemicals was screened against criteria related to toxicity to humans and aquatic organisms and separately against various fate and transport criteria. Chemicals for which data were not available for at least one of these criteria were not included in further analysis. In the second step, EPA took all of the chemicals identified as either highly toxic, mobile, persistent, or bioaccumulative and first screened them against the proxy for occurrence in waste, namely the TRI release data. Any chemical passing this screen has a high potential for occurrence in waste and was identified as a possible non-hazardous industrial waste constituent. Chemicals were also retained in the analysis if they were not on the TRI list. Only the chemicals confirmed as having low releases through the TRI data were eliminated from being possible constituents.

The criteria considered for use in screening (both the possible constituents described in this section and the combined lists discussed in Section 4.4) are summarized in Exhibit 4-4. These criteria were derived using professional judgment to provide a reasonable level of discrimination between

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[4] U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, Report of the EPA Hazardous Substance Task Force, April 1992.

[5] U.S. Environmental Protection Agency, Office of Air Quality, Planning and Standards, Deposition of Air Pollutants to the Great Waters, First Report to Congress, Publication EPA-453/R-93-055, May 1994.

[6] U.S. Environmental Protection Agency, Office of Solid Waste, November 15, 1996.

## Exhibit 4-4
## Criteria Considered for Screening Non-Hazardous Industrial Waste Constituents[a]

| Parameter | Cutoff Value | | Rationale |
|---|---|---|---|
| **I. Toxicity Values** | | | |
| Oral RfD | $<1.3\text{x}10^{-2}$ | mg/kg-day | 50th percentile |
| Oral CSF | Any Value<br>$>2.9\text{x}10^{-1}$ | <br>$(\text{mg/kg-day})^{-1}$ | All Suspect Carcinogens<br>50th percentile |
| Inhalation RfC | $<1\text{x}10^{-2}$ | $\text{ug/m}^3$ | 50th percentile |
| Inhalation UR | Any Value<br>$>3.3\text{x}10^{-4}$ | <br>$(\text{ug/m}^3)^{-1}$ | All Suspect Carcinogens<br>50th percentile |
| Primary MCL | $<5\text{x}10^{-2}$ | mg/l | 50th percentile |
| Acute AWQC | <130 | mg/l | 50th percentile |
| Chronic AWQC | <5.2 | mg/l | 50th percentile |
| **II. Fate and Transport Parameters** | | | |
| Fish BCF | >1,000 | l/kg | About 85th percentile, lists range from 500-100,000 |
| Fish BAF | >1,000 | l/kg | About 50th percentile, lists range from 500-15,000 |
| Kow | >100,000 | 50t760 12y MCL | Chronic |

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[7] Background Document: Identification of Chemicals from Regulatory and Advisory Lists Representing Potential Gaps in the

## Exhibit 4-5. Toxicity Screening Results for Possible Non-Hazardous Industrial Waste Constituents

| Chemicals with CSFs | Chemicals with Unit Risks | Chemicals with Low RfDs |
|---|---|---|
| 2,4,6-Trinitrotoluene | 1,3-Butadiene | |
| 3,3'-Dichlorobenzidine | Aramite | 1,1,2 Trichloropropane |
| 4,4'-Methylenebis(N,N-dimethyl)benzenamine | Asbestos (friable) | 1,2,4 Tribromobenzene |
| Acephate | Azobenzene | 1,3,5-Trinitrobenzene |
| Aramite | Benzidine | 1,3 Phenylenediamine |
| Azobenzene | Bis(chloromethyl) ether | 1,4 Dibromobenzene |
| Benzidine | Hexachlorocyclohexane | 1,4 Dithiane |
| Bis(2-ethylhexyl) adipate | HxCDD | 2-Chlorophenol |
| Bis(chloromethyl) ether | N-Nitrosodi-n-butylamine | 2-Cyclohexyl-4,6-dinitrophenol |
| Cyclotrimethylene trinitramine | N-Nitrosodiethylamine | 2,3 Dichloropropanol |
| Dichlorvos | N-Nitrosopyrrolidine | 2,4,5-T acid |
| Folpet | Nickel subsulfide | 2,4,6-Trinitrotoluene |
| Fomesafen | Propylene oxide | 2,4-DB |
| Furmecyclox | | 2,6-Dimethylphenol |
| Hexachlorocyclohexane | | 3,4 Dimethylphenol |
| Hexachlorodibenzo p dioxin, mixture (HxCDD) | | Acephate |
| N-Nitrosodi-n-butylamine | | Acetataldehyde, trichloro- |
| N-Nitrosodi-n-pth6 0 TD T.ichlora9/06 0 TD -0.03Tc -0.00iro-Fomesafen | | |

## Exhibit 4-5. Toxicity Screening Results for Possible Non-Hazardous Industrial Waste Constituents (continued)

| Low RfDs (continued) | Low RfCs | |
|---|---|---|
| | | |

**Exhibit 4-5. Toxicity Screening Results for Possible Non-Hazardous Industrial Waste Constituents (continued)**

limited for a large proportion of the chemicals identified on the 37 lists. Nevertheless, because all chemicals with cancer toxicity values are considered high hazard for this portion of the analysis, no chemicals would be screened out on the basis of carcinogenicity.

The toxicity screening reduced the number of chemicals dramatically from the original universe of over 2300. As noted above, this reduction is primarily a function of the relatively small number of chemicals (about 400) for which human or ecotoxicity data are available. The screened list contains about one-third (25/74) of the chemicals for which CSFs were available, and about one-quarter (13/52) of those for which inhalation unit risks are available. The chemicals with low (<50th percentile) RfDs comprise by far the largest (107) set of all the chemicals identified by the toxicity screening, representing about one-third of the total number of chemicals for which RfDs have been derived. A large proportion of these chemicals are pesticides. Relatively few chemicals were identified having low inhalation RfCs and AWQCs for aquatic life.

Exhibit 4-6 summarizes the results of the screening of chemicals with regard to fate and transport properties. The first two columns address the potential to volatilize for soil and water, as indicated by the vapor pressure and Henry's Law constant. Since these parameters are directly related, the chemicals in these two columns overlap substantially. The next column lists chemicals with soil or water column degradation constants less than 0.5/year. Since the values for these two media are close for most of the chemicals, separate columns are not provided for each medium. The final three columns identify the chemicals with relatively high aquatic BCFs, beef biotransfer factors, or Kows. Since all three of these values are related to partitioning between lipid and water phases, the chemicals in these three columns also overlap substantially.

As was the case for the toxicity screens, consistently-derived fate and transport parameters are not available to screen the majority of the chemicals. Thus, the menu of chemicals that are identified by the screening criteria related to each individual parameter again is determined primarily by the availability of data. In the case of the fate and transport screening, fewer chemicals are identified as being potentially hazardous. In addition, the fate and transport screening identifies a smaller proportion of the chemicals for which data are available. In all cases, the chemicals exceeding the screening criteria represent less than 10 percent of the chemicals for which data are available.

### 4.3.4 Release Volume Screening of Possible Non-Hazardous Industrial Waste Constituents

Chemicals not screened out by the toxicity or fate and transport criteria were screened against the 1994 TRI data (used as a proxy for occurrence in wastes). The results of this final screening are presented in Exhibit 4-7. Of the 151 unique chemicals or classes of chemicals that were identified in the toxicity or fate and transport screening, TRI release data were available for 24 of them. Five of these chemicals (Freon 113, 1,3-butadiene, chlorine dioxide, chloroprene, and propylene dioxide) had TRI releases above one million pounds in 1994. Nineteen of the chemicals had TRI releases less than a million pounds. This latter group of chemicals were eliminated from further analysis. As noted previously, the remaining 132 chemicals for which no TRI data were available were retained in the analysis.

## Exhibit 4-7
## Screening of High-Toxicity, Persistent, Bioaccumulative/Bioconcentrating Possible Non-Hazardous Industrial Waste Constituents Against TRI Release Volumes

## Exhibit 4-7 (continued)
## Screening of High-Toxicity, Persistent, Bioaccumulative/Bioconcentrating Possible Non-Hazardous Industrial Waste Constituents Against TRI Release Volumes

## Exhibit 4-7 (continued)
## Screening of High-Toxicity, Persistent, Bioaccumulative/Bioconcentrating Possible Non-Hazardous Industrial Waste Constituents Against TRI Release Volumes

### 4.3.5 Summary of Possible Non-Hazardous Industrial Waste Constituents

Exhibit 4-8 summarizes the results of the TRI screening process. It places the possible non-hazardous waste constituents into the same chemical categories as were used to characterize the known non-hazardous industrial waste constituents in Exhibit 4-2. The largest number of possible waste constituents (74) are pesticides and related compounds. As discussed in Section 4.3.2, these chemicals are identified as being potentially hazardous primarily by virtue of low RfDs, although there are also some potent ecotoxins, as well as persistent and bioaccumulative chemicals, among this group.

The next most numerous category among the possible constituents are the other semivolatile organic chemicals. This diverse group includes chemicals recognized both for their toxicity and their fate and transport properties. Twelve metals/inorganic elements or groups are identified including five different thallium salts. Similarly, the other volatile organics group includes 5 nitrosamines among a total of 13 compounds. Also included in this group are two very toxic organometallic compounds, methyl mercury and tetraethyllead. Among the seven chlorinated organics are two of the five chemicals with TRI releases greater than one million pounds (Freon 113 and chloroprene). No other chemical category is represented by more than five chemicals.

## 4.4 Combine and Screen Known and Possible Non-Hazardous Industrial Waste Constituents

In this section, the known (from Section 4.2) and possible (from Section 4.3) non-hazardous industrial waste constituents are combined and screened against toxicity, fate, and transport criteria. Unlike the prior section, screening is oriented more toward groups of chemicals rather than toward individual chemicals, and toward comparing the properties of known versus possible non-hazardous industrial waste constituents. There is, in addition, another screening step related to potential for occurrence in wastes, namely, comparison to 1994 non-confidential TSCA production volume data.

### 4.4.1 Combine the Lists

The lists of known and possible non-hazardous industrial waste constituents are shown in Exhibits 4-2 and 4-8. Exhibit 4-9 summarizes the screening of the known non-hazardous industrial waste constituents in the same way that Exhibit 4-7 provides these data for the possible constituents. As seen in these exhibits, the distribution of chemicals within chemical classes is somewhat different between the known and possible non-hazardous industrial waste constituents. These differences, however, are exaggerated by the removal of the known constituents from consideration as possible constituents. (Logically, a chemical cannot be both a "known" and "possible" waste constituent.) The known non-hazardous industrial waste constituents are distinguished by a relatively high proportion of metals and inorganics, chlorinated volatile organics, other volatile organics, and polycyclic aromatic hydrocarbons, compared to the possible non-hazardous waste constituents. In contrast, pesticides and related compounds constitute a much higher proportion of the possible non-hazardous industrial waste constituents than the known constituents.

The pattern of differences in chemical category can be partially explained by the differences in the data sources. The relatively high prominence of volatile organics among the possible constituents probably reflects the difficulties in controlling fugitive releases of these high-volume chemicals during storage and processing. Such chemicals are somewhat less likely to turn up in groundwater samples (in the release descriptions or in aqueous effluents) because of their high volatility. The prominence of the less volatile organics in the known non-hazardous industrial waste constituents again reflects the greater stability of these chemicals in solid and liquid wastes.

**Exhibit 4-8**
**Possible Non-Hazardous Industrial Waste Constituents by Chemical Class**

# Exhibit 4-9
# Screening of Known Non-Hazardous Industrial Waste Constituents Against TRI Release Volumes

## Exhibit 4-9 (continued)
## Screening of Known Non-Hazardous Industrial Waste Constituents Against TRI Release Volumes

### Exhibit 4-9 (continued)
### Screening of Known Non-Hazardous Industrial Waste Constituents Against TRI Release Volumes

Exhibit 4-9 also shows that the known waste constituents include a much higher number of chemicals with TRI release values greater than one million pounds (45)[10] than is found among the possible constituents (5). This is primarily due to the fact that the known waste constituents were identified first. Many of the high TRI release chemicals also would have been identified as possible non-hazardous industrial waste constituents if they had not been identified as known constituents. The implications of these findings for the potential severity of gaps in the hazardous characteristics are discussed in more detail in Chapter 10.

In the analysis that follows, the known and possible non-hazardous industrial waste constituent lists are combined, and screened against single and multiple parameters related to toxicity, fate and transport, and release potential.

### 4.4.2 Screen Combined List Against Single Criteria

Quantitative Human Toxicity Indicators. Exhibit 4-10 summarizes the toxicological properties of the combined known and possible non-hazardous industrial waste constituents. The chemicals are screened using the same criteria as described for the possible constituents alone in Section 4.3, with the exception that additional criteria related to carcinogenic potency are added (oral CSF and inhalation UR > 50th percentile). The list of suspect carcinogens (i.e., the first and third columns in Exhibit 4-10) contains a large proportion of all chemicals for which EPA has developed CSFs and URs. The proportion of the chemicals with high CSFs or URs (i.e., the second and fourth columns) is likewise very near to one-half of the total suspect carcinogens. This finding indicates that, as expected, the large universe of chemicals initially screened contains almost all of the chemicals that EPA has evaluated as potential human carcinogens. Many classes of chemicals (inorganics, volatile chlorinated organics, pesticides, other volatile chemicals) are represented among the suspect carcinogens.

Ecotoxicity. As shown in the last column of Exhibit 4-10, 18 of the combined known and possible constituents have low AWQCs (below 50th percentile), indicating the potential for adverse effects on aquatic organisms. Many of these chemicals are pesticides, and most of the pesticides are persistent chlorinated pesticides. Although most of these chemicals are no longer produced, their presence among the known non-hazardous industrial waste constituents may give rise for some concern. Also included in this group are selenium, silver, and hydrogen sulfide.

Potential Endocrine Disruptors. Because of the rapidly-evolving state of knowledge regarding chemicals that may act as endocrine disruptors, estrogen inhibitors, or have other hormone-like effects, it is difficult to estimate precisely how many of the combined known and possible non-hazardous industrial waste constituents fall into this category. Based on the rather broad list of potential endocrine disruptors,[11] 23 of the combined constituents are implicated as being potential endocrine disruptors (Exhibit 4-11). (Nine of the TC analytes are also potential endocrine disruptors.) Because of the lack of knowledge concerning dose-response relationships for exposures to single and multiple

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[10] This number includes both unique compounds (e.g., ethylbenzene) and categories of compounds (e.g., antimony compounds).

[11] The list of endocrine disrupting chemicals was developed based on information from Colborn, T., F.S. Saal, and A.M. Soto, 1993, "Developmental Effects of Endocrine-Disrupting Chemicals in Wildlife and Humans," Environmental Health Perspectives, 101:378-384, October 1993; and Warhurst, M., 1996, Introduction to Hormone Disrupting Chemicals, on the World Wide Web at http://www.ed.ac.uk/~amw/oestrogenic.html.

### Exhibit 4-10 Toxicity Summary of Known and Possible Non-Hazardous Industrial Waste Constituents

## Exhibit 4-11
## Potential Endocrine Disruptors

| Known and Possible Constituents | TC Analytes |
|---|---|
| 2,3,7,8-tetrachlorodibenzodioxin (2378-TCDD) | cadmium |
| 2,4,5-trichlorophenoxyacetic acid (2,4,5-T) | heptachlor and heptachlor expoxide |
| alachlor | lead |
| aldicarb | lindane |
| b-hexachlorocyclohexane (b-BHC) | mercury |
| butylbenzylphthalate (BBP) | methoxychlor |
| DDD | pentachlorophenol (PCP) |
| DDE | toxaphene |
| DDT | |
| dibromochloropropane (DBCP) | |
| dibutyl phthalate (DBP) | |
| dieldrin | |
| diethylhexyl phthalate (DEHP) | |
| dimethyl phthalate (DMP) | |
| dioctyl phthalate (DOP) | |
| endosulfan | |
| mirex | |
| parathion | |
| polychlorinated biphenyls (PCBs) | |
| polychlorinated dibenzodioxins (PCDDs) | |
| styrene | |

endocrine disruptors, it is difficult to predict if these chemicals would present risk to humans and non-human receptors. Nevertheless, the fact that so many of these chemicals are present among the constituents may cause concern.

Potential for Frequent Occurrence in Wastes. The combined list of known and possible non-hazardous industrial waste constituents were also searched to identify those chemicals with high potential for occurrence in wastes, as indicated by TRI releases and/or non-confidential TSCA Inventory production data. The results of this analysis are summarized in Exhibit 4-12. Constituents are included in the table only if either TRI release data or non-CBI TSCA inventory data are available for them.

Volatility and Persistence. As discussed in Section 3.5, volatility and persistence appear to be key indicators of potential risks for the TC analytes. In the first four columns of Exhibit 4-13, the known and possible non-hazardous industrial waste constituents are screened against these properties. Vapor pressure of $1.3x10^{-3}$ atmosphere (which is approximately equivalent to 1 mm Hg) is used to identify volatile chemicals. This measure approximates the potential to volatilize; many chemicals with lower vapor pressure could volatilize readily under certain waste management conditions. Even so, 70 known or possible non-hazardous industrial waste constituents fall into this category. This

**Exhibit 4-12 TRI Releases and Non-Confidential TSCA Production Volume Data for the Known and Possible N Hazardous Industrial Waste Constituents**

## Exhibit 4-13 Volatility, Persistence, and Bioaccumulation/Bioconcentration Summary Potential of Known and Possible Non-Hazardous Industrial Was Constituents

finding suggests that, as for the volatile TC analytes, volatilization releases and inhalation exposures (and possibly indirect exposures) may be a concern for some of these chemicals.

Two chemicals, both chlorinated organics, are identified as having long half-lives (greater than 0.15 year) in air. This finding does not mean that all of the other constituents are too short-lived to be of concern through air exposures. Half-lives on the order of a few hours or days also may be of concern in terms of direct inhalation exposures. This criterion is more indicative of the potential for long-range (e.g., regional or global-scale) transport of these chemicals in the vapor phase. Also, as noted in Section 3.5, the air half-lives of many of the inorganic waste constituents (especially the metals) bound to particulates would also be limited only by how long the particles remained suspended in the atmosphere.

The third column of Exhibit 4-13 identifies the non-hazardous industrial waste constituents that are relatively persistent either in soils or in the water column. The metals all fall into this category, along with the PAHs, many chlorinated pesticides, and 2,3,7,8-TCDD. The only volatile organic chemical in this category is 1,2-dichloropropane. Appearance in this category arouses concern for potential inhalation and indirect pathway exposure risks, as discussed in Section 3.5.

A high Kow, as indicated in the fourth column, indicates a high potential to bind to soil organic matter. It is highly correlated with the tendency to bioaccumulate. Thirty-one of the known and possible waste constituents including many persistent pesticides and PAHs, are in this category.

Bioaccumulation Potential. The last three columns of Exhibit 4-13 indicate the potential for bioaccumulation by the known and possible non-hazardous industrial waste constituents in aquatic and terrestrial food chains. The constituents with aquatic BCFs or BAFs greater than 1,000 are limited to the chlorinated pesticides, several phthalate esters, and diethylstilbestial (DES). This finding does not imply that no other constituents present significant risks through indirect pathways; nevertheless, the identified chemicals are all clearly recognized as being problematic from the point of view of bioconcentration. If these chemicals were released in significant amounts from non-hazardous waste industrial management activities, they could present substantial risks through food-chain exposures.

The last column of the table lists chemicals that are taken up from feed by beef cattle with above-average (greater than 75th percentile) efficiency. This list includes most chemicals that also are of potential concern for aquatic ecosystems. Also, several additional classes of chemicals are identified, including the metals and PAHs. Although the beef biotransfer factor is only one of many parameters determining the potential for risks to humans from beef consumption, it is a reasonable indicator of potential concern for this pathway and is a useful indicator of exposure potential in other terrestrial food chains.

LNAPL and DNAPL Formation. The potential to form nonaqueous phase liquids (NAPLs) is of great concern from the point of view of waste management risks. Historically, NAPLs have been serious problems in the Tis a rls or ihis pathwueous chemmbiasteuatr tattor d irdo93 Tw tocipr of mptorfrom taer

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[12] U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, Evaluation of the Likelihood of DNAPL Presence at NPL Sites, EPA 540-R-93-073, September 1993.

### 4.4.3 Screen Combined List Against Multiple Parameters

This section discusses the results of one last round of screening conducted on the entire combined list of known and possible non-hazardous industrial waste constituents. This analysis combines toxicity, persistence, volatility, and bioaccumulation screens in various combinations in order to identify the chemicals most likely to pose risks by various exposure pathways. Only constituents in the intersections of the screens remain (e.g., only constituents that are persistent and highly toxic). For human toxicity, the criteria have been applied in the following order:

- Persistent and Highly Toxic to Humans. This combination is intended to identify highly toxic chemicals that could pose risks through any pathways involving long-term release and transport of contaminants, such as groundwater and indirect pathways involving air, surface water, or groundwater releases.

- Persistent, Highly Toxic to Humans and Bioaccumulative. This screen narrows the above waste constituents to those with potential for adverse effects through indirect food chain exposure.

- Persistent, Highly Toxic to Humans, Bioaccumulative, and Volatile. This combination further narrows the above chemicals to those with potential to cause indirect pathway risks through air releases.

A fourth screen applied persistent, ecotoxic, and bioaccumulative criteria to the combined list of constituents. This combination of screening criteria is intended to identify chemicals for which potential harm to ecological receptors is a potential concern.

The individual criteria used in combination are described in Section 4.3. The persistence screen consisted of a determination of whether the chemicals had soil or water column degradation rate constants of less than 0.5/year. "Highly toxic" indicates any chemical having a CSF or Unit Risk above the 50th percentile of all chemicals, or a chronic RfD below the 50th percentile. Volatility was screened against Henry's Law constant of $10^{-5}$ atm-$m^3$/mole, and bioaccumulation potential determined by an aquatic BCF or BAF value of greater than 1,000 L/Kg.

The results of the combined screening of known and possible non-hazardous industrial waste constituents are summarized in Exhibit 4-15. To a substantial degree, these results parallel the screening-level modeling results for the TC analytes discussed in Section 3.5. Four of the nine persistent and highly toxic chemicals are chlorinated pesticides or degradation products, along with three metals (antimony, beryllium, and molybdenum), benzo(a)pyrene, and 2,3,7,8-TCDD. The appearance of benzo(a)pyrene suggests that other high molecular weight PAHs (some of which are also carcinogens) might also pass this screen if CSF values were available for these compounds. In addition, several other chlorinated pesticides have properties that just miss the toxicity or persistence cutoff values.

When bioaccumulation potential is added to the screening conditions (second column of Exhibit 4-15), no chemicals drop out. This finding shows the high correlation between persistence and bioaccumulative potential: if a chemical was not persistent, it would lack the opportunity to accumulate in environmental media or tissue.

**Exhibit 4-15**
**Multiple Screening Criteria Applied to Known and Possible Non-Hazardous Industrial Waste Constituents**

| Persistent and Highly Toxic | Persistent, Highly Toxic, and Bioaccumulative | Volatile, Persistent, Highly Toxic, and Bioaccumulative | Persistent, Ecotoxic, and Bioaccumulative |
|---|---|---|---|
| 2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD) | 2,3,7,8-TCDD | Aldrin[a] | 2,3,7,8-TCDD |
| Aldrin[a] | Aldrin[a] | DDE | DDT[a] |
| Antimony | Antimony | DDT[a] | Dieldrin |
| Benzo[a]pyrene | Benzo[a]pyrene | | |
| Beryllium | Beryllium | | |
| DDE | DDE | | |
| DDT[a] | DDT[a] | | |
| Dieldrin | Dieldrin | | |
| Molybdenum | Molybdenum | | |

Notes:

[a] Use has been cancelled under FIFRA.

When the criterion of volatility is added to the preceding screens, three chemicals, all persistent pesticides remain. This result again parallels the results seen for the TC analytes in Section 3.5. If vapor pressure cutoff (1 mm Hg), rather than Henry's Law constant ($10^{-5}$ atm.-$M^3$/mole) is used to characterize the potential to volatilize, none of the chemicals qualify in this category.

The last column of Exhibit 4-15 identifies persistent, bioaccumulative, and ecotoxic chemicals. As might be expected from the previous screening results, these chemicals include chlorinated pesticides and 2,3,7,8-TCDD. Because the AWQC screen is based only on harmful concentrations, it does not include any screening for the concentrations normally encountered in the environment. Thus, if a much less toxic chemical (for example zinc or copper) were released into the environment in much larger amounts than the pesticides, the exposure concentrations might be much greater and adverse effects on ecological receptors might occur.

## 4.5 Driving Risk Pathways for the Known and Possible Non-Hazardous Industrial Waste Constituents

EPA has previously evaluated the potential risks associated with the management of many known and possible non-hazardous industrial waste constituents in the context of deriving proposed risk-based exit levels for the proposed HWIR-Waste rulemaking. As discussed in Section 3.5, these proposed exit levels were derived by back-calculating concentrations in wastewaters and nonwastewaters corresponding to acceptable risk levels. The magnitude of the modeled exit levels is inversely proportional to the magnitude of risk posed by the chemical when placed in the specified management units. Proposed exit levels are calculated for groundwater exposures and other pathways. Thus, the proposed exit levels also indicate the relative importance of the exposure pathways for each chemical.

Exhibit 4-16 tabulates the exit levels for 128 of the known or possible non-hazardous industrial waste constituents (i.e., the entire combined list prior to any screens that were also addressed in the HWIR-waste proposed rulemaking), and the exposure pathways that were risk drivers for setting the exit levels. As in the case of the similar analysis for the TC analytes in Section 3.5, many of the known or possible non-hazardous industrial waste constituents have proposed exit levels that are quite low (68 are below 0.1 mg/l). Therefore, the Agency has determined that the presence of these constituents in wastes at even relatively low concentrations may pose significant risks to human health. Again it should be noted that the target cancer risk level used to derive the exit levels was $10^{-6}$, rather than the $10^{-5}$ level used in the derivation of TC regulatory levels. Even so, these levels indicate potential cause for concern for many of these chemicals at even low concentrations in wastes.[15]

As was also the case for the TC analytes, non-groundwater pathway risks drive the establishment of exit levels for about one-quarter of the known or possible non-hazardous industrial waste constituents. The driving pathways include direct inhalation and vegetable and milk ingestion. Pesticides make up a large proportion of the chemicals for which non-groundwater pathways drive the risks, but many volatile chlorinated and nonchlorinated organics also fall into this category. Ecological, rather than human health risks, drive the setting of proposed exit levels for two chemicals (copper and parathion). These findings confirm the indications from the toxicity and fate and transport screening presented in the previous sections that inhalation and indirect pathways could be of concern for many of the known or possible non-hazardous industrial waste constituents.

## 4.6 Potential Acute Hazards Associated With Known and Possible Non-Hazardous Industrial Waste Constituents

To this point, the evaluation of the potential hazards associated with the possible and known non-

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[15] The Agency is currently revising the proposed HWIR-Waste exit level risk modeling methods in response to comments from the Science Advisory Board and other reviewers. Thus, the proposed exit levels shown in Exhibit 4-15 should be regarded as preliminary.

[16] Edelstein, Maravene, "Memorandum to Paul Tobin on the Subject of a Database of Chemicals of Interest for Short Term Inhalation Exposure," September 1993. Sources of data for the database include the Emergency Planning and Community Right-to-Know Act (EPCRA) (40 CFR Part 355), Section 112(r) of the Clean Air Act (CAA) (40 CFR Part 68), and the Occupational Safety an Health Administration (OSHA) Process Safety Management (PSM) Standard (29 CFR Part 1910).

## Exhibit 4-16 (continued)
## Lowest Proposed HWIR-Waste Exit Levels for Known and Possible Non-Hazardous Industrial Waste Constituents

## Exhibit 4-16 (continued)
## Lowest Proposed HWIR-Waste Exit Levels for Known and Possible Non-Hazardous Industrial Waste Constituents

## Exhibit 4-17
## Potential Acute Hazards Associated with Known and Possible Non-Hazardous Industrial Waste Constituents

| Acutely Toxic Chemicals | | Highly Flammable Chemicals | Highly Reactive Chemicals |
|---|---|---|---|
| 1,1,1-Trichloroethane | Furan | 1,3-Butadiene | 1,3,5-Trinitrobenzene |
| 1,3-Butadiene | Hydrazine | Acetaldehyde | 2,4,6-Trinitrotoluene |
| Acetaldehyde | Hydrogen cyanide | Chloroethane | |
| Acrolein | Hydrogen fluoride | Chloromethane | |
| Acrylonitrile | Hydrogen sulfide | Dimethylamine | |
| Allyl alcohol | Methacrylonitrile | Ethane, 1,1'-oxybis- | |
| Allyl chloride | Methanol | Ethylene oxide | |
| Ammonia | Methyl iodide | Formaldehyde | |
| Arsine | Methyl isocyanate | Furan | |
| Bis(chloromethyl) ether | Methyl mercaptan | Hydrogen cyanide | |
| Bromomethane | Nickel carbonyl | Hydrogen sulfide | |
| Carbon disulfide | Nitric oxide | Methyl mercaptan | |
| Chlorine | Nitrogen dioxide | Phosphine | |
| Chlorine dioxide | Phosgene | Propylene oxide | |
| Chloromethane | Phosphine | Vinylidene chloride | |
| Epichlorohydrin | Propylene oxide | | |
| Ethylene oxide | Toluene | | |
| Fluorine | Vinyl acetate | | |
| Formaldehyde | Xylene (mixed isomers) | | |

Notes:

[a] See text for categorization criteria.

adverse effects will occur, only that such effects could potentially be associated with management of wastes containing these chemicals.

Fifteen of the waste constituents are also identified as being highly flammable.[17] These are mostly volatile organics, along with a few inorganic gases and liquids. They substantially overlap with the previous list. Only two of the known or possible non-hazardous industrial waste constituents are identified as being highly reactive.

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[17] ICF Incorporated, Draft Physical/Chemical Properties Criteria Database, October 1987. Sources of data for the database include the Department of Transportation (DOT) Hazardous Materials Table (49 CFR 172.101) and the National Fire Protection Association (NFPA) publication 325M, Fire Hazard Properties of Flammable Liquids, Gases, and Volatile Solids.

## Exhibit 4-18

## Potential Gaps in the Hazardous e f 539.04 302.4 112.16 1.2 re f 209.28 0f 209.28 v;racteristi4-v Id

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| Potential Gap | Basis for Identification | Important Unresolved Issues, Data Gaps |
|---|---|---|
| Potential for LNAPL and DNAPL | Large number of waste constituents have | NAPL formation is highly dependent on |
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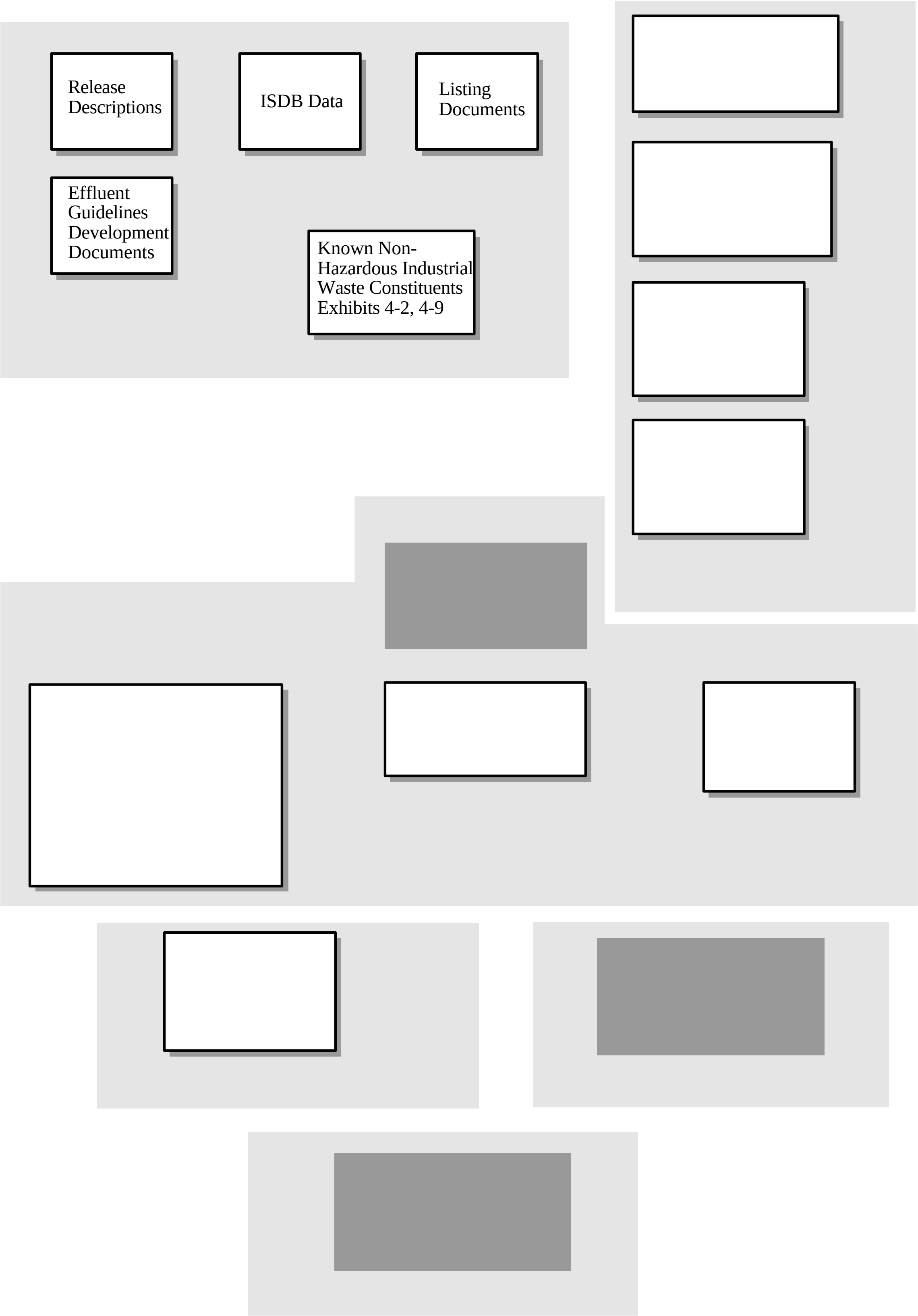
Release Descriptions
ISDB Data
Listing Documents
Effluent Guidelines Development Documents
Known Non-Hazardous Industrial Waste Constituents Exhibits 4-2, 4-9

## EXHIBIT 4-7 SCREENING OF HIGH-TOXICITY, PERSISTENT, BIOACCUMULATIVE/BIOCONCENTRATING POSSIBLE NON-HAZARDOUS WASTE CONSTITUENTS AGAINST TRI RELEASE VOLUMES

| Chemical CAS | Chemical Name | Release Volume | Oral CSF | Inhalation Unit Risk | Oral RfD < 50th | RfC < 50th | AWQC (Chronic) < 50th | Degradation Rate for Water Column | Fish BCF | Henry's Law Constant | Kow | Soil Degradation Rate | Vapor Pressure > 1_3e-3 | Beef Biotransfer Factor >7_8e-4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0000076-13-1 | Freon 113 | 5,077,542 | | | | | | | | ✔ | | | ✔ | |
| 0000106-99-0 | 1,3-Butadiene | 2,711,287 | | ✔ | | | | | | | | | | |
| 0010049-04-4 | Chlorine dioxide | 1,501,041 | | | | ✔ | | | | | | | | |
| 0000126-99-8 | Chloroprene | 1,157,755 | | | | | | | | ✔ | | | ✔ | |
| 0000075-56-9 | Propylene oxide | 1,076,879 | ✔ | ✔ | | | | | | | | | | |
| 0000101-68-8 | Methylenebis(phenylisocyanate) | 846,938 | | | | ✔ | | | | | | | | |
| 0000103-23-1 | Bis(2-ethylhexyl) adipate | 844,594 | ✔ | | | | | | | | | | | |
| 0001163-19-5 | Decabromodiphenyl oxide | 469,811 | | | ✔ | | | | | | | | | |
| 0001332-21-4 | | | | | | | | | | | | | | |

## EXHIBIT 4-7 (CONTINUED)
## SCREENING OF HIGH-TOXICITY, PERSISTENT, BIOACCUMULATIVE/BIOCONCENTRATING POSSIBLE NON-HAZARDOUS WASTE CONSTITUENTS AGAINST TRI RELEASE VOLUMES

| Chemical CAS | Chemical Name | Release Volume | Oral CSF | Inhalation Unit Risk | Oral RfD < 50th | RfC < 50th | AWQC (Chronic) < 50th | Degradation Rate for Water Column | Fish BCF |
|---|---|---|---|---|---|---|---|---|---|

## EXHIBIT 4-7 (CONTINUED)
## SCREENING OF HIGH-TOXICITY, PERSISTENT, BIOACCUMULATIVE/BIOCONCENTRATING POSSIBLE NON-HAZARDOUS WASTE CONSTITUENTS AGAINST TRI RELEASE VOLUMES

| Chemical CAS | Chemical Name | Release Volume | Oral CSF | Inhalation Unit Risk | Oral RfD < 50th | RfC < 50th | AWQC (Chronic) < 50th | Degradation Rate for Water Column | Fish BCF | Henry's Law Constant | Kow | Soil Degradation Rate | Vapor Pressure > 1_3e-3 | Beef Biotransfer Factor >7_8e-4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0067747-09-5 | Prochloraz | | ✔ | | ✔ | | | | | | | | | |
| 0085509-19-9 | NuStar | | | | ✔ | | | | | | | | | |
| 0077501-63-4 | Lactofen | | | | ✔ | | | | | | | | | |
| 0077182-82-2 | Glufosinate ammonium | | | | ✔ | | | | | | | | | |
| 0076578-14-8 | Quizalofop-ethyl | | | | ✔ | | | | | | | | | |
| 0072178-02-0 | Fomesafen | | ✔ | | | | | | | | | | | |
| 0069806-40-2 | Haloxyfop methyl | | | | ✔ | | | | | | | | | |
| 0032536-52-0 | Octabromodiphenyl ether | | | | ✔ | | | | | | | | | |
| 0068085-85-8 | Cyhalothrin | | | | ✔ | | | | | | | | | |
| 0039638-32-9 | Bis(2-chloroisopropyl) ether | | | | | | | | | ✔ | | | | |
| 0067485-29-4 | Hydramethylnon | | | | ✔ | | | | | | | | | |
| 0065195-55-3 | Avermectin B1 | | | | ✔ | | | | | | | | | |
| 0062476-59-9 | Acifluorfen, sodium salt | | | | ✔ | | | | | | | | | |
| 0060568-05-0 | Furmecyclox | | ✔ | | | | | | | | | | | |
| 0060207-90-1 | Propiconazole | | | | ✔ | | | | | | | | | |
| 0055285-14-8 | Carbosulfan | | | | ✔ | | | | | | | | | |
| 0042874-03-3 | Oxyfluorfen | | | | ✔ | | | | | | | | | |
| 0069409-94-5 | Fluvalinate | | | | ✔ | | | | | | | | | |
| 0001314-84-7 | Zinc phosphide | | | | ✔ | | | | | | | | | |
| 0002385-85-5 | Mirex | | | | ✔ | | ✔ | | | | | | | |
| 0002303-16-4 | Diallate | | | | | | | | ✔ | | | | | |
| 0002104-64-5 | EPN | | | | ✔ | | | | | | | | | |
| 0001929-77-7 | Carbamothioic acid, dipropyl-, S-propyl ester | | | | ✔ | | | | | | | | | |
| 0001918-16-7 | Propachlor | | | | ✔ | | | | | | | | | |
| 0001646-88-4 | Aldicarb sulfone | | | | ✔ | | | | | | | | | |
| 0002425-06-1 | Captafol | | | | ✔ | | | | | | | | | |
| 0001309-64-4 | Antimony trioxide | | | | | ✔ | | | | | | | | |
| 0001116-54-7 | N-Nitrosodiethanolamine | | ✔ | | | | | | | | | | | |
| 0000950-37-8 | Methidathion | | | | ✔ | | | | | | | | | |
| 0000944-22-9 | Fonofos | | | | ✔ | | | | | | | | | |
| 0000930-55-2 | N-Nitrosopyrrolidine | | ✔ | ✔ | | | | | | | | | | |
| 0101200-48-0 | Tribenuron methyl | | | | ✔ | | | | | | | | | |
| 0000886-50-0 | Terbutryn | | | | ✔ | | | | | | | | | |
| 0000055-18-5 | N-Nitrosodiethylamine | | ✔ | ✔ | | | | | | | | | ✔ | |
| 0001910-42-5 | Paraquat dichloride | | | | ✔ | | | | | | | | | |
| 0007791-12-0 | Thallium chloride TlCl | | | | ✔ | | | | | | | | | |
| 0010595-95-6 | N-Nitrosomethylethylamine | | ✔ | | | | | | | | | | ✔ | |
| 0010265-92-6 | Methamidophos | | | | ✔ | | | | | | | | | |
| 0010102-45-1 | Thallium(I) nitrate | | | | ✔ | | | | | | | | | |
| 0002303-17-5 | Triallate | | | | ✔ | | | | | | | | | |
| 0008065-48-3 | Demeton | | | | ✔ | | ✔ | | | | | | | |
| 0002439-10-3 | Dodine | | | | ✔ | | | | | | | | | |
| 0007784-42-1 | Arsine | | | | | ✔ | | | | | | | | |
| 0007783-00-8 | Selenious acid | | | | ✔ | | | | | | | | | |
| 0007487-94-7 | Mercuric chloride | | | | ✔ | | | | | | | | | |
| 0007446-18-6 | Thallium(I) sulfate | | | | ✔ | | | | | | | | | |
| 0007287-19-6 | Prometryn | | | | ✔ | | | | | | | | | |
| 0006533-73-9 | Thallium(I) carbonate | | | | ✔ | | | | | | | | | |
| 0005902-51-2 | Terbacil | | | | ✔ | | | | | | | | | |
| 0002921-88-2 | Chlorpyrifos | | | | ✔ | | ✔ | | | | | | | |
| 0010061-01-5 | cis-1,3-Dichloropropene | | | | | | | | | ✔ | | | ✔ | |

## EXHIBIT 4-9 SCREENING OF KNOWN NON-HAZARDOUS WASTE CONSTITUENTS AGAINST TRI RELEASE VOLUMES

| Chemical CAS | Chemical Name | Release Volume | Oral CSF | Inhalation Unit Risk | Oral RfD < 50th | RfC < 50th | Beef Biotransfer Factor >7_8e-4 | AWQC (Chronic) < 50th |
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### EXHIBIT 4-9 (CONTINUED)
### SCREENING OF KNOWN NON-HAZARDOUS WASTE CONSTITUENTS AGAINST TRI RELEASE VOLUMES

| Chemical CAS | Chemical Name | Release Volume | Oral CSF | Inhalation Unit Risk | Oral RfD < 50th | RfC < 50th | Beef Biotransfer Factor >7_8e-4 | AWQC (Chronic) < 50th | Degradation Rate for Water Column | Fish BAF | Fish BCF | Henry's Law Constant | Kow | Soil Degradation Rate | Vapor Pressure > 1_3e-3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0000107-02-8 | Acrolein | 170,087 | | | | ✔ | | | | | | ✔ | | | ✔ |
| 0007440-36-0 | Antimony | 128,663 | | | ✔ | | ✔ | | ✔ | | | | | ✔ | |
| 0000099-65-0 | m-Dinitrobenzene | 100,719 | | | ✔ | | | | | | | | | | |
| 0000074-95-3 | Methylene bromide | 77,545 | | | | | | | | | | ✔ | | | ✔ |
| 0007723-14-0 | Phosphorus | 50,768 | | | ✔ | | | | | | | | | | |
| 0007440-62-2 | Vanadium (fume or dust) | 41,023 | | | | | ✔ | | ✔ | | | | | ✔ | |
| 0000079-46-9 | 2-Nitropropane | 40,523 | | | | | | | | | | ✔ | | | ✔ |
| 0000051-28-5 | 2,4-Dinitrophenol | 39,344 | | | ✔ | | | | | | | | | | |
| 0000542-75-6 | 1,3-Dichloropropylene | 24,756 | | | ✔ | | | | | | | ✔ | | | ✔ |
| 0007440-41-7 | Beryllium | 23,795 | ✔ | ✔ | ✔ | | ✔ | | ✔ | | | | | ✔ | |
| 0000075-34-3 | Ethylidene Dichloride | 23,492 | | | | | | | | | | ✔ | | | ✔ |
| 0000100-44-7 | Benzyl chloride | 23,331 | ✔ | | | | | | | | | ✔ | | | ✔ |
| 0000106-93-4 | 1,2-Dibromoethane | 18,537 | ✔ | ✔ | | | | | | | | ✔ | | | ✔ |
| 0000302-01-2 | Hydrazine | 16,956 | ✔ | ✔ | | | | | | | | | | | |
| 0000120-83-2 | 2,4-Dichlorophenol | 14,760 | | | ✔ | | | | | | | | | | |
| 0000079-34-5 | 1,1,2,2-Tetrachloroethane | 14,027 | ✔ | ✔ | | | | | | | | ✔ | | | ✔ |
| 0000630-20-6 | 1,1,1,2-Tetrachloroethane | 11,746 | ✔ | ✔ | | | | | | | | ✔ | | | ✔ |
| 0000077-47-4 | Hexachlorocyclopentadiene | 9,174 | | | ✔ | | ✔ | ✔ | | | ✔ | ✔ | ✔ | | |
| 0000111-44-4 | Bis(2-chloroethyl) ether | 3,237 | ✔ | ✔ | | | | | | | | ✔ | | | ✔ |
| 0000137-26-8 | Thiram | 3,184 | | | ✔ | | | | | | | | | | |
| 0000098-07-7 | Benzoic trichloride | 2,868 | ✔ | | | | | | | | | | | | |
| 0000056-38-2 | Parathion | 1,147 | | | | | | ✔ | | | | | | | |
| 0007440-28-0 | Thallium | 1,010 | | | | | ✔ | | ✔ | | | | | ✔ | |
| 0000075-27-4 | Dichlorobromomethane | 0 | ✔ | | | | | | | | | ✔ | | | ✔ |
| 0000086-30-6 | N-Nitrosodiphenylamine | 0 | ✔ | | | | | | | | | ✔ | | | |
| 0001336-36-3 | Polychlorinated biphenyls | 0 | ✔ | | | | ✔ | ✔ | | | | ✔ | ✔ | | |
| 0000096-18-4 | 1,2,3-Trichloropropane | | | | ✔ | | | | | | | ✔ | | | ✔ |
| 0000095-94-3 | 1,2,4,5-Tetrachlorobenzene | | | | ✔ | | ✔ | | | ✔ | | ✔ | | | |
| 0000096-12-8 | 1,2-Dibromo-3-chloropropane | | | | | ✔ | | | | | | ✔ | | | |
| 0000156-60-5 | 1,2-Dichloroethylene, trans | | | | | | | | | | | ✔ | | | ✔ |
| 0000122-66-7 | 1,2-Diphenylhydrazine | | ✔ | ✔ | | | | | | | | | | | |
| 0000058-90-2 | 2,3,4,6-Tetrachlorophenol | | | | | | | | | | ✔ | ✔ | | | |
| 0001746-01-6 | 2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD) | | ✔ | | | | ✔ | ✔ | ✔ | | | | ✔ | ✔ | |
| 0000057-97-6 | 7,12-Dimethylbenz[a]anthracene | | | | | | ✔ | | | | | | ✔ | | |
| 0000083-32-9 | Acenaphthene | | | | | | | | | | | ✔ | | | |
| 0000067-64-1 | Acetone | | | | | | | | | | | ✔ | | | ✔ |
| 0000116-06-3 | Aldicarb | | | | ✔ | | | | | | | | | | |
| 0000309-00-2 | Aldrin | | ✔ | ✔ | ✔ | | ✔ | | ✔ | | ✔ | ✔ | ✔ | ✔ | |
| 0000959-98-8 | alpha - Endosulfan | | | | | | | ✔ | | | | | | | |
| 0000319-84-6 | alpha-Hexachlorocyclohexane | | ✔ | ✔ | | | | | | ✔ | | | | | |
| 0000056-55-3 | Benz[a]anthracene | | | | | | ✔ | | ✔ | | | | ✔ | ✔ | |
| 0000218-01-9 | Benzo(a)phenanthrene | | | | | | ✔ | | ✔ | | | | ✔ | ✔ | |
| 0000050-32-8 | Benzo[a]pyrene | | ✔ | | | | ✔ | | ✔ | | | | ✔ | ✔ | |
| 0000205-99-2 | Benzo[b]fluoranthene | | | | | | ✔ | | ✔ | | | ✔ | ✔ | ✔ | |
| 0033213-65-9 | beta - Endosulfan | | | | | | | ✔ | | ✔ | | | | | |

## EXHIBIT 4-10 TOXICITY SUMMARY OF KNOWN AND POSSIBLE NON-HAZARDOUS INDUSTRIAL WASTE CONSTITUENTS

| Inhalation Unit Risk (All) | Inhalation Unit Risk > 50th Percentile | Oral CSF (All) | Oral CSF > 50th Percentile | Oral RfD < 50th Percentile | Oral RfD < 50th Percentile (Continued) | AWQC (Chronic Freshwater) < 50th Percentile |
|---|---|---|---|---|---|---|
| 1,1,1,2-Tetrachloroethane | Acrylamide | 1,1,1,2-Tetrachloroethane | 1,2-Dibromoethane | 1,1,2 Trichloropropane | Glycidylaldehyde | 2,3,7,8-TCDD |
| 1,1,2,2-Tetrachloroethane | Aldrin | 1,1,2,2-Tetrachloroethane | 1,2-Diphenylhydrazine | 1,1,2-Trichloroethane | Haloxyfop methyl | alpha - Endosulfan |
| 1,1,2-Trichloroethane | alpha-Hexachlorocyclohexane | 1,1,2-Trichloroethane | 2,3,7,8-TCDD | 1,2,3-Trichloropropane | Hexabromobenzene | Antimony |
| 1,2-Dibromoethane | Benzidine | 1,2-Dibromoethane | Acrylamide | 1,2,4 Tribromobenzene | Hexachlorocyclopentadiene | Azinphos-methyl |
| 1,2-Diphenylhydrazine | Beryllium | 1,2-Diphenylhydrazine | Acrylonitrile | 1,2,4,5-Tetrachlorobenzene | Hexachloroethane | beta - Endosulfan |
| 1,3-Butadiene | beta-BHC | 1,4-Dioxane | Aldrin | 1,2,4-Trichlorobenzene | Hydramethylnon | Chlorpyrifos |
| Acetaldehyde | Bis(2-chloroethyl) ether | 2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD) | alpha-Hexachlorocyclohexane | 1,3,5-Trinitrobenzene | Hydrogen sulfide | Copper |
| Acrylamide | Coal tars | 2,4,6-Trinitrotoluene | Benzo[a]pyrene | 1,3-Dichloropropylene | Imazalil | Cyanides (soluble salts and complexes) |
| Acrylonitrile | Dieldrin | 4,4'-Methylenebis(N,N-dimethyl)benzenamine | Benzoic trichloride | 1,3-Phenylenediamine | Lactofen | DDT |
| Aldrin | Hexachlorocyclohexane | Acephate | Beryllium | 1,4 Dibromobenzene | Linuron | Demeton |
| alpha-Hexachlorocyclohexane | HxCDD, mixture | Acrylamide | beta-BHC | 1,4 Dithiane | m-Dinitrobenzene | Dieldrin |
| Aramite | Hydrazine | Acrylonitrile | Bis(2-chloroethyl) ether | 2,3 Dichloropropanol | Mecoprop | Endosulfan |
| Azobenzene | N-Nitrosodi-n-butylamine | Aldrin | DDE | 2,4,5-T acid | Mercuric chloride | Hexachlorocyclopentadiene |
| Beryllium | N-Nitrosodiethylamine | alpha-Hexachlorocyclohexane | DDT | 2,4,6-Trinitrotoluene | Merphos | Hydrogen sulfide |
| beta-BHC | N-Nitrosodimethylamine | Aniline | Dieldrin | 2,4-DB | Methamidophos | Malathion |
| Bis(2-chloroethyl) ether | N-Nitrosopyrrolidine | Aramite | Hexachlorocyclohexane | 2,4-Dichlorophenol | Methidathion | Mirex |
| Bis(chloromethyl) ether | Nickel subsulfide | Azobenzene | HxCDD, mixture | 2,4-Dinitrophenol | Methoxone | Parathion |
| Bromoform | | Benzo[a]pyrene | Hydrazine | 2,6-Dimethylphenol | Methyl mercury | Polychlorinated biphenyls |
| Coal tars | | Benzoic trichloride | N-Nitrosodi-n-butylamine | 2-Chlorophenol | Methyl parathion | |
| DDT | | Benzyl chloride | N-Nitrosodi-n-propylamine | 2-Cyclohexyl-4,6-dinitrophenol | Mirex | |
| Dichloromethane | | Beryllium | N-Nitrosodiethanolamine | 3,4 Dimethylphenol | Molinate | |
| Dieldrin | | beta-BHC | N-Nitrosodiethylamine | Acephate | Molybdenum | |
| Epichlorohydrin | | Bis(2-chloroethyl) ether | N-Nitrosodimethylamine | Acetaldehyde, trichloro- | Naled | |
| Formaldehyde | | Bromoform | N-Nitrosomethylethylamine | Ace Tj 123.84 0 TD 0.0456 Tc (Molybdenum | Tc (Molyled) Tj -552.40528 | TcTD 0.03As243w (DDT) Tj 214.32 0 TD 0.6.16 |

## EXHIBIT 4-12 TRI RELEASES AND NON-CONFIDENTIAL TSCA PRODUCTION VOLUME DATA FOR THE KNOWN AND POSSIBLE NON-HAZARDOUS INDUSTRIAL WASTE CONSTITUENTS

| Chemical CAS | Chemical Name | 1994 TRI Release Volume > 1 million lbs. | 1994 Non-Confidential TSCA Production Volume > 1 million lbs. |
|---|---|---|---|
| | **Known Chemicals** | | |
| 0000071-55-6 | 1,1,1-Trichloroethane | X | |
| 0000079-00-5 | 1,1,2-Trichloroethane | | X |
| 0000095-63-6 | 1,2,4-Trimethylbenzene | X | |
| 0000107-06-2 | 1,2-Dichloroethane | X | |
| 0000542-75-6 | 1,3-Dichloropropylene | | X |
| 0000075-07-0 | Acetaldehyde | X | |
| 0000075-05-8 | Acetonitrile | X | X |
| 0000079-06-1 | Acrylamide | X | X |
| 0000079-10-7 | Acrylic acid | X | |
| 0000107-13-1 | Acrylonitrile | X | |
| 0007429-90-5 | Aluminum (fume or dust) | X | |
| 0007664-41-7 | Ammonia | X | |
| 0000062-53-3 | Aniline | X | |
| ---- | Antimony compounds | X | |
| 0000071-43-2 | Benzene | X | |
| 0000074-83-9 | Bromomethane | X | CBI |
| 0000075-15-0 | Carbon disulfide | X | |
| 0000056-23-5 | Carbon tetrachloride | | X |
| 0007782-50-5 | Chlorine | X | |
| 0000108-90-7 | Chlorobenzene | X | |
| 0000075-00-3 | Chloroethane | X | |
| 0000067-66-3 | Chloroform | X | X |
| 0000074-87-3 | Chloromethane | X | |
| 0007440-47-3 | Chromium | X | |
| 0007440-50-8 | Copper | X | |
| 0008001-58-9 | Creosote | X | |
| 0001319-77-3 | Cresol (mixed isomers) | X | |
| 0000098-82-8 | Cumene | X | |
| ---- | Cyanide compounds | X | |
| 0000075-71-8 | Dichlorodifluoromethane | X | |
| 0000075-09-2 | Dichloromethane | X | |
| 0000100-41-4 | Ethylbenzene | X | |
| 0000107-21-1 | Ethylene glycol | X | |
| 0000050-00-0 | Formaldehyde | X | |
| 0000064-18-6 | Formic acid | X | |
| ---- | Glycol Ethers | X | |
| 0000067-72-1 | Hexachloroethane | | X |
| 0000074-90-8 | Hydrogen cyanide | X | |
| 0007664-39-3 | Hydrogen fluoride | X | |
| 0007783-06-4 | Hydrogen sulfide | | X |
| 0007439-96-5 | Manganese | X | |
| 0000067-56-1 | Methanol | X | |
| 0000078-93-3 | Methyl ethyl ketone | X | |
| 0000108-10-1 | Methyl isobutyl ketone | X | |
| 0000080-62-6 | Methyl methacrylate | X | |
| 0000071-36-3 | n-Butyl alcohol | X | |
| 0000091-20-3 | Naphthalene | X | |
| ---- | Nickel compounds | X | |
| 0000095-47-6 | o-Xylene | X | |
| 0000106-42-3 | p-Xylene | X | |
| 0000108-95-2 | Phenol | X | |
| 0000100-42-5 | Styr82424 Tc (X) Xj -198.24 -9i7 Tc (X) Tj -198.24 -9.36 39 0.0644Tetrc (0000067c (0000106-42-3) Tj 57.12 0 TD -0.0414 T112D 0.00 | | |

## EXHIBIT 4-13 VOLATILITY, PERSISTENCE, AND BIOACCUMULATION/BIOCONCENTRATION SUMMARY POTENTIAL OF KNOWN AND POSSIBLE NON-HAZARDOUS INDUST

| Vapor Pressure > 1.3e-3 atm. | Air Half-Life > 75th Percentile | Low Soil/Water Degradation Constant (< 0.5) | Kow >$10^5$ | High Fish BAF (>1000) | High Fish BCF (>1000) |
|---|---|---|---|---|---|
| 1,1,1,2-Tetrachloroethane | Dichloromethane | 1,2-Dichloropropane | 2,3,7,8-TCDD | 1,2,4,5-Tetrachlorobenzene | 2,3,4,6-Tetrachlorophenol |
| 1,1,1-Trichloroethane | Polychlorinated biphenyls | 2,3,7,8-TCDD | 3-Methylcholanthrene | alpha-Hexachlorocyclohexane | 3-Methylcholanthrene |
| 1,1,2,2-Tetrachloroethane | | 3-Methylcholanthrene | 7,12-Dimethylbenz[a]anthracene | beta-BHC | Aldrin |
| 1,1,2-Trichloroethane | | Aldrin | Aldrin | DDE | Butyl benzyl phthalate |
| 1,2,3-Trichloropropane | | Antimony | Benz[a]anthracene | DDT | Chlorobenzilate |
| 1,2-Dibromoethane | | Benz[a]anthracene | Benzo(a)phenanthrene | | DDD |
| 1,2-Dichlorobenzene | | Benzo(a)phenanthrene | Benzo[a]pyrene | | Diallate |
| 1,2-Dichloroethylene, trans | | Benzo[a]pyrene | Benzo[b]fluoranthene | | Dibutyl phthalate |
| 1,2-Dichloropropane | | Benzo[b]fluoranthene | DDD | | Dieldrin |
| 1,3-Dichloropropylene | | Beryllium | DDE | | Diethylstilbestrol |
| 1,4-Dioxane | | Copper | DDT | | Hexachlorocyclopentadiene |
| 2-Chlorophenol | | DDD | Di(2-ethylhexyl) phthalate | | Kepone |
| 2-Ethoxyethanol | | DDE | Dibenz[a,h]anthracene | | Pentachlorobenzene |
| 2-Nitropropane | | DDT | Dieldrin | | |
| Acetone | | Dibenz[a,h]anthracene | Diethylstilbestrol | | |
| Acetonitrile | | Dieldrin | Fluoranthene | | |
| Acrolein | | Indeno(1,2,3-cd)pyrene | Hexachlorocyclopentadiene | | |
| Acrylonitrile | | Kepone | Indeno(1,2,3-cd)pyrene | | |
| Allyl chloride | | Manganese | Kepone | | |
| Benzyl chloride | | Molybdenum | n-Dioctylphthalate | | |
| Bis(2-chloroethyl) ether | | Nickel | Pentachlorobenzene | | |
| Bromoform | | Pyrene | Polychlorinated biphenyls | | |
| Bromomethane | | Thallium | Pyrene | | |
| Carbon disulfide | | Vanadium (fume or dust) | | | |
| Chlorodibromomethane | | Zinc | | | |
| Chloromethane | | | | | |
| Chloroprene | | | | | |
| cis-1,2-Dichloroethylene | | | | | |
| cis-1,3-Dichloropropene | | | | | |
| Cumene | | | | | |
| Dichlorobromomethane | | | | | |
| Dichlorodifluoromethane | | | | | |
| Dichloromethane | | | | | |
| Epichlorohydrin | | | | | |
| Ethane, 1,1'-oxybis- | | | | | |
| Ethyl acetate | | | | | |
| Ethyl methacrylate | | | | | |
| Ethylbenzene | | | | | |
| Ethylidene Dichloride | | | | | |
| Formaldehyde | | | | | |
| Formic acid | | | | | |
| Freon 113 | | | | | |
| Furan | | | | | |
| Isobutyl alcohol | | | | | |
| Methanol | | | | | |
| Methyl isobutyl ketone | | | | | |
| Methyl methacrylate | | | | | |
| Methylene bromide | | | | | |
| n-Butyl alcohol | | | | | |
| N-Nitrosodi-n-propylamine | | | | | |
| N-Nitrosodiethylamine | | | | | |
| N-Nitrosodimethylamine | | | | | |
| N-Nitrosomethylethylamine | | | | | |
| p-Chloroaniline | | | | | |
| Styrene | | | | | |
| Toluene | | | | | |
| trans-1,3-Dichloropropene | | | | | |
| Trichlorofluoromethane | | | | | |
| Vinylidene chloride | | | | | |
| Xylene (mixed isomers) | | | | | |

**3lDUSTRKNOWWptn8H1o4STITUO**

## EXHIBIT 4-16 LOWEST PROPOSED EXIT LEVELS FOR CHEMICALS

| Constituent | Lowest Exit Level for chemicals from HWIR waste models (mg/L) | Model |
|---|---|---|
| 1,1,1,2-Tetrachloroethane | 0.0078 | Groundwater |
| 1,1,1-Trichloroethane | 0.0539 | Groundwater |
| **1,1,2,2-Tetrachloroethane** | **0.0037** | **Direct inhalation** |
| 1,1,2-Trichloroethane | 0.0018 | Groundwater |
| 1,2,3-Trichloropropane | 0.34 | Groundwater |
| 1,2,4,5-Tetrachlorobenzene | 0.0317 | Groundwater |
| **1,2,4-Trichlorobenzene** | **0.685** | **Direct inhalation** |
| 1,2-Dibromo-3-chloropropane | 0.000114 | Groundwater |
| 1,2-Dichlorobenzene | 6.1 | Groundwater |
| 1,2-Dichloropropane | 0.0023 | Groundwater |
| 1,3,5-Trinitrobenzene | 0.003 | Groundwater |
| 1,3-Dichloropropylene (1,3-Dichloropropene) | 0.00085 | Groundwater |
| 1,3-Phenylenediamine | 0.3 | Groundwater |
| 1,4-Dioxane | 0.0136 | Groundwater |
| 2,3,4,6-Tetrachlorophenol | 0.58 | Groundwater |
| 2,3,7,8-TCDD | 1.78E-10 | Groundwater |
| 2,4,5-T acid | 0.64 | Groundwater |
| 2,4-Dichlorophenol | 0.18 | Groundwater |
| 2,4-Dimethylphenol | 1.19 | Groundwater |
| 2,4-Dinitrophenol | 0.105 | Groundwater |
| 2,6-Dinitrotoluene | 0.064 | Groundwater |
| 2-Chlorophenol | 0.32 | Groundwater |
| **2-Ethoxyethanol** | **14.7** | **Direct inhalation** |
| **2-Nitropropane** | **0.00019** | **Direct inhalation-worker** |
| 3,3'-Dimethoxybenzidine | 0.0102 | Groundwater |
| 3-Methylcholanthrene | 1.41E-06 | Groundwater |
| 7,12-Dimethylbenz[a]anthracene | 2.76E-06 | Groundwater |
| Acenaphthene | 4.9 | Groundwater |
| Acetone | 6 | Groundwater |
| Acetonitrile | 0.3 | Groundwater |
| Acetophenone | 6.4 | Groundwater |
| **Acrolein** | **0.00248** | **Direct inhalation-worker** |
| Acrylamide | 0.000038 | Groundwater |
| Acrylonitrile | 0.00034 | Groundwater |
| **Aldrin** | **5.64E-07** | **Beef/milk ingestion** |
| **Allyl chloride** | **0.0742** | **Direct inhalation** |
| **alpha-Hexachlorocyclohexane** | **0.000142** | **Vegetable/root ingestion** |
| Aniline | 0.017 | Groundwater |
| Antimony | 0.053 | Groundwater |
| Benz[a]anthracene | 4.30E-06 | Groundwater |
| Benzidine | 6.80E-07 | Groundwater |
| Benzo(a)pyrene | 7.04E-06 | Groundwater |
| Benzo[b]fluoranthene | 0.0000661 | Groundwater |
| Benzyl alcohol | 15 | Groundwater |
| **Benzyl chloride** | **1.13** | **Vegetable/root ingestion** |
| Beryllium | 0.00032 | Groundwater |

## EXHIBIT 4-16 (CONTINUED - PAGE 2)
## LOWEST PROPOSED EXIT LEVELS FOR CHEMICALS

| Constituent | Lowest Exit Level for chemicals from HWIR waste models (mg/L) |
|---|---|

## EXHIBIT 4-16 (CONTINUED - PAGE 3)
## LOWEST PROPOSED EXIT LEVELS FOR CHEMICALS

| Constituent | Lowest Exit Level for chemicals from HWIR waste models (mg/L) | Model |
|---|---|---|
| m-Dinitrobenzene (1,3-Dinitrobenzene) | 0.0064 | Groundwater |
| Methanol | 30 | Groundwater |
| Methyl isobutyl ketone | 3 | Groundwater |
| Methyl methacrylate | | |

# CHAPTER 5. POTENTIAL GAPS ASSOCIATED WITH NATURAL RESOURCE DAMAGES AND LARGE-SCALE ENVIRONMENTAL PROBLEMS

This chapter discusses risks associated with non-hazardous industrial waste management that are not addressed in Chapters 3 or 4. Chapter 3 examined potential gaps inherent in the current hazardous waste characteristics, thereby focusing on the adverse effects that the characteristics were meant to address, namely risks arising primarily from acute events such as fires, explosions, and acute exposures of waste management and transportation workers, and health risks caused by local environmental contamination near waste management units. Chapter 4 examined potential gaps associated with adverse human health or localized ecological effects from constituents not included in the toxicity characteristic. This chapter addresses a third set of risks associated with non-hazardous industrial waste management.

- Section 5.1 addresses the pollution of groundwater by constituents that diminish the value and usability of the resource without threatening human health;

- Section 5.2 addresses damage from non-hazardous industrial waste management to air quality through odors that harm the quality of life but may not have severe health effects; and

- Section 5.3 examines possible contributions to regional and global environmental problems from the management of non-hazardous industrial waste, including: air deposition to the Great Waters, damages from airborne particulates, global climate change, potential damage from endocrine disruptors, red tides, stratospheric ozone depletion, tropospheric ozone and photochemical air pollution, and water pollution.

These environmental problems may or may not meet the RCRA statutory or regulatory definitions of the types of risks that the hazardous waste management program is meant to address.

## 5.1 Damage to Groundwater Resources

As noted in Chapter 2, the most common and well-documented impact of releases from non-hazardous industrial waste management is groundwater contamination. If contamination is present at high enough concentrations, the use of the groundwater as a water supply for human consumption or other use may result in adverse effects on health. Human health risks associated with exposure to toxic pollutants are not the only concern associated with groundwater contamination, however. Non-toxic pollutants such as iron, chloride, or total dissolved solids may be present in concentrations that damage the aesthetic qualities and usability of the water without posing outright health hazards. In areas where groundwater is used as a drinking water supply, such water pollution must be remediated, limitations must be placed on its use, and/or alternative sources must be found. These actions may be expensive and strain existing water supplies. Where alternative supplies are not economically available, groundwater resources of marginal quality, which do not exceed health-based levels, may continue to be used. Even where the polluted groundwater is not used for drinking water, the value of the resource may decline because it is no longer available for future use as drinking water without remediation.

This non-toxic pollution of groundwater from non-hazardous industrial waste management was found relatively often in the environmental release descriptions summarized in Chapter 2. Seventy-five (84 percent) of the 89 release descriptions with data on regulatory levels had constituents detected at levels exceeding non-health-based or non-ecologically-based standards, principally on aesthetic or usability criteria developed under the Safe Drinking Water Act as Secondary Maximum Contaminant Levels (SMCLs). Releases at 70 of these 75 sites also exceeded health and/or ecological-based standards. Of the 177 non-TC constituents identified in the release case studies, 9 constituents (plus pH and total dissolved solids) have SMCLs. (Some of these constituents also have health-based or ecologically-based levels.) Exhibit 5-1 lists all constituents with SMCLs and shows how frequently they were found among the 89 case studies where concentration and regulatory standards data were available. The most commonly detected constituents, iron, chloride, and manganese, all have SMCLs. Also, all SMCLs, except those for foaming agents, color, and corrosivity, were violated by at least several documented releases. (See Exhibit 2-6 for additional data on the concentrations at which these constituents were detected.)

**Exhibit 5-1**
**Constituents/Properties with SMCLs Found in Release Descriptions**

| Constituents/Properties | Number of Times Detected | Number of Times Detected Above SMCL |
|---|---|---|
| pH | 66 | 24 |
| Iron | 54 | 49 |
| Chloride | 52 | 32 |
| Sulfate | 50 | 29 |
| Total dissolved solids | 48 | 29 |
| Manganese | 39 | 34 |
| Zinc | 33 | 13 |
| Copper | 17 | 2 |
| Aluminum | 12 | 12 |
| Fluorides | 12 | these0.0luc 0.becau o286 Tdid da |

may have missed many cases of odor problems from non-hazardous industrial waste management facilities because state regulatory programs largely focus on groundwater concerns.  Also, odor problems are often handled at the local level and thus the states may not get involved.

The potential for odor problems clearly exists at non-hazardous industrial waste facilities that manage certain types of wastes.  For example, food processing facilities (e.g., slaughterhouses that must dispose of offal and alimentary contents from slaughtered animals) may have odor problems if their air releases are not carefully managed.  In addition to food wastes, potential odor problems may arise from chemical wastes.  Exhibit 5-2 lists a number of the chemicals identified in the release descriptions (although not necessarily for odor) that have extremely low odor thresholds in either air or water.  Ten of these chemicals have threshold odor concentrations in air (the lowest concentrations at which odors can be detected or recognized) of 0.01 mg/m$^3$ or less, and six of them can be detected by odor in water solutions at concentrations of 0.006 mg/l or less.

**Exhibit 5-2**
**Chemicals from Release Descriptions with Low Odor Thresholds**

| Chemical Name | ThresholdOdorConcentrationsin Air (mg/m$^3$) | Threshold Odor Concentrations in Water (mg/l) |
|---|---|---|
| 1,2,4-Trichlorobenzene | - | 0.005 |
| 2,4,6-Trichlorophenol | 0.001 | - |
| 2,4-Dimethylphenol | 0.001 | - |
| Acetophenone | 0.01 | - |
| Benzenethiol | 0.0005 | - |
| beta-BHC | - | 0.0003 |
| Chlordane | - | 0.0000025 |
|  | Ch1,R0715  Tc 88 0 9 Tc (0.055-2) TjDi (-)yl e Tw  Tc (Ch1,R0715  Tc 8 |  |
| 2,4-Dimethylphenol |  | -3l c2t/4o-.09  T 0.0036  Tc (-) Tj   -377.04 |

## 5.3 Large-Scale Environmental Problems

EPA considered whether any major large-scale environmental problems (e.g., global climate change, potenti -05 2.6975 1.0788 2.8125 1.3oe froms docri 1 0o0.06fuptors) might b TDaused65o TwF least to somg.,Liai1.07C b

**Exhibit 5-3. Initial List of Large-Scale Environmental Problems**

✓ Air deposition to the Great Waters
✓ Damages from airborne particulates
✓ Global climate change
✓ Potential damages from endocrine disruptors
✓ Red tides
✓ Stratospheric ozone depletion
✓ Tropospheric ozone and photochemical air pollution
✓ Water pollution

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[1] U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, *Deposition of Air Pollutants to the Great Waters, First Report to Congress*, EPA-453/R-93-055, May 1994.

combustion. At present, however, a complete and comprehensive inventory of the locations of particular sources and the amount of individual toxic pollutants that each source emits to the air is lacking. Nevertheless, EPA has identified several known air pollutants of concern for Great Waters. Exhibit 5-4 lists these pollutants and selected U.S. sources. Most pollutants in this exhibit are TC analytes, while a smaller set are chemicals (or chemical groups) of concern discussed in Chapter 4. Thus, these pollutants are likely candidates for further analysis as potential gaps in the hazardous waste characteristics.

**Exhibit 5-4. U.S. Sources of Air Pollutants of Concern for Great Waters**[a]

| **Pollutant** | |
|---|---|
| | |
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| | |
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| | |
| | |

biogenic. $CH_4$ would not be emitted but for the human activity of landfilling the waste, which creates anaerobic conditions conducive to $CH_4$ formation.[6] This approach does not distinguish between the timing of $CO_2$ emissions, provided that they occur in a reasonably short time scale relative to the speed of the processes that affect global climate change. That is, as long as the biogenic carbon would eventually be released as $CO_2$, it does not matter whether it is released virtually instantaneously (e.g., from combustion) or over a period of a few decades (e.g., decomposition on the forest floor).

$CO_2$ accounts for the largest share of U.S. GHG emissions, comprising 1,408 million metric tons of carbon equivalent (MMTCE) out of total 1994 U.S. emissions of 1,666 MMTCE.[7] Combustion of fossil fuels results in the vast majority of the $CO_2$ emissions (1,390 MMTCE), with the remainder from industrial processes such as cement production, lime production, limestone consumption (e.g., iron and steel production), soda ash production and use, and $CO_2$ manufacture. $CO_2$ emitted from landfills as a product of both aerobic and anaerobic decomposition of organic wastes is not counted, as described above.

Methane is the second most important GHG; U.S. emissions in 1994 were 166 MMTCE.[8] Of the anthropogenic sources, the largest is landfills (which contribute 36 percent of the total U.S. methane emissions), agricultural activities (32 percent), coal mining (15 percent), production and processing of natural gas and oil (11 percent), fossil fuel combustion (3 percent), and wastewater treatment (0.6 percent).[9] As explained above, $CH_4$ from landfills <u>is</u> counted as an anthropogenic GHG.

The majority of landfill $CH_4$ emissions result from MSW landfills (90 to 95 percent), with the remaining methane emitted from the disposal of industrial wastes. Methane emissions from large MSW landfills, however, are currently regulated under EPA's recent New Source Performance Standards and Emissions Guidelines,[10] which require collection and control of landfill gas. Small MSW landfills and industrial waste monofills are not subject to these new regulations and thus may warrant further investigation. This is particularly true for small landfills or monofills managing non-hazardousmall landfillsactivities (3hav88. higtS2bioch TD j ET q 480 52a2a2a2a2eons Guide

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[6] Because $CH_4$ has a higher global warming potential than $CO_2$, $CH_4$'s incremental global warming potential is counted.

[7] U.S. Environmental Protection Agency, Office of Policy Planning and Evaluation, *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-1994*, EPA 230-R-96-006, November 1995.

[8] *Ibid.*

[9] *Ibid.*

[10] 61 *Federal Register* 9905, March 12, 1996.

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[11] Several other terms are and have been used, such as persistent organic pollutants, which actually are a subset of PBTs.

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[16] Colborn, T., vom Saal, F.S., and Soto, A.M., "Developmental Effects of Endocrine-Disrupting Chemicals in Wildlife and Humans," Environmental Health Perspectives

tested. The identity of the chemical or chemicals in the sewage effluent causing the effects is not known, however. A number of chemicals known to be present in sewage effluent were tested for estrogenic effects in fish. These chemicals included nonylphenol, octylphenol, bisphenol-A, DDT, and PCBs. Furthermore, a mixture of different estrogenic chemicals was found to be considerably more potent than each of the chemicals when tested individually, a finding that recently was replicated.[22]

In addition to the effects described above, other documented endocrine disrupting effects in wildlife populations from industrial effluents have unknown causative agents. For example, kraft mill effluent caused a variety of effects in two fish species: white suckers and mosquitofish.[23] Lake Superior white suckers collected from a site receiving primary-treated bleached kraft mill effluent exhibited increased age to maturity, smaller

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[22] Arnold, S.F., et al., *supra* footnote 14.

[23] Munkittirck, K.R., Portt, C.B., Van Der Krakk, G.J., Smith, I.R., and Rokosh, D.A., "Impact of Bleached Kraft Mill Effluent on Population Characteristics, Liver MFO Activity, and Serum Steroid Levels of A Lake Superior White Sucker (*Catostomus Commersoni*) Population, Can. J. Fish. Aquat. Sci., 48:1371-1380, 1991.

[24] Davis, W.P., and Bortone, S.A., "Effects of Kraft Mill Effluent on the Sexuality of Fishes: An Environmental Early Warning?" in Colborn, T., and Clement, C. (Eds.), Chemically-Induced Alterations in Sexual and Functional Development: The Wildlife/Human Connection, Princeton Scientific Publishing, Princeton, N.J., pp. 113-127, 1992.

In conclusion, the evidence that alkylphenols, bisphenol-A, and phthalates are endocrine disruptors is based mainly on laboratory studies. The effects of these chemicals on wildlife populations is not known. Based on the endocrine disrupting effects of organochlorines on populations of fish, birds, reptiles, and mammals, however, it is possible that alkylphenols, bisphenol-A, phthalates, and other chemicals also could have endocrine disrupting effects in wildlife. Furthermore, as seen in Chapter 4, it is likely that some of these chemicals (e.g., the phthalates) are also components of several non-hazardous industrial wastes.

### 5.3.5 Red Tides

Red tides are rapid increases in growth (i.e., blooms) of freshwater and marine plants called dinoflagellates, which typically are microscopic unicellular organisms that photosynthesize but also have tails for movement. A red tide occurs when dinoflagellates multiply rapidly due to optimal growth conditions such as abundant dissolved nutrients and sunlight. They produce toxins to defend themselves from zooplankton and other aquatic grazers. The term red tides includes orange, brown, red, and even green blooms.

Shellfish, such as clams, mussels, oysters, or scallops, consume dinoflagellates and can accumulate the toxins in their flesh. Usually, the shellfish are not severely affected, but they can contain enough toxins to sicken and even kill humans. The recently discovered *Pfiesteria piscida* is one of many species of dinoflagellate that causes red tides. It produces potent toxins that cause bleeding sores in fish and can adversely affect humans via air releases. It recently has caused massive fish kills in the Neuse and Pamlico Rivers in North Carolina.[25]

Several case studies have shown the relationship between the levels of nutrients, such as phosphorus, nitrogen, silicon, and iron, in coastal and fresh waters, and the proliferation of red tides.[26] Studies also have shown that the high levels of nutrients and eutrophication of the water (which favors the development of red tides) are often caused by surrounding human development and industrial and domestic wastewaters.[27] Recent development of agribusiness and factory farms in coastal areas releases wastes with high levels of nutrients into the water that may favor red tides.[28]

Some researchers believe that the occurrence of red tides has been increasing over the years, although improvements in the monitoring and reporting of red tides could account for this.[29] Even if such an increase were occurring, however, a commensurate increase in human poisoning from ingestion of shellfish contaminated with dinoflagellate toxins has not been seen, likely because of the improved monitoring and reporting of red tides.[30]

Notwithstanding the potential link between red tides and constituents that are often found in non-hazardous industrial waste, little if any evidence has been found during this review concerning the degree to

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[25] Broad, W.J., "A Spate of Red Tides Menaces Coastal Seas," The New York Times, August 27, 1996; and Lewitus, A.J., R.V. Jesien, T.M. Kana, J.M. Burkholder, H.B., Jr., Glasgow, E. May, "Discovery of the Phantom Dinoflagellate in Chesapeake Bay," Estuaries 18(2):373-378, 1995.

[26] Ikeda, T., T. Matsumoto, H. Kisa, Y. Ishida, A. Kawai, "Analysis of Growth Limiting Factors Causative of Freshwater Red Tide by Dinoflagellate Peridinum Bipes F. Occultatum," Jap.-J.-Limnol.-Rikusuizatsu, 54(3): 179-189, 1993; Jiang, G., "The Preliminary Study on The Eutrophication and the Red Tide in the South Coastal Area of Zhejiang, Donghai-Mar.-Sci.-Donghai-Haiyang, 11(2): 55-6, 1993; Okaichi, T., S. Montani, A. Hasui, "The Role of Iron in the Outbreaks of Chattonella Red Tide," Red Tides: Biology, Environmental Science, and Toxicology, Proceedings of the First International Symposium on Red Tides, held in November 10-14, 1987, in Takamatsu, Kagawa-Prefecture, Japan, p. 353-356; and "Thousands of Gulf Fish Die; Red Tide Is Probable Cause," The New York Times, September 1996.

[27] Skojoldal, H.R., "Eutrophication and Algal Growth in the North Sea," Mar. Environ. Cent., Mar. Res., Bergen-Nordnes, Norway, p. 445-478, undated.

[28] Wu, R.S.S., "The Environmental Impact of Marine Fish Culture: Towards a Sustainable Future," International Conference on Marine Pollution and Ecotoxicology, held in Hong Kong, Jan. 22-26, 1995, Vol. 31, no. 4-12, p. 159-166; and Broad, *supra* footnote 25.

[29] Personal communications with Tony Amos, University of Texas Marine Science Institute, Port Aransas, Texas, and Daniel Baden, School of Marine and Atmospheric Science, Miami, Florida, on October 22, 1996.

[30] Personal communication with Scott Rippey, U.S. Food and Drug Administration, October 21, 1996.

which these wastes may be contributing to the problem. Therefore, for the purposes of this hazardous waste characteristic gaps study, EPA does not plan to conduct further research in this area at this time.

### 5.3.6 Stratospheric Ozone Depletion

The stratospheric ozone layer protects living organisms from damaging solar ultraviolet radiation (UV-B). Depletion of the ozone layer means a greater amount of UV-B radiation is reaching the earth's surface, which increases human skin cancers and cataracts, impairs human immune systems, reduces crop yields, and damages plant and animal life.[31] Several industrial chemicals, including chlorofluorcarbons (CFCs), halons, carbon tetrachloride, methyl chloroform, and methyl bromide, are known to be stratospheric ozone-depleting substances (ODSs).

For many years, ODSs have been used in a variety of manufacturing and other activities. With the ratification of the Montreal Protocol and its subsequent amendments and adjustments, the United States agreed to eliminate the production of ODSs by January 1, 1996 (with a few exceptions). In addition, the disposal of ODSs is tightly controlled in order to prevent further ozone depletion. Thus, EPA believes that, for purposes of the

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[31] *Environmental Goals for America, with Milestones for 2005 (Draft for Federal Review), supra* footnote 3.

[32] The majority of these documents were developed to support the first key substitutes rulemaking (59 *Federal Register* 13044, March 18, 1994).

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U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, entering surface waters and resulting in risks or damage. Industrial wastewaters that are point source discharges subject to regulation under the Clean Water Act are exempt from the definition of solid waste.[36] Many of the wastes from agriculture – one of the largest contributers to water pollution from runoff – are exempt from the definition of hazardous waste (although they are solid wastes).[37] Alternatively, EPA could increase controls on point and non-point sources of water pollution via other programs.[38] Thus, for purposes of the hazardous characteristic scoping study, EPA does not plan to research this area further at this time.

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[36] 40 CFR 261.4(a)(2). This exemption applies only to the actual point source discharge. It does not exclude industrial wastewater while they are being collected, stored, or treated before discharge; nor does it exclude sludges generated by industrial wastewater treatment.

[37] 40 CFR 261.4(b). This exemption applies to wastes that are returned to the soil as fertilizers, such as animal manures and the unused portion of crops.

[38] Some of these controls currently are being implemented. For example, a recent final National Pollutant Discharge Elimination System (NPDES) storm water multi-sector general permit was published for industrial activities (60 *Federal Register* 50803, September 29, 1995).

# CHAPTER 6. STATE EXPANSIONS OF THE TOXICITY CHARACTERISTIC AND LISTINGS

States may adopt hazardous waste regulations that are broader or more stringent than federal RCRA Subtitle C regulations. A number of states have done so by regulating additional wastes as hazardous. For example, states have:

- Expanded the ignitability, corrosivity, or reactivity (ICR) characteristics;
- Expanded the toxicity characteristic (TC);
- Listed wastes as hazardous that are not hazardous under the federal rules; and
- Restricted exemptions from the federal program.

These expansions beyond the federal hazardous waste identification rules reflect state judgments about gaps in the federal program and thereby constitute potential gaps that may merit further investigation.

EPA has identified examples of such expansions by using readily available information on state hazardous waste identification rules. In 1992, the EPA Office of Solid Waste examined state hazardous and non-hazardous industrial waste programs in 32 states.

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[1] U.S. Environmental Protection Agency, Office of Solid Waste, *Identifying Higher-Risk Wastestreams in the Industrial D Universe: The State Experience*, draft prepared by Science Applications International Corporation and Kerr & Associates, Inc., July 30, 1993.

California, Michigan, and Washington have added constituents to the list of TC analytes, as shown in Exhibit 6-1. Both California and Michigan have added zinc, and both California and Washington have added PCBs.[2] Other additional constituents include certain metals, pesticides, dioxins, and potential carcinogens. An example of a state regulatory level that is lower that the federal TC level is California's regulatory level of 1.7 mg/l for pentachlorophenol (versus 100 mg/l under the federal TC).

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[2] New Jersey had also added a TC regulatory level for PCBs, but the State recently adopted the federal regulations by reference and will now use the same characteristics and listings as the federal program. A number of states have added PCB wastes to their hazardous waste listings.

[3] *Identifying Higher-Risk Wastestreams in the Industrial D Universe: The State Experience, supra* footnote 1 at pages 20A-B.

[4] *Ibid*., pages 8-14.

Exhibit 6-1

## Exhibit 6-1 (continued)
## State Toxicity Characteristics:
## Additional Constituents and More Stringent Regulatory Levels

**MICHIGAN**

| Constituent | Regulatory Level (mg/l) |
|---|---|

- In California, wastes containing any of almost 800 listed materials are presumed hazardous, unless proven through testing not to exhibit any of California's criteria for identifying hazardous waste.

- Maine has listed certain wastes from the production of linuron and bromacil, and has listed *proposed* additions to the federal list of hazardous wastes.

- Maryland has listed 9 specific chemical warfare agents.

- Michigan has added certain chemical production wastes to its "K" or specific source list, and has listed many state-only "U" wastes including organics, inorganics in particle form, pharmaceuticals (e.g., phenobarbital), chemical warfare agents, and

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[5] *Ibid*.

- Massachusetts, New York, and North Dakota do not recognize exemptions at 40 CFR 261.4(b)(10) through (13). (These wastes include the last four wastes named directly above.)

### 6.4 Summary

Some states appear to be regulating a significant number of wastes as hazardous that are not covered under federal RCRA regulations. Moreover, a few states have taken different approaches to identifying characteristic hazardous wastes. In particular, California and Washington regulations go beyond constituent-by-constituent definitions and apply acute toxicity criteria to the whole waste. State expansions of hazardous waste identification regulations reflect state judgment about gaps in the federal program. State expansions have filled these gaps, but only in the specific states with such expansions. Such potential gaps apparently are *not* being filled in the remaining states that have not expanded the federal hazardous waste definitions.

# CHAPTER 7. SUMMARY OF POTENTIAL GAPS

This chapter reviews the broad categories of potential gaps identified in the previous three chapters. Different ways of organizing the potential gaps are discussed, and a single comprehensive list of the potential

EPA considered other methods of classifying the potential gaps for purposes of further analysis. Gaps could be identified, for example, in terms of individual chemicals and their specific properties and hazards. Alternatively, the gaps could be organized around groups of chemicals with specific hazardous properties or types of risks. EPA rejected these approaches for purposes of this Scoping Study as impractical because too many individual chemicals or groups of chemicals, risks, and pathways are involved. In addition, defining potential gaps in categories that do not parallel the approaches used to identify such gaps would make it more difficult to appreciate the evidence and uncertainty associated with each potential gap.

## 7.2 Summary of Potential Gaps

Exhibit 7-1 lists the potential gaps in the hazardous waste characteristics identified by EPA in the preceding chapters. The individual gaps are organized according to the section or chapter in which they are discussed, with reference to specific chemical classes, exposure pathways, or types of risks, as appropriate. Potential gaps are evaluated in the following chapters in order to assess their potential significance in terms of potential risks to health and the environment. Because of data limitations, most of this evaluation focuses on potential gaps associated with the TC analytes and other chemicals. Chapter 8 examines the relationship between potential gaps, specific industries, and waste management methods. Chapter 9 discusses the extent to which the various potential gaps may already be addressed to some extent by existing regulatory systems. Finally, Chapter 11 presents a Summary evaluation of the potential gaps against a number of risk and regulatory criteria.

**Exhibit 7-1. Summary of Potential Gaps in the Hazardous Waste Characteristics**

| Category of Potential Gap | Nature of Potential Gap |
|---|---|
| Potential Gaps in the ICR Characteristics (Sections 3.2 to 3.4) | Ignitability<br>● Exclusion of DOT combustible liquids<br>● Exclusion of aqueous flammable liquids<br>● References outdated DOT regulations<br>● No test method for non-liquids<br><br>Corrosivity<br>● Exclusion of corrosive non-liquids<br>● pH limits are potentially not protective<br>● pH test methods are not predictive of risk<br>● Corrosion of non-steel materials is not addressed<br>● Solubilization of non-metals is not addressed<br>● Exclusion of irritants and sensitizers<br><br>Reactivity<br>● Definition is broad, non-specific<br>● References outdated DOT regulations<br>● No test methods are specified |
| Potential Gaps Associated With the TC Analytes (Sections 3.5 and 3.6) | Groundwater Pathway Risks<br>● DAF values potentially not protective |

### Exhibit 7-1. Summary of Potential Gaps in the Hazardous Waste Characteristics (continued)

| Category of Potential Gap | Nature of Potential Gap |
|---|---|
| Potential Gaps Associated With the TC Analytes (Sections 3.5 and 3.6) (continued) | <u>Ecological Risks Not Addressed</u><br>● Potent ecological toxicants<br>● Persistent/bioaccumulative pesticides<br><u>Non-Groundwater Pathways Not Addressed</u><br>● Inhalation (volatile organics)<br>● Surface water pathway<br>● Indirect/food chain (volatile, persistent, and bioaccumulative chemicals)<br><u>TCLP Limitations</u><br>● May not accurately predict leachate concentration or risks for certain wastes and units |
| Potential Gaps Associated with | |

**Exhibit 7-1. Summary of Potential Gaps in the Hazardous Waste Characteristics (continued)**

| Category of Potential Gap | Nature of Potential Gap |
|---|---|
| Potential Gaps Associated with | |
| | |

## 8.2 Potential Gaps as a Function of Industry/Waste Source

This section discusses non-hazardous industrial waste generation by various industries as follows:

Section 8.2.1 reviews available data on the volume of such waste generated by specific industries or industry groups;

Section 8.2.2 compares these data with the industries responsible for the releases documented in Chapter 2;

Section 8.2.3 identifies the industries responsible for generating non-hazardous industrial wastes containing constituents with the highest risk of adverse human health effects; and

Section 8.2.4 identifies the industries with facilities reporting TRI releases to land and underground injection of known or possible non-hazardous industrial waste constituents.

### 8.2.1 Non-Hazardous Industrial Waste Generation by Industry

In 1988, the Agency estimated that approximately 7.6 billion tons of non-hazardous industrial waste was generated and managed on-site annually in the United States.[3] Approximately 68 percent of this waste came from four major industry groups:

- Paper and allied products (SIC 26): 2.25 billion tons (29.6 percent);
- Chemicals and allied products (SICs 2812-2819, 2821, 2824, 2851, 2891, 2865, 2869, and SICs 2812-2a0vf);

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[3] Ibid., p.2. This volume may include some special wastes, such as in the primary metals or electrical power generation industries.

[redacted]

The listing documents for solvent wastes and wastes from the dye and pigment industries are another source of information on non-hazardous industrial waste. All of the information related to waste volumes and constituents concentrations for the dye and pigment industries, however, was claimed proprietary by the submitters and, therefore, could not be included in this Study. EPA recently identified non-hazardous industrial solvents in developing a recent proposed rulemaking. The amounts of solvent wastes have not been broken down by industry and, therefore, could not be included in Exhibit 8-1.

### 8.2.2 Industries Responsible for Documented Non-Hazardous Industrial Waste Releases

The environmental release descriptions discussed in Chapter 2 provide additional evidence about the industries (and waste management practices) associated with potential gaps in the characteristics. Exhibit 8-2 tabulates, by industry, the frequency of documented releases and their exceedence of health-based or ecologically-based regulatory standards. As shown in this exhibit, some of the industries that show up frequently in the release descriptions are among the high-volume industries identified above. The most frequently occurring industry group in the release descriptions is electric, gas, and sanitary services (SIC 49) with all of those release descriptions originating in the refuse systems sector (SIC 4953). This industry sector includes commercial waste management facilities. As noted in Chapter 2, most of these commercial non-hazardous industrial waste management units are located in California, where considerable monitoring data were available. From these data, EPA could not determine the industries that generate the wastes managed by these commercial facilities.

The next three industry groups with the most documented releases are the paper and allied products (27 releases), chemicals and allied products (11 releases), and food and kindred products (10 releases). These industry groups also are among the largest generators of non-hazardous industrial waste. The primary metals industry, another high-volume group, also has a moderate number of documented releases; they account for 6 of the 112 total releases documented in Chapter 2.

Exhibit 8-2 also shows the numbers of documented releases at which the maximum detected concentrations of constituents exceeded health-based or ecologically-based standards.[4] All but six of the 101 releases with data on the standards exceeded had exceedences of health- or ecologically-based standards.[5] These six releases exceeded secondary maximum contaminant levels (SMCLs) only. Sixty-five of these releases also violated other standards.

Exhibit 8-3 shows the total numbers of times particular chemicals were found in the release descriptions for various industry sectors. (The totals are the sums of the number of individual chemicals detected at each site, counting all chemicals for each site, even if a chemical is detected at more than one site. For example, the total detections at two sites having 10 chemicals each, 3 of which are the same, is 20, not 17.) In addition, the exhibit shows the numbers of times such

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[4] Health-based or ecologically-based standards included Primary MCLs, MCLGs, and state standards established to protect health or the environment. Non-health-based or non-ecologically-based standards are those set to preserve groundwater usability or aesthetics, such as Secondary MCLs or standards for which any health or ecological bases were not explained.

[5] EPA lacks information on the regulatory standards that were exceeded for all releases from California and for two releases from other states. All releases described in this Study, however, were documented to have exceeded one or more applicable federal, state, or local regulatory standards.

**Exhibit 8-2**

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chemicals were detected above regulatory levels, and the proportions of chemicals found above health-based or ecologically-based standards. The 3 industries with the most releases, electric, gas, and sanitary services (35 releases), paper and allied products (27 releases), and chemicals and allied products (11 releases), also had the highest numbers of chemical detections (350, 340, and 250, respectively). The average number of chemicals detected per facility varies substantially across industries. For example, the 3 industries noted above had means of 10, 13, and 23 chemicals detected per release, respectively. The average number of regulatory and health- or ecologically-based exceedences per release also varies greatly across industries. For example, the electric, gas, and sanitary services industry averages only 3 regulatory and 2 health- or ecologically-based exceedences for every 10 chemical detections. In contrast, the chemical industry averages 9 regulatory and 7 health- or ecologically-based exceedences for every 23 chemical detections.

### 8.2.3 Occurrence of High-Hazard Industrial Waste Constituents by Industry

Another indicator of the potential severity of hazards associated with releases from non-hazardous industrial waste management in various industries is the frequency of occurrence of waste constituents with the highest risk to humans. Exhibit 8-4 identifies the chemicals that appeared most frequently in the release descriptions, the number of total appearances, and the number of times the chemical was present in groundwater above regulatory or other health-based levels based on $10^{-5}$ cancer risks or a hazard quotient greater than 1.0. As noted in Section 5.1, many of the most frequently occurring chemicals do not have health-based or ecologically-based standards, but may have SMCLs or other regulatory levels. Among these are the three most common constituents found in the release descriptions: iron, chloride, and sodium, as well as manganese, zinc, calcium, magnesium, potassium, copper, aluminum, and silver.

A substantial number of potentially toxic chemicals were detected in the release descriptions. For example, 11 of the 52 most frequently detected chemicals are known or suspect carcinogens by ingestion or inhalation.[6] Only one of the most frequently detected chemicals (phosphorous) is identified as having a low RfD, although several other chemicals on the list are generally considered toxic, including lead, mercury, cadmium, arsenic, and chromium. Seven of the most frequently detected chemicals are chlorinated volatile organics, with trichlorethylene, occurring most often (17 times). While all of the inorganic analytes appearing on the list are persistent, none of the most frequently occurring organic chemicals were identified as persistent in Chapter 4. In fact, none of the persistent bioaccumulative chlorinated pesticides identified as posing potentially high risks are seen in the release descriptions more than three times and most were seen in only one release description.

Exhibit 8-5 shows the number of occurrences and the number of regulatory, health-based, or ecologically-based exceedences for the constituents detected most frequently in the release descriptions for each industry group. For each group, the 15 most frequently detected chemicals or all detected chemicals are shown, whichever is smaller. In almost all industry groups, inorganic chemicals are found more often than organics. This finding may be due, in part, to a lack of analytical data for organic chemicals in some industries. Volatile organic chemicals are rarely found among the most frequently detected chemicals, with a few exceptions. Iron, manganese, and sulfate were among the most frequently found chemicals in the electric, gas, and sanitary services release descriptions, and volatile organics represent the bulk of the most frequently detected chemicals for the electronic and other electronic equipment industry and the petroleum refining industry. The relative scarcity of

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[6] These are chemicals that were identified as having Cancer Slope Factors or Unit Risks in IRIS or HEAST.

## Exhibit 8-4
## Most Frequently Occurring Constituents in the Release Descriptions

| Constituent | Number of Occurrences in Release Descriptions | Number of Occurrences Above Regulatory Levels or HBLs[a] |
|---|---|---|
| **TC Constituents** | | |
| Lead | 37 | 22 |
| Chromium | 36 | 21 |
| Arsenic | 29 | 24 |
| Barium | 28 | 28 |
| Cadmium | 28 | 28 |
| Benzene | 23 | 16 |
| Mercury | 19 | 6 |
| Selenium | 18 | 18 |
| Trichloroethylene | 17 | 8 |
| Vinyl chloride | 13 | 6 |
| Silver | 12 | 12 |
| Chlorobenzene | 9 | 9 |
| Tetrachloroethylene | 9 | 9 |
| Chloroform | 8 | 8 |
| 1,4-Dichlorobenzene | 5 | 0 |
| **SMCL Constituents** | | |
| 1812 | 12fume12.4dust)Tc 0  Tw (13) Tj | 158.4 0  TD (6)2 |
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## Exhibit 8-4 (continued)
## Most Frequently Occurring Constituents in the Release Descriptions

| Constituent | Number of Occurrences in Release Descriptions | Number of Occurrences Above Regulatory Levels or HBLs[a] |
|---|---|---|
| Toluene | 20 | 20 |
| Phenol | 18 | 18 |
| Ammonia | 16 | 11 |
| Calcium carbonate | 15 | 0 |
| Nickel | 14 | 4 |
| Dichloromethane | 12 | 12 |
| Nitrite | 11 | 9 |
| Ethylidene dichloride | 10 | 10 |
| Xylene (mixed isomers) | 10 | 10 |
| Acetone | 9 | 9 |
| Nitrogen | 8 | 0 |
| Beryllium | 7 | 7 |
| cis-1,2-Dichloroethylene | 7 | 7 |
| Ethylbenzene | 7 | 7 |
| Vanadium (fume or dust) | 7 | 6 |
| 1,2-Dichloroethylene | 6 | 6 |
| Boron and compounds | 6 | 3 |
| Chloromethane | 6 | 0 |
| Cyanides | 6 | 6 |
| Phosphorus | 6 | 1 |
| 1,2-Dichlorobenzene | 5 | 5 |
| Antimony | 5 | 5 |
| Carbon disulfide | 5 | 5 |
| Cobalt | 5 | 0 |
| Naphthalene | 5 | 3 |

[a] Regulatory levels include MCLs, SMCLs, AWQCs, or other state health- or ecologically-based standards. HBLs are drinking

## Exhibit 8-5
## Occurrence of Waste Constituents by Industry Group

| Industry Group (SIC) | Constituent | Number of Occurrences in Release Descriptions | Number of Occurrences Above Regulatory, Health- or Ecologically-based Levels |
|---|---|---|---|
| Paper and Allied Products (26) | pH | 22 | 12Health- or |
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## Exhibit 8-5 (continued)

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## Exhibit 8-5 (continued)
## Occurrence of Waste Constituents by Industry Group

| Industry Group (SIC) | Constituent | Number of Occurrences in Release Descriptions | Number of Occurrences Above Regulatory, Health- or Ecologically-based Levels |
|---|---|---|---|
| | 1,1-Dichloroethane | 1 | 1 |
| | 2,4-Dimethylphenol | 1 | 0 |
| | Aluminum* | 1 | 1 |
| | Ammonia | 1 | 1 |
| | Antimony | 1 | 1 |
| | Arsenic | 1 | 1 |
| | BEHP | 1 | 1 |
| | Benzene | 1 | 1 |
| | Beryllium | 1 | 1 |
| | Cadmium | 1 | 1 |
| | Calcium | 1 | 0 |
| Electronic and Other Electronic Equipment (36) | 1,1-Dichloroethane | 1 | 1 |
| | Carbon tetrachloride | 1 | 1 |
| | Chloride* | 1 | 1 |
| | Chloroform | 1 | 1 |
| | Iron* | 1 | 1 |
| | Manganese* | 1 | 1 |
| | Methylene chloride | 1 | 1 |
| | pH* | 1 | 0 |
| | Phenolics | 1 | 0 |
| | Sodium | 1 | 0 |
| | Sulfate* | 1 | 1 |
| | Tetrachloroethylene | 1 | 1 |
| | Toluene | 1 | 1 |
| | Total Organic Carbon | 1 | 0 |
| | Total Organic Halogens | 1 | 0 |
| Stone, Clay, and Glass Products (32) | Ammonia | 1 | 1 |
| | Arsenic | 1 | 1 |
| | Barium | 1 | 1 |
| | Benzene | 1 | 1 |
| | Beryllium | 1 | 1 |

[redacted]

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from these sectors do have health-based or ecologically-based standards. Furthermore, some constituents with SMCLs may also pose health and ecological risks. The same pattern applies to stone, clay, and gas products (SIC 32), and food and kindred products (SIC 20). In the food and kindred products industry, the only health-based exceedences were for nitrates, nitrites, or both. All of the other most frequent exceedences for this industry group were non-health-based and non-ecologically-based.

### 8.2.4 Industries Reporting Releases of TC Analytes or Known or Possible Non-Hazardous Industrial W Constituents

Another indication of the potential importance of the various industries with regard to non-hazardous industrial waste management is provided by data concerning the amounts of chemicals these industries release to the environment, as reported under the EPCRA TRI requirements. Exhibit 8-6 identifies, by industry, volumes of TC analytes or known or possible non-hazardous industrial waste constituents that in 1992 were reported released to land or underground injection in an amount exceeding 1 million pounds.[7] Volumes of waste released to land or underground injection are presented in this Study because they are thought to be the most indicative of the volume of non-hazardous waste at the facilities. The listed volumes are the mass of individual constituents in waste streams or other emissions rather than total waste volumes as presented in other exhibits in this chapter. The volumes may include hazardous, special, and municipal solid waste as well as non-hazardous industrial waste.

The largest volume of constituents reported released via underground injection in 1992 were from the chemicals and allied products industry, which contributed 99.3 percent of total volume from underground injection. A significant portion of these constituents may be in hazardous wastewaters. The second and third largest volumes of TRI constituents come from the petroleum refining and primary metals industries, which contributed 0.57 and 0.04 percent of total volume from underground injection, respectively. The two constituents released in the largest volumes to underground injection from the chemicals and allied products industry were methanol and acetonitrile, with 38 and 29 percent of total volume for that industry, respectively. Methanol was also released in the highest volume from the petroleum refining industry, comprising 57 percent of the total constituent volume reported for that industry.

The largest volume of constituents released to land originates from the primary metals industry, which contributes 74.2 percent of the total volume. Most of that volume (99 percent) is comprised of constituents, such as zinc, copper, and chromium, that may be present in large volume special wastes. (Further investigation is needed to determine whether any of these releases involve special or hazardous wastes.) The two chemicals comprising almost equal proportions released by this industry are zinc and copper, with about 48 percent each. The second and third largest volumes of constituents were from the petroleum refining and paper and allied products industries, respectively. Petroleum refining contributed 10.1 percent of total volume and paper and allied products contributed 8.4 percent of total volume released to land. Naphthalene and xylene, with 43 and 32 percent of total volume reported released to land, constituted the largest proportion of the constituents from the

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[7] Detailed 1994 TRI facility-specific data were not available when this Study was prepared, therefore, 1992 TRI data were used.

## Exhibit 8-6 Non-Hazardous Industrial Waste Constituents Reported Released by Industry

**Exhibit 8-6 Non-Hazardous Industrial Waste Constituents Reported Released by Industry (continued)**

petroleum refining industry.  Almost 99 percent of the volume of constituents released to land by the paper and allied products industry was methanol.

## 8.3 Potential Gaps as a Function of Management Practices

This section of the Scoping Study reviews the available information related to management practices:

| | |
|---|---|
| Section 8.3.1 | examines the prevalent management practices among the major non-hazardous industrial waste generating industries; |
| Section 8.3.2 | reviews the evidence regarding environmental releases as a function of management type for major management technologies; |
| Section 8.3.3 | describes limited data available on the potential hazards associated with use constituting disposal; and |
| Section 8.3.4 | briefly discusses the potential nature of the hazards associated with less well-characterized management practices. |

### 8.3.1 Waste Management Practices by Waste Type and Industry

As noted previously, the data related to non-hazardous industrial waste management practices are quite limited and may be somewhat outdated.  Inconsistencies frequently were found between data from the different sources.  Exhibit 8-7 summarizes the information for the relatively high volume generation industries.  Based on the available information, the vast majority of non-hazardous industrial waste is aqueous and is managed in surface impoundments before treatment and ultimate discharge under NPDES.  The proportion of these wastes going to surface impoundments in 1985 ranged from 78.6 percent in the food and kindred products industry to 99.7 percent in the textile manufacturing industry, with a total of 96.5 percent of all wastes managed in this fashion in the 15 industries included in the exhibit.  The second most widely used land-based management technology was land application.  Only about 1.3 percent of the waste volume from the 15 industries was managed in this fashion in 1985, with substantially larger proportions going this route in the organic chemicals industry (3.1 percent), the food and kindred products industry (20 percent), and water treatment industry (15 percent).  Landfills and waste piles each accounted for about one percent of the total waste managed in the 15 industries.

Exhibit 8-8 estimates the number of active landfills, surface impoundments, land application units, and waste piles used to manage non-hazardous waste in various industry groups in 1985.  At that time, 55 percent of these land-based units were surface impoundments.  This finding indicates that, on average, surface impoundments handled larger volumes of waste than other management units since they managed a substantially greater percentage (96 percent) of total on-site non-hazardous industrial waste.  In all industries except primary iron and steel and transportation equipment, surface impoundments were the most common type of management units.  Waste piles constituted 19 percent of the total units.  They were the most common type of unit in the primary iron and steel and transportation equipment industries, were the second most common type in eight industries, and tied for second in another.  Land application units represented 16 percent of all units.  Over 70 percent of these units, however, were in the food and kindred products industry.  Landfills represented only 10 percent of all units.

Surface impoundments, land application, landfills, and waste piles are clearly not the only management technologies that can be used for non-hazardous industrial wastes. The totals in Exhibit 8-7 do not reflect all of the possible options for waste management. Exhibit 8-9 provides data from the Industrial D Industry Profiles discussed in Section 8.1 relating to non-hazardous industrial waste management practices in some industries occurring most frequently in the release descriptions. Most of these data are from the 1987 TSDR, and some are from the ISDB. We data are from the 1987 Ttt,faD -0.0677 iztion 8thi-0.ourcm

## Exhibit 8-9
## Non-Hazardous Industrial Waste Management by Industry and Waste Type from TSDR and ISDB

| Industry Group (SIC) | Major Waste Type(s)[a,b] | Management Type(s) | Total Amount (thousand metric tons) |
|---|---|---|---|
| Chemicals and Allied Products (280, 282 (except 2821), 285, 288, 289 (except 2891, 2892, 2893)) | Aqueous Liquid<br>Organic Liquid | WWT & Tank Systems[c] | 79,669 |
| | | Surface Impoundments[c] | 2,029 |
| | | Underground Injection[c] | 236 |
| | | Incineration[c] | 43 |
| | | Landfill[c] | 14 |
| | | Other Processes/Methods[c] | 8 |
| | | Recycle/Reuse[c] | 4 |
| | | Land Application[b] | <1 |
| Industrial Inorganic Chemicals (281) | Aqueous Liquid<br>Solid Residue<br>Gas<br>Sludge/Slurry | WWT & Tank Systems[c] | 25,421 |
| | | Underground Injection[c] | 958 |
| | | Recycle/Reuse[b] | 752 |
| | | Other Processes/Methods[b] | 395 |
| | | Waste Pile Storage[b] | 356 |
| | | Surface Impoundments[b] | 263 |
| | | Landfill[b] | 43 |
| | | Incineration[c] | 2 |
| Plastics and Resins (2821) | Aqueous Liquid | WWT & Tank Systems[c] | 68,414 |
| | | Surface Impoundments[c] | 45,842 |
| | | Underground Injection[b] | 421 |
| | | Landfill[b] | 132 |
| | | Recycle/Reuse[b] | 73 |
| | | Land Application[b] | 41 |
| | | Incineration[b] | 25 |
| | | Waste Pile Storage[b] | 5 |
| | | Other Processes/Methods[b] | 3 |
| | | Container/Tank Storage[b] | <1 |

## Exhibit 8-9 (continued)
## Non-Hazardous Industrial Waste Management by Industry and Waste Type from TSDR and ISDB

| Industry Group (SIC) | Type(s) | Type(s) | |
|---|---|---|---|
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Exhibit 8-10 tabulates by industry the number of waste management units of different types found in the release descriptions. Of the 120 waste management units identified in the release descriptions, 73 (61 percent) are landfills, while 28 (23 percent) are surface impoundments. Twelve land application units (10 percent) and 4 waste piles were also identified, along with one trench, 1 evaporation pond, and 1 stormwater retention pond.

These data provide a somewhat different picture than would be expected, merely based on the number of management units in the various industries and the volumes of wastes managed in different types of units. Despite the preponderance of landfills in the release descriptions, the vast majority of the non-hazardous industrial wastes are being managed (or were being managed at the time of the TSS) in surface impoundments. As shown in Exhibit 8-8, for the industries presented, there are 15,253 surface impoundments versus only 2,757 landfills. Several possible explanations for this apparent discrepancy can be advanced. First, better groundwater monitoring data may be available for landfills than for surface impoundments. Second, management methods may have changed substantially in the last 11 years. This explanation seems unlikely; surface impoundments or related treatment systems probably will remain a management method of choice as long as aqueous wastes are the dominant waste form. Some movement to tanks or other treatment systems may have occurred, and process changes may also have reduced the volume of liquid wastes, but EPA has no information as to how extensive these changes may have been. In any event, a large-scale shift away from surface impoundments to landfills seems unlikely, simply based on cost considerations, even if it was technically feasible for some wastes.

Another possible explanation is that the initial concentrations of potentially toxic constituents may be lower, on average, for surface impoundments than for landfills, and the highly concentrated solid residues from the impoundments may themselves end up in landfills, or the surface impoundments may be closed as landfills. Finally, design features of non-hazardous industrial waste landfills may make them more prone to releases, although the other factors just discussed are likely to be more important.

### 8.3.3 Potential Hazards Associated with Use Constituting Disposal

Few data are available on use that constitutes disposal (UCD) of solid wastes, which is regulated at the state level. Some data, however, are available for one category of these wastes: certain delisted wastes that are now being used in a manner constituting disposal. In the first case discussed below, a full risk assessment of UCD was not done at the time the waste was delisted. In the second case, pending proposals at the federal level would authorize UCD of delisted wastes; some states, however, may already be permitting some UCD practices for these wastes under other regulatory provisions.

Delisted K088 (spent potliners from primary aluminum reduction) that has been treated with lime and heated in a rotary kiln by a specific petitioner and subsequently disposed of primarily in a monofill has caused high leaching rates of cyanides, fluoride, and arsenic. While the treatment residue passes the TCLP test, the leachate from the monofill exceeds the TC level for arsenic and the delisting requirements for cyanides and fluoride. The treatment residual also has a pH of approximately 12.9 and is hazardous and not covered by the petitioner's exclusion. This K088 treatment residual also has been used for on-site road construction, under a state RCRA Subtitle D management permit. A recent site inspection found, after rainfall, large puddles of dark colored water, the same color as the treatment residue used to build the road. Samples of the runoff water are currently being analyzed.

This case raises two issues:

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[8] 59 *Federal Register* 67256, December 29, 1994.

whether and to what extent such management methods may pose significant risks to human health or the environment. This data gap is discussed in more detail in Chapter 10.

## EXHIBIT 8-6 TRI REPORTED RELEASES TO LAND OR UNDERGROUND INJECTION BY CONSTITUENT AND INDUSTRY

| Type of |
|---|
| |

## EXHIBIT 8-6  TRI REPORTED RELEASES TO LAND OR UNDERGROUND INJECTION BY CONSTITUENT AND INDUSTRY (continued)

EXHIBIT 8-6 TRI REPORTED RELEASES TO LAND OR UNDERGROUND INJECTION BY CONSTITUENT AND INDUSTRY (continued)

| Chemical Name[a] | Type of Chemical | SIC 32 |  | SIC 33 |  | SIC 34 |  | SIC 35 |  | SIC 36 |  | SIC 37 |  | SIC 38 |  | SIC 39 |  | Invalid |  | Total UI | Total Land | Total Combined |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
|  |  | UI | L | UI | L | UI | L | UI | L | UI | L | UI | L | UI | L | UI | L | UI | L |  |  |  |
| 1,1,1-TRICHLOROETHANE | VCO | 0 | 0 | 0 | 2,916 | 0 | 39,778 | 0 | 6,805 | 3 | 10 | 0 | 200 | 0 | 350 | 0 | 0 | 0 | 0 | 561 | 76,381 | 76,942 |
| 1,2-DICHLOROETHANE | VCO | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6,927 | 1,858 | 8,785 |
| 1,3-BUTADIENE | VO | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1,000 | 372 | 1,372 |
| ACETALDEHYDE | OVO | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1,905,859 | 289 | 1,906,148 |
| ACETONITRILE | OVO | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 20,111,640 | 29 | 20,111,669 |
| ACRYLAMIDE | OSO | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4,188,680 | 963 | 4,189,643 |
| ACRYLONITRILE | OVO | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 65,880 | 0 | 3,861,550 | 8,071 | 3,869,621 |
| ANILINE | OSO | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1,195,676 | 1,173 | 1,196,849 |
| BENZENE | VO | 0 | 0 | 8,600 | 500 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 20 | 0 | 0 | 0 | 0 | 0 | 0 | 355,683 | 340,636 | 696,319 |
| BROMOMETHANE | OVO | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1,000 | 0 | 1,000 |
| CARBON DISULFIDE | OVO | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2,704 | 21 | 2,725 |
| CHLOROBENZENE | VCO | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 72,000 | 817 | 72,817 |
| CHLOROFORM | VCO | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 50,240 | 28,582 | 78,822 |
| CHLOROMETHANE | VCO | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 86,709 | 0 | 86,709 |
| CHLOROPRENE | VCO | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 54,000 | 1,811 | 55,811 |
| CHROMIUM | IO | 0 | 10,526 | 8 | 842,104 | 8 | 842,104 | 8 | 842,104 |  |  |  |  |  |  |  |  |  |  |  |  |  |
| COPPER | M/I |  |  |  |  |  |  |  |  |  | 842,104 | 842,104 | 842,104 | 842,104 | 842,104 | 842,104 |  |  |  |  |  |  |
| CUMENE | VH |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| DICHLORODIFLUOROMETHANE | VCO |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| DICHLOROMETHANE | VCO |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| ETHYLBENZENE | VH |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| FORMALDEHYDE | OVO |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| FREON 113 | CFC |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| METHANOL | OVO |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| METHYL ETHYL KETONE | OVO |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| METHYL ISOBUTYL KETONE | OVO |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| METHYL METHACRYLATE | OVO |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| N-BUTYL ALCOHOL | OVO |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| NAPHTHALENE | OSO |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| PROPYLENE OXIDE | OVO |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| STYRENE | VH |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| TETRACHLOROETHYLENE | VCO |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| TOLUENE | VH |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| TRICHLOROETHYLENE | VCO |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| TRICHLOROFLUOROMETHANE | VCO |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| VINYL CHLORIDE | VCO |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| XYLENE (MIXED ISOMERS) | VH |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| ZINC (FUME OR DUST) | M/I |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Total |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

# CHAPTER 9. POTENTIAL FOR GAPS TO BE ADDRESSED BY EXISTING REGULATIONS

The potential gaps described in Chapters 3 and 4 of this Scoping Study were identified solely in terms of their relationship to non-hazardous industrial waste management, and not with regard to whether they might be controlled under RCRA or other regulatory programs. This chapter examines the extent to which existing regulatory programs may already address these potential gaps and thereby helps to evaluate the extent of the potential gaps. The programs reviewed are as follows:

- RCRA,
- Clean Water Act (CWA),
- Safe Drinking Water Act (SDWA),
- Clean Air Act (CAA),
- Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA),
- Toxic Substances Control Act (TSCA),
- Pollution prevention initiatives,
- Occupational Safety and Health Act (OSHA), and
- Hazardous Materials Transportation Act (HMTA).

The regulatory control provided by these programs is reviewed in general terms, rather than in detail. Further analysis would be necessary to determine the precise degree of protection that these programs provide against particula1bovide0Act (HMTA).ac 0005 3.58.ws2.20012 f w (Orticula1evention9.1 2 -(ö.268 Tw (381xic Substa1 (CAARC

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[1] Constituents are included in Appendix VIII if a reputable scientific study has found that the constituent has toxic, carcinogenic, mutagenic, or teratogenic effects on humans or other forms of life.

> substantial present or potential hazard to human health or the environment when improperly treated, stored, transported, or disposed of, or otherwise managed.

EPA has established four hazardous waste lists:

- Hazardous waste from non-specific sources, or F wastes;
- Hazardous wastes from specific sources, or K wastes;
- Discarded commercial chemicals that are toxic, or P wastes; and
- Discarded commercial chemicals that are acutely hazardous, or U wastes.

Because the F and K listings focus on waste streams, rather than on particular constituents, identification of a chemical as a constituent in a listed F or K waste does not automatically imply that all or most industrial wastes containing that constituent are regulated by the hazardous waste listings. For example, the F003 listing regulates benzene when it is a spent solvent, but does not regulate other benzene-containing wastes such as petroleum refining wastes. Similarly, for a chemical to be controlled by a P or U listing, it must be a discarded commercial product. If the source of the chemical is different (e.g., from a waste mixture that is not covered by an F or K listing), it is not regulated as a listed waste. For example, 2,4-dimethylphenol, which is a listed U waste (U101) when it is a discarded commercial chemical, was found among the environmental releases from non-hazardous industrial waste management documented in Chapter 2. This chemical also was found in the other two sources of data on non-hazardous industrial waste constituents, the Industrial Studies Database (ISDB) and the

writers, EPA has established effluent limitations for 127 toxic pollutants on direct discharges to waters by 34 industrial source categories and publicly-owned treatment works (POTWs). Permit writers use these guidelines to establish discharge limits and other permit conditions.  Where effluent guidelines do not exist for an industry, permit writers use best engineering judgment to determine appropriate permit conditions.

CWA regulations and permits directly limit exposures through surface water pathways.  The CWA also indirectly addresses exposures to CWA regulated chemicals though other pathways by providing incentives for reducing or eliminating the use of such chemicals or for cross-media transfer of such chemicals.

Chapter 3 identified three potential gaps in the current toxicity characteristic that may be addressed to some extent by the Clean Water Act:

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# Exhibit 9-2
# CWA Effluent Limitations Relevant to Certain Known Non-Hazardous Industrial Waste Constituents

| **Phenols** | **CWA Effluent Limit** | **Volatile Chlorinated Organics (Potential DNAPL formers)** | **CWA Effluent Limit** | **PAHs** | **CWA Effluent Limit** |
|---|---|---|---|---|---|
| 2,4-Dimethylphenol | ✓ | 1,1,1,2-Tetrachloroethane | -- | 2-Methylnaphthalene | -- |
| 2,4-Dinitrophenol | ✓ | 1,1,1-Trichloroethane | ✓ | 7,12-Dimethylbenz[a]anthracene | -- |
| 2-Nitrophenol | ✓ | 1,1,2,2-Tetrachloroethane | ✓ | Acenaphthene | ✓ |
| 4,6-Dinitro-o-cresol | ✓ | 1,1,2-Trichloroethane | ✓ | Acenaphthylene | ✓ |
| 4-Nitrophenol | ✓ | 1,2,3-Trichloropropane | -- | Anthracene | ✓ |
| p-Chloro-m-cresol | ✓ | 1,2,4,5-Tetrachlorobenzene | -- | Benz[a]anthracene | ✓ |
| Phenol | ✓ | 1,2,4-Trichlorobenzene | ✓ | Benzo(a)phenanthrene | ✓ |
| Phenolics | -- | 1,2-Dibromo-3-chloropropane | -- | Benzo(k)fluoranthene | ✓ |
| | | 1,2-Dichlorobenzene | ✓ | Benzo[a]pyrene | ✓ |
| | | 1,2-Dichloroethylene | -- | Benzo[b]fluoranthene | [illegible] |

## Exhibit 9-3
## CWA Coverage of Industries Represented in Release Descriptions

| Industry Group | SIC Code | Total Number of Releases | CWA Effluent Limitations |
|---|---|---|---|
| Electric, Gas, and Sanitary Services (refuse only) | 49 | 35 | no |
| Paper and Allied Products | 26 | 27 | yes |
| Chemicals and Allied Products | 28 | 11 | yes; separates organic and inorganic manufacturing |
| Food and Kindred Products | 20 | 10 | no |
| T2y79.84 563 |  | 11 |  |
|  |  |  |  |

units. The constituents and possible gaps that the SDWA could address under source water protection programs are discussed below. At this point in time, however, no such source protection programs have been developed.

In Chapter 3, groundwater risks associated with TC analytes were identified as a potential gap in the hazardous characteristics. As Exhibit 9-4 shows, MCLs are established for 27 of the TC constituents, including all TC metals with the exception of silver. The seven TC metals with established MCLs are among the top 20 frequently occurring constituents in the release descriptions. MCLs are also established for other constituents frequently occurring in the release descriptions including chlorobenzene, chloroform, tetrachloroethylene, trichloroethylene, and vinyl chloride. The MCLs for chlorobenzene, lead, and mercury may address the ecological risks posed by these constituents, even though EPA did not specifically evaluate ecological risks when setting the MCLs.

**Exhibit 9-4**
**TC Constituents with SDWA MCL Levels**

| **TC Analyte** | **SDWA MCL** | **TC Analyte** | **SDWA MCL** | **TC Analyte** | **SDWA MCL** |
|---|---|---|---|---|---|
| 1,1-Dichloroethylene | -- | Chloroform | ✓ | Methyl ethyl ketone | -- |
| 1,2-Dichloroethane | ✓ | Chromium | ✓ | Nitrobenzene | -- |
| 1,4-Dichlorobenzene | ✓ | Cresol (mixed isomers) | -- | o-Cresol | -- |
| 2,4,5-Trichlorophenol | -- | Endrin | ✓ | p-Cresol | -- |
| 2,4,6-Trichlorophenol | -- | Heptachlor | ✓ | Pentachlorophenol | ✓ |
| 2,4-D, salts and esters | ✓ | Heptachlor epoxide | ✓ | Pyridine | -- |
| 2,4-Dinitrotoluene | -- | Hexachlorobenzene | ✓ | Selenium | ✓ |
| Arsenic | ✓ | Hexachloro-1,3-butadiene | -- | Silver | -- |
| Barium | ✓ | Hexachloroethane | -- | Silvex (2,4,5-TP) | ✓ |
| Benzene | ✓ | Lead | ✓ | Tetrachloroethylene | ✓ |
| Cadmium | ✓ | Lindane | ✓ | Toxaphene | ✓ |
| Carbon Tetrachloride | ✓ | m-Cresol | -- | Trichloroethylene | ✓ |
| Chlordane | ✓ | Mercury | ✓ | Vinyl chloride | ✓ |
| Chlorobenzene | ✓ | Methoxychlor | ✓ | | |

Chapter 4 identified two groups of known non-hazardous industrial waste constituents that may present hazards through the groundwater pathway: toxic metals and volatile chlorinated organic compounds. Exhibit 9-5 lists chemicals representative of these gaps and indicates whether they have MCLs and were detected above MCL levels in the release descriptions presented in Chapter 2. In the release descriptions, most of these constituents were detected in groundwater at levels above their MCLs.

## Exhibit 9-5

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|---|---|---|---|---|---|
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### 9.2.3 Clean Air Act Amendments

Section 112 of the Clean Air Act Amendments (CAAA) regulates emissions of 189 toxic constituents, or hazardous air pollutants (HAPs). EPA has defined source categories that emit these HAPs and specified the maximum available control technology (MACT) that must be used by these sources to reduce HAP releases. EPA has promulgated air toxics regulations for three source categories that handle solid waste: RCRA Subtitle C facilities, off-site waste operations, and municipal waste combustors. Of these three categories, only off-site waste operations handle non-hazardous industrial waste.

Off-site waste operations are defined to include hazardous waste treatment, storage, and disposal facilities, industrial wastewater treatment facilities, industrial waste landfills that receive waste from off-site, and other facilities that provide waste management support services or recover and/or recycle spent materials. Municipal waste landfills, POTWs, incinerator units, and site remediation activities are not regulated by this rule. Off-site operations must control emissions from tanks and containers that manage material with an average volatile organic compound (VOC) concentration equal to or greater than 100 parts per million by weight. Land disposal of such wastes is prohibited. In addition, a leak detection and repair program must be implemented for all equipment containing material with total VOC concentration of 10 percent or more. Thus, the CAA regulations for these sources could address potential gaps in the hazardous waste characteristics in two ways:

- Exposures to waste constituents through inhalation are addressed for non-hazardous industrial wastes with average VOC content greater than 100 ppm, if managed in certain facilities; and

- Exposure to VOCs at off-site operations through direct contact with solid waste or from groundwater leachate may be reduced or controlled by the prohibition of land disposal of wastes that contain material with an average VOC concentration equal to or greater than 100 parts per million by weight.

The CAA has the potential to address inhalation exposures from the TC constituents. As Exhibit 9-6 demonstrates, all but seven TC constituents (counting heptachlor expoxide) are designated as HAPs under the CAA.

Inhalation pathway exposure to non-TC volatile chlorinated organic compounds and to persistent organic pesticides were identified in Chapter 4 as a potential gap in the hazardous waste characteristics. As Exhibit 9-7 demonstrates, the CAA regulates emissions of 16 of the 35 known non-hazardous volatile chlorinated organics. EPA also has designated as HAPs two of the six persistent pesticides identified in the second column of Exhibit 4-11.

Like the CWA, the CAA specifies emission limits for selected industries. Thus, for a potential gap to be addressed by the CAA, the gap constituents must be generated by one of the industrial categories regulated by the CAA. Exhibit 9-8 demonstrates that little overlap exists between the industries subject to CAA air toxics emission limits and those industries represented in the release descriptions. Among the industries represented in the release descriptions, the CAA specifies emission limits for segments of the chemicals production industry and off-site waste management operations.

## Exhibit 9-6
## TC Constituents Designated as HAPs under CAA

| TC Analyte | CAA HAP | TC Analyte | CAA HAP | TC Analyte | CAA HAP |
|---|---|---|---|---|---|
| 1,1-Dichloroethylene | -- | Chloroform | ✓ | Methyl ethyl ketone | ✓ |
| 1,2-Dichloroethane | ✓ | Chromium | ✓ | Nitrobenzene | ✓ |
| 1,4-Dichlorobenzene | ✓ | Cresol (mixed isomers) | ✓ | o-Cresol | ✓ |
| 2,4,5-Trichlorophenol | ✓ | Endrin | -- | p-Cresol | ✓ |
| 2,4,6-Trichlorophenol | ✓ | Heptachlor | ✓ | Pentachlorophenol | ✓ |
| 2,4-D, salts and esters | ✓ | Heptachlor epoxide | -- | Pyridine | -- |
| 2,4-Dinitrotoluene | ✓ | Hexachlorobenzene | ✓ | Selenium | ✓ |
| Arsenic | ✓ | Hexachloro-1,3-butadiene | ✓ | Silver | -- |
| Barium | -- | Hexachloroethane | ✓ | Silvex (2,4,5-TP) | -- |
| Benzene | ✓ | Lead | ✓ | Tetrachloroethylene | ✓ |
| Cadmium | ✓ | Lindane | ✓ | Toxaphene | ✓ |
| Carbon tetrachloride | ✓ | m-Cresol | ✓ | Trichloroethylene | ✓ |
| Chlordane | ✓ | Mercury | ✓ | Vinyl chloride | ✓ |
| Chlorobenzene | ✓ | Methoxychlor | ✓ |  |  |

## Exhibit 9-7
## CAA Hazardous Air Pollutants (HAPs) Specified for Potential Gap Constituents

| Volatile Chlorinated Organics | CAA HAP | Persistent Organic Pesticides | CAA HAP |
|---|---|---|---|
| 1,1,1,2-Tetrachloroethane | -- | Aldrin | -- |
| 1,1,1-Trichloroethane | ✓ | DDD | -- |
| 1,1,2,2-Tetrachloroethane | ✓ | DDE | ✓ |
| 1,1,2-Trichloroethane | ✓ | DDT | -- |
| 1,2,3-Trichloropropane | -- | Dieldrin | -- |
| 1,2,4,5-Tetrachlorobenzene | -- | Hexachlorobenzene | ✓ |
| 1,2,4-Trichlorobenzene | ✓ | | |
| 1,2-Dibromo-3-chloropropane | ✓ | | |
| 1,2-Dichlorobenzene | -- | | |
| 1,2-Dichloroethylene | -- | | |
| 1,2-Dichloroethylene, trans | -- | | |
| 1,2-Dichloropropane | ✓ | | |
| 1,3-Dichlorobenzene | -- | | |
| 1,3-Dichloropropylene | ✓ | | |
| Allyl chloride | ✓ | | |
| Benzoic trichloride | ✓ | | |
| Bis(2-chloroethyl) ether | ✓ | | |
| Chlorobromomethane | -- | | |
| Chlorodibromomethane | -- | | |
| Chloroethane | ✓ | | |
| Chloromethane | ✓ | | |
| cis-1,2-Dichloroethylene | -- | | |
| Dichloro-2-propanol, 1,3- | -- | | |
| Dichlorobromomethane | -- | | |
| Dichlorodifluoromethane | -- | | |
| Dichloromethane | ✓ | | |
| Dichloropropane | -- | | |
| Epichlorohydrin | ✓ | | |
| Ethylidene Dichloride | ✓ | | |
| Hexachlorocyclopentadiene | ✓ | | |
| Pentachloroethane | -- | | |
| Tetrachloroethane, N.O.S. | -- | | |
| trans-1,3-Dichloropropene | -- | | |
| Trichlorofluoromethane | -- | | |
| Trichloromethanethiol | -- | | |

Emissions standards have not yet been established for the paper, food, primary metals, or non-metallic minerals industries. As presented in Exhibit 9-8, however, the most important industry in terms of the potential gaps that the CAA may address is the organic chemicals manufacturing industry. Emissions standards have been established for segments of this industry.

**Exhibit 9-8**
**CAA Coverage of Industries Represented in Release Descriptions**

| Industry Group | SIC Code | Number of Documented Releases | CAA Air Emission Limits |
|---|---|---|---|
| Electric, Gas, and Sanitary Services (refuse only) | 49 | 35 | Off-site waste operations, hazardous waste TSDFs |
| Paper and Allied Products | 26 | 27 | no |
| Chemicals and Allied Products | 28 | 11 | Emissions from synthetic organic chemical industry, elastomer production, epichlorohydrin production |
| Food and Kindred Products | 20 | 10 | no |
| Primary Metals | 33 | 6 | no |
| Non-Metallic Minerals | 14 | 4 | no |

## 9.3 Federal Insecticide, Fungicide, and Rodenticide Act

FIFRA controls chemical pesticides through a process whereby the manufacturer registers the composition of the pesticide and certifies to EPA that the pesticide will perform its intended function without unreasonable adverse impacts in the environment under commonly recognized practices for use. EPA can place a registered substance under special review if the substance is suspected of causing unreasonable adverse effects on the environment. Under this process, EPA can prohibit the distribution, sale, and/or use of a pesticide through a cancellation or suspension of its registration.

### Exhibit 9-9
### Status of Pesticides That are TC Analytes or Known Non-Hazardous Industrial Waste Constituents

| Pesticides/Intermediate/Degradation Product | Status |
|---|---|
| Aldicarb | Active; restricted use |
| Atrazine | Active; restricted use |
| Carbofuran | Active; restricted use |
| 2,4-D, salts and esters | Active |
| Diazinon | Active |
| Dimethoate | Active |
| Disulfoton | Active; restricted use |
| Endosulfan (pesticide is a mixture of alpha and beta isomers) | Active |
| Endosulfan, alpha- | Active |
| Endosulfan, beta- | Active |
| Endosulfan sulfate | Metabolic product of endosulfan |
| Endothall | Active |
| Heptachlor | Active; restricted use |
| Heptachlor epoxide | Degradation product of heptachlor |
| Lindane (gamma-HCH) | Active; restricted use |
| Molinate | Active |
| Mesitylene | Active use (registration not required) |
| Methyl iodide | Active use (registration not required) |
| Methoxychlor | Active |
| Methyl parathion | Active; restricted use |
| O,O-Diethyl O-pyrazinyl phosphorothioate (Thionazin) | Active |
| Parathion | Active; restricted use |
| Pentachlorophenol | Active; restricted use |
| Phorate | Active; restricted use |
| Sulfotepp | Active |
| 2,3,4,6-Tetrachlorophenol | Canceled |
| 2,4,5-Trichlorophenol | Canceled |
| 2,4,6-Trichlorophenol | Canceled |
| Aldrin | Canceled |
| alpha-HCH | Canceled |
| beta-HCH | Canceled; no longer produced in U.S. |
| DDE | Degradation product of canceled ingredient |
| DDT/DDD | Canceled |
| Dieldrin | Canceled |
| Endrin | Canceled |
| Endrin aldehyde | Byproduct/degradation product of endrin |
| Endrin ketone | Byproduct/degradation product of endrin |
| Famphur | Most uses canceled; no currently active products |
| Hexachlorobenzene | Canceled |
| Silvex (2,4,5-TP) | Canceled |
| Toxaphene | Most uses canceled; no currently active products |

Sources:

## 9.4 Toxic Substance Control Act

TSCA was enacted to fill gaps in the Federal Government's authority to regulate problem chemicals. Most EPA regulations, such as the Clean Air Act and the Clean Water Act, regulate chemicals only after they are produced and used. However, there are many opportunities for a chemical to cause harm to human health or the environment prior to it becoming a waste, such as during production or use. Under Section 6 of TSCA, EPA has the authority to regulate the production, use, distribution, and disposal of chemicals that are identified as potentially hazardous. EPA has exercised the authority under Section 6 to regulate the production, distribution, and disposal of PCBs from electrical equipment and as byproducts of chemical manufacturing processes. The presence of PCBs in the release descriptions probably results from the past disposal of old products containing PCBs. Because TSCA bans the production of PCBs, however, their presence in waste should diminish over time. Actions under TSCA do not significantly address any other potential gaps.

## 9.5 Pollution Prevention

EPA has developed a number of pollution prevention initiatives that could address potential gaps in the characteristics by limiting the production of harmful chemicals. These initiatives include:

- **Source Reduction Review Project (SRRP)**. EPA has an on-going effort to introduce source reduction concepts into individual rules. As part of the SRRP, EPA conducted an in-depth analysis of source reduction measures and cross-media issues in the development of 24 rule makings for air toxics (Maximum Achievable Control Technology or MACT standards), water pollution (effluent guidelines) and hazardous wastes (listing determinations) that were pending in 1993 and 1994. The project's goal is to foster the use of source reduction measures as the preferred approach for achieving environmental protection, followed in descending order by recycling, treatment, and as a last resort, disposal. For the long term, EPA hopes that SRRP will provide a model for the regulatory development efforts in all of its programs.

- **Environmental Technical Initiative (ETI)**. EPA has promoted pollution prevention efforts for selected industries through technology development. For example, the Agency has supported research on recycling plastics, replacing current solvents with less harmful alternatives, and developing cleaner processes in plating and metal finishing.

- **Waste Exchanges**. Waste exchanges provide a mechanism for recycling and reusing industrial waste. In general, waste exchanges try to match generators of waste with companies interested in recycling or reusing these materials. The goals of waste exchanges are to reduce disposal costs, reduce disposal quantities, reduce demand for natural resources, and potentially increase the value of wastes. EPA has supported the non-federal waste exchanges through (1) funding a national computerized listing system, the National Materials Exchange Network (NMEN), and (2) issuing grants to develop support for individual waste exchanges or specific waste exchange activities.

- **Toxics Release Inventory (TRI)**. The TRI can have an instrumental role in pollution prevention by providing communities with the information that can be used to persuade industries to reduce emissions, and by establishing a benchmark to measure progress. For example, EPA established the 33/50 Program whereby companies voluntarily pledged to reduce releases of 17 priority pollutants reported in TRI in 1988 by 33 percent in 1992 and by 50 percent in 1995.

Further research is needed to determine the impact of these initiatives on potential gaps in the characteristics.

## 9.6 Occupational Safety and Health Act

Workplace safety is largely regulated by the Occupational Safety and Health Act (OSHA). The program that most directly relates to chemical hazards encountered in the workplace is the permissible exposure limits (PELs)[2] established for selected workplace chemicals.

Subpart Z of 29 CFR 1910.1000 specifies PELs for toxic and hazardous substances in the workplace. These PELs are based on threshold limits values (TLVs) established by the American Conference of Governmental Industrial Hygienists (ACGIH) and on the Recommended Exposure Limits (RELs) developed by the National Institute for Occupation Safety and Health (NIOSH). OSHA has adjusted some of these values when developing PELs. The PELs are intended to reduce diseases such as liver and kidney pains, neuropathy and cardiovascular effects, respiratory effects, deterioration of lung function, narcosis, biochemical and metabolic changes, and other health impairments caused by workplace exposure to chemicals.

As discussed above, OSHA regulates workplace inhalation exposure to designated constituents by establishing PELs. As shown in Exhibit 9-10, 33, or over 75 percent, of the TC constituents have PELs established under OSHA.

The majority of potential gaps associated with non-TC analytes identified in Chapter 4 are related to exposures to contaminated media, rather than workplace exposures. OSHA PELs, however, could address workplace exposures to a few of the major chemicals classes that comprise several of the potential gaps, including volatile chlorinated organics, other volatile and semivolatile organics, and pesticides. Exhibit 9-11 demonstrates that 21 of the 35 known non-hazardous volatile chlorinated organics in Exhibit 4-2 have OSHA PELs. Similarly, 33 of the 41 and 20 of the 45 other volatile and semivolatile organics, respectively, have OSHA PELs.

## 9.7 Hazardous Materials Transportation Act

HMTA gives the Department of Transportation (DOT) the authority to regulate the transportation of hazardous materials in interstate commerce. The HMTA regulates materials not covered by the hazardous waste characteristic, and therefore addresses hazards from these potential gaps, but only in the context of risks in transportation and to transportation workers. These materials include the following:

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[2] A PEL is the average maximum concentration of a chemical in air that is allowable for a worker to be exposed to in the course of an 8-hour working day.

## Exhibit 9-10
## 1 1,4-DichlorobenzeneCresol (mixed isomers)o-Cresol--

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## Exhibit 9-11

## OSHA PELs Specified for Known Non-Hazardous Industrihit 9-11

PELs Specified for Known Non-Hazardous Industrihit 9-11
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For a potential gap to be addressed by the CWA or CAA, the gap constituents must both have regulatory levels established by the programs and be generated by one of the regulated industrial categories. The CWA and CAA establish limits for about the same number of volatile chlorinated organics. The industrial categories regulated by the CWA, however, overlap more extensively than those regulated by the CAA with the industries represented in the release descriptions. Therefore the CWA effluent limitations will be more effective in addressing potential gaps. Each of the regulations discussed in this chapter do not address all of the known and possible non-hazardous industrial waste chemicals, and therefore none of the potential gaps are completely addressed by non-RCRA regulations.

# CHAPTER 10. SUMMARY EVALUATION OF NATURE AND EXTENT OF POTENTIAL GAPS

This chapter evaluates potential gaps in terms of their significance to human health and the environment. It synthesizes and summarizes information presented in previous chapters.

Section 10.1 discusses the objectives of the gaps analysis and the specific criteria used to evaluate potential gaps.

Section 10.2 presents the findings of the evaluation and discusses major data gaps and unresolved issues.

Section 10.3 describes a possible framework for determining an appropriate course of action based on the results of this Scoping Study.

## 10.1

Presence in Non-Hazardous Industrial Waste. This entry indicates the number of the TC analytes and known or possible non-hazardous industrial waste constituents identified in Chapter 4 that fall into the potential gap and summarizes other available data on presence in waste. The number of chemicals in a given class indicates, to some extent, the potential frequency of their appearance in non-hazardous industrial wastes or use in different industries.

Frequently Detected Constituents in Release Descriptions. This column indicates how frequently the class of chemicals was detected in the documented releases from non-hazardous industrial waste management facilities. These data provide a second indicator of the frequency of the class of chemicals in wastes released to the environment. In some tables, this column also addresses the extent to which the releases had constituent concentrations detected in excess of health- or ecologically-based regulatory standards or other health-based levels. These data address the severity and type of the risk presented by the releases.

TRI Chemicals with Releases > One Million Pounds. This column identifies any constituents falling into the identified potential gaps that have 1994 TRI releases to air, land, water, and underground injection combined greater than one million pounds. Eighty-three of the 250 individual or classes of TRI chemicals for which data were available had reported releases exceeding one million pounds. These data served as a proxy for widespread use and appearance in wastes.

Affected Industries. This column presents two types of data. First, it identifies the industries most often associated with documented releases of a particular class of chemicals in the release descriptions. These data indicate, at least for the population of facilities evaluated, which industries seem to have the highest frequency of releases to the environment of each class of compounds. As noted previously, however, this indicator is imperfect, in part because the available data focus on releases to groundwater and some families of constituents may present risks primarily through other pathways. The column also uses information presented in Chapter 8 to identify the industries with particular classes of chemicals frequently occurring in their non-hazardous industrial wastes.

Affected Management Methods. This column identifies the types of management units at which the various classes of chemicals are detected most frequently in the release descriptions or other data sources. This criterion has the same limitation as the release description information identified above, namely, it focuses on groundwater contamination and thereby may miss chemicals that pose risks through other pathways. However, since presence in groundwater indicates presence in wastes, this column also provides information about the types of management units or practices that have releases to groundwater and are likely to have releases to other media (e.g., volatilization), as discussed in the screening-level risk results from Section 3.5.

Potential Coverage by Other Regulations. This column summarizes information presented in Chapter 5 (for large-scale environmental problems) and Chapter 9 (for TC and non-TC chemicals). It briefly describes the potential extent of coverage of potential gaps by existing regulatory programs. In some cases, despite the appearance that a particular gap is covered by a regulatory program, information from the release descriptions or elsewhere may indicate that such coverage is not preventing releases to the environment.

Comments/Data Gaps. The final column of each table identifies the major analytical uncertainties and

## 10.2 Findings of the Evaluation

This section summarizes the evaluations of the five different types of potential gaps identified in the previous chapters, namely potential gaps associated with:

- The existing ignitability, corrosivity, and reactivity characteristics;
- The existing toxicity characteristic;
- Chemicals not included in the toxicity characteristic;
- Natural resource damages and large-scale environmental problems; and
- State expansion of the TC and listings.

The last part of this section reviews the major data gaps and uncertainties.

### 10.2.1 Potential Gaps Associated with the ICR Characteristics

**Ignitability**

Exhibit 10-1 summarizes the analysis of the potential gaps in the ICR characteristics. (This exhibit does not include a column on the constituents that were frequently detected in the release descriptions because of the difficulty of judging waste ICR properties based on the environmental monitoring data (e.g., groundwater sampling from the release descriptions). The first page of the exhibit addresses the limitations in the ignitability characteristic. The first potential gap in this characteristic relates to the lack of coverage of combustible liquids, that is, liquids with flash points above 140 F and below 200 F. The Age1 by ha not ifundwandydata ty 9.36 0 TD

## Exhibit 10-1 (continued)
## Evaluation of Potential Gaps Associated With the Ignitability, Corrosivity, and Reactivity (ICR) Characteristics

| Potential Gap | Nature of Risk | Presence in Non-Hazardous Industrial Waste | TRI Chemicals with 1994 Reported Releases > One Million lbs. | Affected Industries | Affected Management Methods | Potential Coverage by Other Regulations | Comments/Major Data Gaps |
|---|---|---|---|---|---|---|---|
| **<u>CORROSIVITY</u>**<br>● Exclusion of Corrosive Non-liquids | ● Skin, eye injuries and ecological risks, facilitated transport of pollutants | ● Not addressed | ● Not addressed | ● Not addressed | ● Not addressed | ● Several states regulate corrosive solids as hazardous waste. | ● Lack of data on specific substances, wastes, and/or damage cases that fall within potential gaps. |
| ● pH Limits Potentially Not Protective, pH Test Methods Not Predictive of Risk | ● pH test may not identify some corrosive materials | ● Not addressed | ● Not addressed | | ● Not addressed | ● DOT and OSHA rules use a dermal corrosion test (not pH); they cover worker and transportation risks. | |
| ● Corrosion of Non-Steel Materials Not Addressed | ● Corrosion of plastic, clay, other liner materials and non-steel containers or tanks | ● Many NAPL-formers; alcohols, ketones | ● Toluene, xylene, carbon disulfide, styrene, ethylbeneze, trichlorofluoromethane, phenols | | ● Waste management methods that involve materials such as plastic, clay, and other materials besides steel | ● CAA limits disposal of solvents in certain units. | |
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The final panel of Exhibit 10-1 summarizes the information related to the potential gaps in the reactivity characteristic. A major question for this potential gap is whether the over-broadness of the definition has increased the occurrence of human health or environmental damages or risks due to reactive materials. The release descriptions do not contain information related to violent chemical reactions. Also, while some DOT-classified reactive chemicals are among the non-hazardous industrial waste constituents, there is no evidence that would indicate whether these chemicals are present in forms or concentrations that are reactive. The need to specify test methods is likewise linked both to the severity of reactivity as a problem for non-hazardous industrial waste management operations, and to the extent to which such issues are not already addressed by the DOT regulations, OSHA regulations, or process safety management practices.

### 10.2.2 Potential Gaps Associated with TC Analytes

Exhibit 10-2 summarizes the analysis of five types of potential gaps associated with the toxicity characteristic:

- TC regulatory levels for the groundwater pathway;
- Risks through non-groundwater pathways, including inhalation, surface water, and indirect pathways;
- Acute human health risks;
- Risks to ecological receptors; and
- Limitations in the TCLP.

Each of these gaps is discussed below, following a brief review of data applicable to all four potential gaps.

One indication of the significance of these potential gaps is that 25 of the 40 TC analytes were detected in at least one of the descriptions of releases from non-hazardous industrial waste management units described in Chapter 2. Many are detected frequently above regulatory levels. Six TC metals and arsenic are among the most commonly detected analytes in the release descriptions.

All TC analytes are regulated under federal and state regulatory schemes in addition to the RCRA hazardous waste characteristics. The TC analytes are included in 40 CFR Part 261, Appendix VIII, and therefore many wastes have been listed based on the presence of TC chemicals. Media-specific regulatory programs also control individual analytes. MCLs or MCLGs have been promulgated to limit exposures to about half the TC analytes in community drinking water systems. Most volatile TC analytes are Hazardous Air Pollutants under the CAA, and most TC analytes have OSHA Permissible Exposure Limits (PELs), which limit occupational exposures. CWA Ambient Water Quality Criteria trigger regulatory control of most of the TC analytes through NPDES permits and state surface water quality standards, although, as noted in Chapter 3, the TC regulatory levels may not be adequately protective against surface water risks for some analytes.

## Exhibit 10-2
## Evaluation of Potential Gaps Associated with Toxicity Characteristic Analytes and TCLP

| Potential Gap | Nature of Risk | Detection in Release Descriptions | TRI Chemicals with 1994 Reported Releases > Million lbs. | Affected Industries | Affected Management Methods | Coverage by Other Regulations | Comments/Major Data Gaps |
|---|---|---|---|---|---|---|---|
| Groundwater pathway risks | • Wastes with TC constituents below | • | | | | | |
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## Exhibit 10-2 (continued)
## Evaluation of Potential Gaps Associated with Toxicity Characteristic Analytes and TCLP

| Potential Gap | Nature of Risk | Detection in Release Descriptions | TRI Chemicals with 1994 Reported Releases > Million lbs. | Affected Industries | Affected Management Methods | Coverage by Other Regulations | Comments/Major Data Gaps |
|---|---|---|---|---|---|---|---|
| Acute adverse health effects were not considered in derivation of TC levels. | ● Screening analysis showed that short-term concentrations of all volatile TC organics calculated at fenceline were far below applicable short-term (occupational) exposure standards<br>● Unusual release events (e.g., fires or explosions) could result in higher exposures | ● Specific constituents of potential concern were not identified. | ● Specific constituents of potential concern were not identified. | ● Not addressed | Not addressed. | ● OSHA PELs, CAA | • Acute hazards are addressed by ICR characteristics |
| Ecological risks were not considered in derivation of TC levels. TC constituents include potent ecotoxins, persistent and bioaccumulative pesticides. | ● Potential damage to nearby aquatic ecosystems from releases to surface water and through aquatic and possibly terrestrial food chain exposures from runoff<br>● TC analytes with a ratio of TC leachate concentration to AWQC > 10,000 include chlorinated pesticides, chlorobenzene, lead, mercury, pentachlorophenol, silver, toxaphene, and 2,4,5-trichlorophenol.<br>● Ratio is > 100,000 for mercury, methoxychlor, silver, and toxaphene. | ● Lead, mercury, silver, and chlorobenzene each were detected at more than 5 of 112 releases. | ● Chlorobenzene | ● Chemicals, refuse systems, paper, primary metals, and others | ● Waste piles, land application units, surface impoundments, landfills | ● State Industrial D, CWA effluent limits, FIFRA | ● Uncertainty in estimating degradation and dilution<br>● Limited data on wastestreams and releases to various pathways |
| TCLP may not accurately predict leachate concentration or risks for certain wastes and units. | ● Release concentrations may be higher or lower than predicted, implying higher or lower exposure concentrations and risks.<br>● Main concerns are for oily wastes; highly alkaline wastes; wastes with multiple constituents; wastes disposed in certain types of landfills; some types of treated wastes; some types of contaminated soil; and non-groundwater pathways. | ● Lead, cadmium, chromium, arsenic, barium, benzene, selenium, lindane, and vinyl chloride were detected in groundwater at levels exceeding their TC levels, indicating that TCLP may have underestimated the long-term releases of some wastes. | ● Chromium compounds, lead compounds, arsenic compounds, and vinyl chloride (of those listed in prior column) | ● Not addressed | ● All types | ● RCRA listings, state Industrial D; states have developed alternative leaching procedures, e.g., Cal WET | ● Limited data on wastestreams and management unit environments<br>● Waste heterogeneity, sampling procedures, sample preparation, leaching procedure contribute to uncertainty in test results. |

### TC Regulatory Levels for Groundwater

The first of the potential TC gaps concerns whether the existing leachate concentrations remain demonstrably protective of human health through the groundwater pathway, given advances in toxicological, fate, and transport data and modeling since the TC was promulgated. As noted in Section 3.5.2, the only changes in toxicological values that have occurred since the TC was promulgated are the reduction of the RfD for pentachlorophenol, promulgation of a cancer slope factor for this compound, the reduction in the RfD for p-cresol, the replacement of the MCL for lead with a lower action level, and replacement of the MCL for silver with an SMCL. Of these changes, only the classification of pentachlorophenol as a carcinogen significantly changes the risk implicit in the TC regulatory levels. EPA also has refined its approach for modeling the fate and transport of both organic and inorganic constituents in groundwater. Most recently, groundwater risks were modeled for the TC analytes in the HWIR-Waste proposed rulemaking. This modeling, which is still undergoing revisions, was performed using some assumptions that differ significantly from those made in the derivation of the TC regulatory levels.

### TCLP Limitations

The final potential gap in the TC characteristic is the limitations in the ability of the TCLP to accurately predict releases of hazardous constituents from wastes. The Agency has received numerous comments and data on the utility of the TCLP in general and for specific wastes and environments. Potential limitations of the method include difficulties in performing the analysis on oily, hydrophobic wastes and in simulating leachate characteristics for highly alkaline wastes, certain types of landfill environments, long-term mobility of organics in some treated (non-hazardous) wastes, and some contaminated soils. Furthermore, the TCLP was not designed to simulate releases into non-groundwater pathways (e.g., air).

In the context of this Scoping Study, EPA has not identified any significant new information bearing on the magnitude of this potential gap. The Agency has reviewed other possible leaching methods (such as the SPLP and Cal WET methods), but has not found compelling evidence that they are more appropriate for general use than the TCLP. The high frequency of occurrence of TC analytes in groundwater above MCLs or HBLs near non-hazardous industrial waste facilities, as shown in the release descriptions, suggests that the TCLP may not adequately detect situations that could result in harm to human health or the environment. The blame cannot unambiguously be placed on the TCLP, however. Even if the TCLP accurately predicts TC leachate levels, site-specific fate and transport processes (e.g., dilution by a factor of less than 100) and waste management practices could result in the exceedances of MCLs and other regulatory levels.

### 10.2.3 Potential Gaps Associated with Non-TC Waste Constituents

Exhibit 10-3 summarizes the evaluation of potential gaps associated with non-TC chemicals that are known or possible non-hazardous industrial waste constituents. Separate evaluations are presented for each of the 10 categories of chemicals identified in Chapter 4, which are associated with the groundwater, inhalation, or indirect pathways:

- Metals and other inorganics;
- Volatile chlorinated organics;
- Volatile hydrocarbons;
- Other volatile organics;
- Pesticides and related compounds;
- Phthalate esters;
- Phenolic compounds;
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**Exhibit 10-3**

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## Exhibit 10-3 (continued)
## Evaluation of Potential Gaps Associated with Non-TC Chemicals

| Chemical Type | Nature of Risk | Presence in Non-Hazardous Industrial Waste[a] | Frequently Detected Constituents in Release Descriptions | TRI Chemicals with 1994 Reported Releases > One Million lbs. | Affected Industries | Affected Management Methods | Potential Coverage by Other Regulations | Comments/Major Data Gaps |
|---|---|---|---|---|---|---|---|---|
| Other Volatile <Organics | ● Potential cancer risks > $10^{-5}$ and noncancer risks of HQ>1<br>● Highly variable toxicity and fate and transport | ● 58 compounds | ● Acetone | ● Methanol, methylisobutyl ketone, n-butanol, formaldehyde, acetinitrile, | ● Chemicals refuse systems, and paper industries have 88 percent of detections | ● 75 percent of detections from landfills and remainder from surface impoundments. | ● State Industrial D; most in Appendix VIII; RCRA listings California TC includes acrylonitrile; most are CAA | ● Wide range of toxicological, fate and transport properties<br>● Limited data on |
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## Exhibit 10-3 (continued)
## Evaluation of Potential Gaps Associated with Non-TC Chemicals

| Chemical Type | Nature of Risk | Presence in Non-Hazardous Industrial Waste | Constituents in Release Descriptions | 1994 Reported Releases > One Million lbs. | Affected Industries | Affected Management Methods | Potential Coverage TD -0. Tc Regulations | (Affected) Tj 24.my Oth.0073 25.0 Tw ( Comments/Major Data Gaps |
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humans and ecological receptors. These and other indicators of hazard, combined with indicators of exposure potential, demonstrate the potential for risks to human health or the environment.

Presence in Non-Hazardous Industrial Waste. The numbers of chemicals in the various classes that are known or possible non-hazardous industrial waste constituents varies widely:

- 103 pesticides and related compounds,
- 67 other semi-volatile organic compounds,
- 61 metals or other inorganics,
- 58 other volatile organics,
- 45 volatile chlorinated organics;
- 46 NAPL formers (30 DNAPL formers and 9 NAPL formers),
- 19 polycyclic aromatic hydrocarbons,
- 13 volatile hydrocarbons,
- 13 phenolic compounds, and
- 6 phthalate esters.

Frequently Detected Constituents in Release Descriptions. Six non-TC metals are among the most frequently occurring analytes in the release descriptions, along with three volatile chlorinated organics, one other volatile organics, and one phenolic compound. The other classes of chemicals were not detected frequently in the release descriptions, which predominately included groundwater contamination. The constituents found in the release descriptions, however, frequently violated MCLs and other health-based levels.

TRI Chemicals with 1994 Reported Releases Exceeding One Million Pounds. These broad categories of potential gaps include many chemicals with high TRI release volumes. In the case of the non-TC metals and other inorganics, copper, zinc, manganese, and cyanides (as CNH) fell into this category. As was the case for the frequency of occurrence in the release descriptions, several volatile organic waste constituents (chlorinated and nonchlorinated) that have high TRI release volumes are TC analytes. None of the pesticides, phthalate esters, or PAHs were among the chemicals with TRI releases greater than one million pounds. Two phenolic compounds and three semivolatile organics were among the waste constituents with the highest TRI releases. Many of the potential NAPL forming compounds also are high-release compounds.

Affected Industries. A relatively small number of industries tend to account for the bulk of the occurrences of most categories of wastes with chemicals of concern. For almost all chemical classes, most detections of chemicals constituents[2] identified in the release descriptions were associated with three industry groups: chemicals and allied products, refuse systems, and paper and allied products. Phenolic compounds diverge from this pattern. The three industries identified above account for only about 35 percent of the releases of such compounds, and 8 other industries had detections of phenolic constituents.

Affected Management Methods. As noted in Chapter 8, about 65 percent of the release descriptions were associated with landfills, 28 percent with surface impoundments, and 11 percent from land application units, 4 percent from waste piles, with the other management units accounting for less than 1 percent each. (Several release descriptions involved more than one facility.) This pattern generally applies to the individual classes of chemicals, with a few significant exceptions. Since metals and inorganics were detected much more often than other constituents, data on these detections dominate the overall pattern. The other classes of chemicals with relatively high numbers of detections (volatile hydrocarbons, other volatile organics, phenolic compounds, and

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[2] Each chemical detected at a release site constitutes one detection. Thus, each release may have multiple detections (i.e., multiple constituents) and each chemical may have multiple detections (i.e., be found at multiple releases).

chlorinated volatile organics) were most commonly found in landfill releases, like the metals.  For some chemical classes with relatively low numbers of detections, such as other semivolatile organics, phthalate esters, and PAHs, the proportions of detections from landfills and surface impoundments is almost equal, with few releases are reported from other management units.

### Potential Coverage by Other Regulations

- Water pollution.

At this time, the Agency does not plan to further consider any of these potential gaps, except possibly air deposition and endocrine disruptions. These two potential gaps are discussed below and summarized in Exhibit 10-4.

### Air Deposition to the Great Waters

Few data are available on the contribution of non-hazardous industrial waste management to the deposition of toxic particulates (including toxic metals and persistent chlorinated organic chemicals) in the Great Waters ecosystems. While non-hazardous industrial waste constituents include toxic metals such as cadmium, lead, and mercury, the extent of their long-range transport is unknown. Persistent chlorinated organic chemicals also are among non-hazardous industrial waste constituents. Many of them have been banned from manufacture or further use and therefore are unlikely to be managed in significant quantities as non-hazardous industrial wastes. They may, however, continue to be found in remediation wastes.

### Potential Damages from Endocrine Disruptors

The next potential gap is exposure to suspect endocrine disruptors. Depending upon what criteria are used to identify these constituents, 28 suspect endocrine disruptors have been found among the TC analytes and known or possible non-hazardous industrial waste constituents. Only the metals are encountered frequently in the release descriptions, however. These metals are most commonly present in releases detected from facilities in the chemicals and allied products, refuse systems, paper and allied products, industrial sand, and primary metals industries. These releases are most often seen from landfills, followed by surface impoundments, based on the release descriptions summarized in Chapter 2.

One suspect endocrine disruptor, styrene, is high on the TRI list, having total releases of 40 million pounds in 1994. Almost all of the styrene releases are to air, with well under one million pounds being released to land. Releases of the phthalate esters as a class also exceed one million pounds, although the releases of these compounds individually are all less than one million pounds.

The use of many suspect endocrine disrupting pesticides has been banned or strictly limited. A significant portion of the endocrine disruptors are TC analytes or otherwise listed in 40 CFR Part 261, Appendix VIII. The greatest uncertainty concerning this potential gap is a lack of knowledge about dose-response relationships for single and multiple agents, and the relative contribution of non-hazardous industrial waste management to the total exposure of human and environmental receptors.

A key step in any risk analysis is characterizing the sources of releases of toxic or otherwise hazardous materials to the environment. Thus, possibly the most important data gap is the lack of current data on the generation, composition, and management of non-hazardous industrial wastes. EPA's most recent comprehensive data on these topics are approximately a decade old. Many of the data are even older. While the basic nature of non-hazardous industrial wastes and waste management practices are not likely to have changed dramatically, nonetheless, some important changes are likely to have occurred because of regulatory, economic, and technical developments since the data were gathered.

Additional data gaps relate to exposure potential. Because of the lack of site-specific data, the Agency had to rely primarily on proxies for exposure and risk potential. Environmental fate, transport, and toxicological parameters have been used as a primary screening criteria to identify and evaluate hazards. As noted in Chapter 5, consistent and reliable data related to these properties are available for only a relatively limited portion of the universe of chemicals under consideration.

Likewise, the Agency has no direct data on the amounts of certain constituents released from non-hazardous industrial waste management units. Instead, 1994 TRI release data were used as proxies for such data. Another data source the Agency employed to assess exposure potential was the release descriptions from non-hazardous industrial waste management facilities. While these data provide direct evidence of environmental contamination, it is often not clear whether the management practices that resulted in releases are still in use.

Some data gaps in this analysis are common to all risk analyses. For example, the need to conduct analysis on a national scale and to consider a wide range of site conditions, facility characteristics, and geographic settings dictates the use of generic, rather than site-specific modeling to estimate exposures through the various pathways. Thus, the analysis of groundwater exposures relies on probabilistically-defined dilution and attenuation values and the screening-level risk modeling uses highly generic release, transport, and exposure models. This approach only roughly approximates potential risks to humans and ecological receptors. Moreover, extensive professional judgment was required to generalize from generic modeling for specific chemicals to broad classes of waste constituents.

Another major source of uncertainty is associated with toxicity of the waste constituents. The dose-response models and data used are the most current available to the Agency. Nevertheless, substantial uncertainty exists regarding the probability and severity of adverse effects as a function of dose for many chemicals. The use of a generically defined "chronic" exposure period may mask important relationships between exposure periods and effects. Also, the Agency was not able to derive any specific dose-response relationships for endocrine disruptors or for any non-additive combinations of pollutant exposures. These uncertainties, unlike some of the others just discussed, are not likely to be resolved in the near future.

## 10.3 Framework for Determining an Appropriate Course of Action

The U.S. Environmental Protection Agency will consider the appropriate course of action to address significant gaps or potential gaps in the hazardous waste characteristics identified by the Study. This section describes the framework that EPA plans to use in considering what course of action is appropriate. As part of this process, the Agency will consider comments on the Study from interested parties.

EPA's approach for considering a course of action will include two main steps:

Step 1: Identify the critical research needs and associated next steps necessary to analyze key issues and fill major data deficiencies identified in the Scoping Study; and

Step 2: Identify and evaluate options to address the environmental management concerns resulting from any gaps in the characteristics that were clearly identified in the Scoping Study.

Both of these steps are described in more detail below.

### 10.3.1 Step 1: Identify Critical Research Needs and Next Steps Necessary to Analyze Key Issues and Fill Major Data Deficiencies

The results of the Scoping Study vary greatly in terms of the certainty that can be attributed to gaps in the hazardous waste characteristics. Some of the potential gaps, most notably certain limitations in the ICR characteristics, are clearly identifiable problems. Most potential gaps, however, are associated with considerable uncertainty that limits the degree to which conclusions can be made about either the precise nature and extent of the gap or how, if at all, it should be addressed. Thus, a critical activity in the near-term will be to assess what additional data and analysis are needed to reduce uncertainty and better determine the significance of the most important potential gaps in the characteristics identified by the Scoping Study.

### 10.3.2 Step 2: Identify and Evaluate Options to Address Any Clearly Identified Gaps

Some of the gaps identified in the Scoping Study are sufficiently defined that the Agency can consider options for addressing the problem. Modifying an existing characteristic or developing a new characteristic may be an appropriate method of filling some of these gaps. Other gaps may be better addressed through other regulatory programs or in coordination with such programs. Thus, the list of options that the Agency may consider include:

- Specifying additional or revised test methods;
- Expanding the definitions of existing characteristics;
- Modifying the characteristics to reflect new risk data and modeling techniques;
- Creating new characteristics, including contingent characteristics based on management method or the type of generator or waste;
- Identifying new hazardous waste listings or modifying existing listings;
- Modifying other regulatory programs (e.g., Subtitle D);
- Developing a non-regulatory approach (e.g., recycling, waste minimization); and
- Promoting voluntary industry programs.

In evaluating a range of feasible options for particular gaps, the Agency will consider a variety of factors including, but not necessarily limited to the following:

- Affected industries, wastes, and management practices;
- Human health and environmental benefits, such as reduced hazards and loadings of hazardous constituents;

# HAZARDOUS WASTE CHARACTERISTICS
# SCOPING STUDY

1

# APPENDIX A

# ENVIRONMENTAL RELEASE DESCRIPTIONS

# SECTION A.1:

# STATE INDUSTRIAL SOLID WASTE AND STATE SUPERFUND RELEASE DESCRIPTIONS

Operable Unit 2 addresses groundwater concerns. The groundwater plume is discharging to Bayou Texar locate one mile from the site. There are no active water supply wells between the site and the groundwater discharge point, therefore, the contamination does not pose a risk as a current drinking water source. The groundwater remedy selected consists of monitoring groundwater conditions as natural attenuation, flushing, and dispersion occur since contaminant loadings to the groundwater have been eliminated. Selected components of the groundwater remedy include:

1. Groundwater monitoring of the sand and gravel aquifer;
2. Groundwater monitoring of Bayou Texar;
3. Door-to-door survey of irrigation wells;
4. Request access from private landowners to plug and abandon impacted irrigation wells;
5. Utilization of institutional controls to restrict new wells; and
6. Advisory program.

## Sources of Information

Draft Phase II Remedial Investigation; Agrico Chemical Site, Pensacola, Florida, Volume I of III. Geraghty & Miller, Inc. f Conoco Inc. and Freeport-McMoRan, April 29, 1992.

EPA Region IV Superfund Proposed Plan Fact Sheet, Agrico Chemical Site, prepared by U.S. EPA Region IV, February 1

Final Phase II Remedial Investigation; Agrico Chemical Site, Pensacola, Florida, Volume II of IV. Geraghty and Miller, Inc November 1993.

Final Phase II Remedial Investigation; Agrico Chemical Site, Pensacola, Florida, Volume III of IV. Geraghty and Miller, In Appendix F, November 1993.

Record of Decision: Operable Unit 1; Agrico Chemical NPL Site, Pensacola, Escambia County, Florida. EPA Region 4, September 29, 1992.

Written correspondence submitted by facility and/or State on draft version of release descriptions, October 1996

## ARIZONA CHEMICAL FLORIDA

### Facility Overview

| | |
|---|---|
| Facility Name: | Arizona Chemical Company |
| Location: | Panama City, Florida |
| Waste Stream: | Process wastewater |
| Media Affected: | Groundwater |

The facility was established in 1936 to process International Paper mill by-products into useable chemicals. The first operation established was a crude sulfate turpentine unit to process terpene chemicals that can be found in household cleaners, solvents, flavorings, and fragrances. In 1945, the plant moved into a second area of paper mill by-products recovery, the conversion of black liquor soap from the pulping process into crude tall oil. The crude tall oil is further refined into high purity fatty acids and rosins used in printing inks, adhesives, protective coatings, and synthetic rubber. A polyterpene resin production unit was added in 1971, raising facility employment to approximatel 280. Limonene, a citrus by-product, was later added to the raw material base. Three Florida Class III surface water bodi exist within a one-half mile radius of the site, and are designated to be managed for recreation and propagation of healthy and wildlife.

### Wastes and Waste Management Practices

Prior to December 1990, a rosin sump received wastewater from the plant and discharged to an unlined industria wastewater holding pond. No information was available in the State files on the pond other than a map showing it to be approximately 200 feet by 100 feet, with depths ranging from 3 to 10 feet.

### Extent of Contamination

Groundwater samples collected from four monitoring wells around the pond were analyzed pursuant to the 1990 Consent Order and are summarized below. Concentrations of benzene, iron, manganese, sodium, and total dissolved so (TDS) exceeded Florida guidance standards. Pond sludge and sediment samples revealed elevated concentrations of inorganics, ethylbenzene, xylenes, and chlorinated pesticides. The Preliminary Contamination Assessment Report (PCA states that a comparison of the material in the pond with the adjacent groundwater quality suggests that the pond is not a source of contamination because ethylbenzene and xylenes were not detected in the groundwater. The suspected sourc these purgeable compounds in the semi-solid material is a result of accidental releases of process water entering the stormwater system from the resin sump. Chlorinated pesticides found in bottom layer sediments of the pond could not be traced to any historical usage of DDT at the site. Concentrations of metals found in the sludge are believed to be due to t adsorption concentration effect of organic material on metal concentrations in the incoming wastewater. The metals are believed to be from two major sources, cooling water flows into the pond containing corrosives from the heat exchangers stormwater runoff from roads and parking lots.

**GROUNDWATER CONTAMINANTS COMPARED TO FLORIDA OR FEDERAL DRINKING WATER STANDARDS**

| Contaminant | Highest Detected Level (mg/l) | FL Standard (mg/l) | MCL (mg/l) | SMCL (mg/l) |
|---|---|---|---|---|
| Benzene | 0.0043 | 0.001 | 0.005 | -- |
| Iron | 48 | 0.3 | -- | 0.3 |
| Manganese | 0.068 | 0.05 | -- | 0.05 |
| Sodium | 260 | 160 | -- | -- |
| TDS | 910 | 500 | -- | 500 |

### Corrective Actions/Regulatory Actions

The resin sump, which received wastewater from the resin plant, was taken out of service on December 1, 1990. Wastewater from the resin plant is now treated within a permitted treatment system. A January 8, 1990 Consent Order required that Arizona Chemical Company implement a groundwater study at the industrial wastewater holding pond. The facility continues in a remedial phase of the Consent Order.

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## Facility Overview

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|---|---|
| Facility Name: | Stone Container Corporation |
| Location: | Panama City, Florida |
| Waste Stream: | Process wastewater |

The Stone paper mill has been in operation since 1931. Prior to that time a lumber mill was located at the site. Southern Kraft Company owned the paper mill when it was constructed. International Paper purchased it some time later, and then sold it to Southwest Forest Industries in 1979. Stone purchased the mill from Southwest Forest Industries in 1987. The mill produces Kraft liner board and bleached market pulp. Chemicals used in the paper manufacturing process since the mill was constructed include aluminum sulfate, calcium carbonate, calcium oxide, chlorine, chlorine dioxide, elemental oxygen, hydrogen peroxide, rosinsize, so
carbonate, sodium chlorate, sodium hydroxide, sodium hypochlorite, sodium sulfate, sodium sulfide, and sulfuric acid.

## Wastes and Waste Management Practices

In 1955, primary clarification to remove settleable solids from the mill's effluent began. The treated effluent was discharged to St. Andrews Bay. Over the years, a small bayou in the area of the pretreatment pond was reclaimed using
materials. A permit issued December 31, 1986 expired June 1, 1988. A timely operating permit renewal application was
prior to the expiration of the 1986 operating permit. The facility operated without a permit until May 1990, when a Conser
Order was signed.

The facility now operates an industrial wastewater pretreatment system associated with pulp and paper manufacturing. It consists of a lime pond, emergency clarifier, primary clarifier, pump station holding pond, ash sluice por
stormwater ditch, and a primary clarifier ditch which conveys industrial wastewater and stormwater to the primary clarifier
treatment. Primary treated effluent from the facility is discharged to Bay County Regional WWTF for additional treatment
to discharge into St. Andrews Bay.

The facility received a Notice of Violation in November 1988 for direct discharges of wastewater from the facility t the groundwater.  Stone currently operates under a Consent Order requiring sampling every 90 days, implementation of corrective actions if sampling reveals continuing contamination, and reimbursement to FDEP for expenses.

**Sources of Information**

Stone Container Corporation Industrial Wastewater Pretreatment Facility Groundwater Investigation Report, Volume I, undated.

FDEP Northwest District Site Summary Memorandum, September 20, 1995.

Written correspondence submitted by facility and/or State on draft version of release descriptions, October 1996.

| | |
|---|---|
| Facility Name: | Zellwood Farms |
| Location: | Zellwood, Florida |

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|---|---|
| Facility Name: | Atlas Processing Company |
| Location: | Shreveport, Louisiana |
| Waste Stream: | Refinery sludge and process wastewater |
| Media Affected: | Groundwater and soil |

## Facility Overview

Atlas Processing Company operates an oil refinery in Shreveport, Louisiana. The refinery has operated since 1923.

## Wastes and Waste Management Practices

The facility disposes of wastewater and sludges from the process of refining oil from crude. The facility treats process water in a series of wastewater surface impoundments and discharges the effluent through a permitted NPDES outfall. The surface impoundments have been in existence for approximately 16 years. Past waste management practices have utilized an area adjacent to the surface impoundments known as the South Dirt Pile Area as temporary waste storage area for the storage of non-hazardous waste generated from the cleaning of the surface impoundments. In addition, impacted soils resulting from spills and leaks in the facility have also been temporarily stored the South Dirt Pile Area in the past. The wastes in the South Dirt Pile Area as well as the wastewater in the adjacent surf impoundments were tested and were determined not to be hazardous under TCLP. Sludges generated from the surface impoundments are disposed of off-site at a permitted facility. Prior to the existence of the wastewater impoundments and South Dirt Pile Area, this area was used as a process wastewater pond up until the 1970’s. Presumably, the majority of t contamination to the soil and groundwater is related to the former wastewater pond. However, the South Dirt Pile Area m have also contributed volatile and semi-volatile organic compounds in the soil and groundwater.

In 1987, six (6) groundwater monitor wells were installed around the wastewater treatment impoundments. Four these wells are up-gradient and two are down-gradient of the surface impoundments. In 1995, four (4) permanent groundwater monitor wells were installed in the vicinity of the South Dirt Pile Area and down gradient of the surface impoundments. One of the wells was located in the middle of the South Dirt Pile Area and the other 3 were located down gradient of the South Dirt Pile Area.

In August 1995, soil samples were continuously collected from the ground surface to the termination depth of eac borehole. Groundwater monitoring wells were installed in each of the four soil boring holes. Groundwater is sampled quarterly.

## Extent of Contamination

Groundwater - In 1995, groundwater samples were analyzed for metals and volatile and semi-volatile organics. T of eight metals were detected above the method detection limit. Volatile and semi-volatile organics were also detected, however, none of the samples exceeded the MCL. A thin layer of phase-separated hydrocarbons (PSH) equal to 0.01 foo was found in one monitoring well.

Since installation of the groundwater monitor wells around the impoundments, the facility has been sampling groundwater for chlorides, sulfate, pH, phenols, and BTEX quarterly and the results continuously reported to LaDEQ. Sp conductance and MEK were added to this list in 1993 and 1994, respectively. Sample results from 1996 indicated that chloride and sulfate exceeded the SMCL and specific conductance exceeded the SMCL and specific conductance excee the MCL in some of the wells. However, it should be noted that the detected values have not changed significantly from t first sampling event in 1987.

The table below presents groundwater monitoring data from the 1995 sampling of the wells in the South Dirt Pile Area and the 1996 sampling of the wastewater impoundments groundwater monitor wells.

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| 2-Methylnaphthalene | | | |
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Soil - In 1995, during the installation of the 4 monitoring wells in the South Dirt Pile Area soil samples were continuously collected from the ground surface to the termination depth of each borehole. The samples were analyzed fo Skinner List Metals and copper, silver, tin, and zinc. Detectable concentrations were reported for 11 of the 16 metals analyzed: arsenic, barium, chromium, cobalt, copper, lead, nickel, selenium, tin, vanadium, and zinc. Numerous volatile

Personal communication with Groundwater Protection Division, Louisiana Department of Environmental Quality, August 1

Written correspondence submitted by facility and/or State on draft version of release descriptions, October 1996

### Facility Overview

Beaird Industries manufactures steel vessels for the nuclear power industry at its Shreveport, Louisiana facility. As part of this manufacturing process, the facility sandblasts only non-painted, virgin metal surfaces. It does not reline, resurface, or repaint any metal surfaces. Historically, blastihe faf40F2etal surfaces.

| | |
|---|---|
| Facility Name: | Beaird Industries |
| Location: | Shreveport, Louisiana |
| Waste Stream: | Spent blasting sand and steel grit dust |
| Media Affected: | Groundwater |

## CITGO PETROLEUM CORPORATION - LOUISIANA REFINERY LOUISIANA

### Facility Overview

Citgo Petroleum Corporation owns and operates a crude oil refinery. The plant's operations are separated into two functional areas: the Lube Plant and the Refinery. The Refinery is the nation's sixth largest. It was built in 1944 to produce aviation fuel. Through the years, new process units and unit upgrades have enabled the Refinery to increase its capacity from 70,000 barrels to the present 320,000 barrels per day. The refinery processes a high-sulfate crude from Venezuela. The site is located near the Calcasieu River and the Indian Marais Bayou runs through the site boundaries.

| | |
|---|---|
| Facility Name: | Citgo Petroleum Corp. Louisiana Refinery |
| Location: | Lake Charles, Louisiana |
| Waste Stream: | Refinery wastes |
| Media Affected: | Soil and groundwater |

| | |
|---|---|
| Chromium | 28 |
| Copper | 23.6 |
| Magnesium | 14,000 |
| Mercury | 0.106 |
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## Facility Overview

The Gretna Machine and Iron Works facility is owned by Trinity Industries. Gretna reconditions barges at the Harvey, Louisiana site.

Facility Name: Gretna Machine and Iron Works

Location: Harvey, Louisiana

Waste Stream: Washwater from production of heavy metal products

## Wastes and Waste Management Practices

Gretna generated paint wastes and burned waste oils in two boilers. A 1.5 acre surface impoundment had been used as a dewatering/evaporation pit since before 1957. The impoundment contains oily solid residues from past waste management activities. Wastes were generated during the degassing and cleaning of barges. The unlined pi received washwater from gas-freeing and barge-cleaning operations. Historically, it has been a repository for wastes fron barges such as gasoline, diesel, #6 oil, and creosote.

In 1986, the site was required to characterize the wastewater in the impoundment. The analysis indicated the presence of hazardous constituents, but not at levels to be considered hazardous waste. The Louisiana Department of Environmental Quality (LDEQ) could not successfully document that the site was receiving hazardous wastes from barge Gretna claims to have received only oil and gas products, no listed hazardous waste. Gretna also states that the

## Facility Overview

The International Paper, Louisiana Mill plant in Bastrop, Louisiana is a pulp and paper mill. Manufacturing unit operations include wood processing, pulping, bleaching, power and steam generation, chemical recovery, paper machine operation, roll finishing, sheet finishing, and shipping. The nearest surface water body is Stalkinghead Creek. The groundwater table ranges from 30 to 80 feet in depth in Bastrop.

| | |
|---|---|
| Facility Name: | International Paper - Louisiana Mill |
| Location: | Bastrop, Louisiana |
| Waste Stream: | Inorganic light metal salts<br>Inorganic liquids<br>Lime kiln slake |

## Wastes and Waste Management Practices

The facility disposed of the following wastes in two inorganic settling basins: inorganic light metal salts, inorganic liquids, lime kiln slake, solid waste from a digester, bark, and other wood waste. These settling basins were operated for approximately 18 years before closing in 1989.

## Extent of Contamination

Eight groundwater monitoring wells are sampled quarterly by International Paper personnel using LDEQ approve sampling methods. Data are reported semi-annually. Levels of arsenic, chromium, manganese, iron, selenium, and sulfa were above Federal drinking water standards. In the table below, data are presented from quarterly groundwater samplin results from 1990-1995.

**GROUNDWATER CONTAMINANTS COMPARED TO FEDERAL DRINKING WATER STANDARDS**

| Contaminant | Highest Detected Level (mg/l)* | MCL (mg/l)(mg/ | ) |
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wastewater is now disposed.  The LDEQ is currently evaluating statistical analyses provided by the site to determine whe
any remedial action will be required.

### Sources of Information

Louisiana Department of Environmental Quality, Solid Waste Division files, June 1996.

Personal communication with Groundwater Protection Division, Louisiana Department of Environmental Quality, August 1

Written correspondence submitted by facility and/or State on draft version of release descriptions, October 1996

# DEAN FOODS - PILGRIM FARMS SITE MICHIGAN

## Facility Overview

Facility Name: Dean Foods - Pilgrim Farms Site
Location: Bentheim, Michigan
Waste Stream: Pickle brine wastewater
Media Affected: Groundwater

Dean Foods-Pilgrim Farms Site was originally a

In addition, residents near the site have complained of a serious mosquito biting problem. The Michigan Department of Public Health investigated the problem and determined that the species *Aedes Dorsalis*, which breeds in a salt water environment, was found in large populations at nearby residences. It was determined that the wall of one of th site's pickle brine seepage lagoons was leaking salt water to a nearby wetland, creating the breeding environment for the mosquitoes.

**Corrective Actions/Regulatory Actions**

Fiberglass tanks were installed to replace the leaking wooden vats that previously stored the pickles and brine. I November 1987, Pilgrim Farms was placed on Michigan's Act 307 Priority List with a rating of 31 (on a scale of 0-48, with being the most severe). No treatment of contaminated groundwater has been proposed.

| | |
|---|---|
| Facility Name: | Flamm Pickle Company |
| Location: | Eau Claire, Berrien County, Michigan |
| Waste Stream: | Pickle process wastewater (brine) |
| Media Affected: | Vegetation |

Diagram of wastewater flow through facility and map of facility and surrounding area from permit application, undated.

Letter from Michigan DNR to Flamm Pickle, June 29, 1990.

Michigan DNR Interoffice Communication, April 25, 1996.

Chart Drain flows east prior to discharge to the Kalamazoo River.  This decline may be caused by uptake of the nitrogen the wetland vegetation.

| SURFACE WATER CONTAMINANTS COMPARED TO MICHIGAN OR FEDERAL DRINKING WATER STANDARDS | | | | |
|---|---|---|---|---|
| **Contaminant** | **Highest Detected Level (mg/l)** | **MI Standard (mg/l)** | **MCL (mg/l)** | **SMCL (mg/l)** |
| Ammonia | 10.0 | -- | -- | -- |
| COD | 127.0 | -- | -- | -- |
| Nitrate | 45.7 | 10 | 10 | -- |
| Nitrite | 0.02 | -- | 1 | -- |
| TDS | 3092.0 | -- | -- | 500 |
| Toluene | <.005 | 1.0 | 1.0 | -- |

Soil - The constituents of concern at Murco's agricultural fields that received treated wastewater via spray irrigatic and solid wastes via soil injection are phosphorous, nitrates, and ammonia.  As shown in the table below, all three were f in concentrations exceeding background levels at the site; however, calcium, magnesium, and potassium were considera lower than background levels.

| SOIL CONTAMINANTS COMPARED TO BACKGROUND CONCENTRATIONS | | |
|---|---|---|
| **Contaminant** | **Average Detected Level (mg/kg)** | **Average Background Concentration (mg/kg)** |
| Ammonia | 5.47 | 0.25 |
| Calcium | 337.1 | 18,008 |
| Magnesium | 53.5 | 6,025 |
| Nitrates | 5.43 | 0.58 |
| Phosphorous | 283.4 | 173 |
| Potassium | 65.0 | 108 |

Facility Name: Wexford Sand Company,
Yuma Site

Location: Slagle Township, Wexford County,

of manganese are present in the aquifer.  The PAMAK is not biodegrading as the company had thought it would.  The sar
washing operation has never held a permit to discharge as is required under the Water Resources Commission Act.

An isochemical contour of Pamak-4 from the July 1988 analytical results indicates that contamination is present ir
the groundwater.  According to a May 1989 hydrogeological report by ASI, these levels of Pamak-4 in the groundwater do
pose a significant impact to the environment based on its low toxicity levels.

A September 28, 1994, memo from the Michigan Department of Natural Resources states that sampling results o
site show levels of manganese and arsenic to be above permittable limits.

**GROUNDWATER CONTAMINANTS COMPARED TO MICHIGAN OR FEDERAL DRINKING WATER STANDARDS**

| Contaminant | Highest Detected Level (mg/l) | MI Standard (mg/l) | MCL (mg/l) | SMCL (mg/l) |
|---|---|---|---|---|
| Ammonia-N | 0.15 | ID | -- | -- |
| Arsenic | 0.05 | 0.05 | 0.05 | -- |
| Bicarbonate (mg $CaCO_3$/l) | 449 | -- | -- | -- |
| COD | 19 | -- | -- | -- |
| Conductivity (umhos/cm) | 786 | -- | -- | -- |
| Iron | 9.6 | ID | -- | 0.3 |
| Lead | 0.31 | 0.004 | -- | 0.3 |
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## BIAD CHILE PROCESSING PLANT - GARFIELD NEW MEXICO

### Facility Overview

Facility Name: Biad Chile Processing Plant - Garfield

Location: Garfield, New Mexico

Waste Stream: Food processing wastewater

Media Affected: Groundwater

Biad Chile Processing Plant - Garfield is located in Garfield, New Mexico, in Dona Ana County. The facility washes red chiles, which are then dehydrated and powdered on-site. The wastestream produced from this process is chile wastewater.

### Wastes and Waste Management Practices

Up to 90,000 gallons per day of chile wastewater is screened for solids and discharged via concrete irrigation ditches to a minimum of 16 acres of farmland. The discharge occurs during fall and winter months, September through January.

### Extent of Contamination

The table below identifies the highest level of each constituent detected in downgradient wells. Groundwater is monitored tri-annually at three wells. Nitrate/nitrite and total dissolved solids were found to be above New Mexico or Fed standards.

**GROUNDWATER CONTAMINANTS EXCEEDING**
**NEW MEXICO OR FEDERAL DRINKING WATER STANDARDS**

| Contaminant | Highest Detected Level (mg/l) | C5vel (mg/lIroNDWATER CONs 1.4(1h-79(i52TjEr)-5(d)1.2(l.0 T.8 Tw(NEW)T)-5 291.522 Tm0Tc( ) 38c2cTc( )M 0.9W | | |
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# SANTA FE INGREDIENTS COMPANY, INC. NEW MEXICO

## Facility Overview

| | |
|---|---|
| Facility Name: | Santa Fe Ingredients Company, Inc. |
| Location: | Hidalgo County, New Mexico |
| Waste Stream: | Food processing wastewater |
| Media Affected: | Groundwater |

Santa Fe Ingredients Company, Inc. is located in McCormack County, New Mexico. The facility washes red chiles, which are then dehydrated and powdered on-site. The wastestream produced from this process is chile wastewater. The depth to groundwater is approximately 150 feet.

## Wastes and Waste Management Practices

Up to 750,000 gallons per day of washwater is discharged to a tar-lined concrete sump, then pumped through a solids separator screen and through a gated distribution to a land application area of approximately 120 acres. This area is bermed to prevent surface runoff. The facility is not allowed to land apply more than 200 pounds of total nitrogen per acre per year.

## Extent of Contamination

The table below identifies the highest level of each constituent detected in downgradient wells. Fluoride and nitrate/nitrite were found to be above New Mexico or Federal standards.

**GROUNDWATER CONTAMINANTS EXCEEDING NEW MEXICO OR FEDERAL DRINKING WATER STANDARDS**

| Contaminant | Highest Detected Level (mg/l) | NM Standard (mg/l) | MCL (mg/l) | SMCL (mg/l) |
|---|---|---|---|---|
| Alkalinity (as $CaCO_3$) | 158.5 | -- | -- | -- |
| Bicarbonate | 2.83 | -- | -- | -- |
| Bicarbonate alkalinity | 172.7 | -- | -- | -- |
| Calcium | 111.3 | -- | -- | -- |
| Carbonate | 0.34 | -- | -- | -- |
| Carbonate alkalinity | 10.2 | -- | -- | -- |
| Chloride | 60 | 250 | -- | 250 |
| Fluoride | 2.41 | 1.6 | 4 | 2 |
| Magnesium | 11.9 | -- | -- | -- |
| Nitrate/nitrite as N | 12.9 | 10 | 10 | -- |
| Potassium | 5.5 | -- | -- | -- |
| Sodium | 100.4 | -- | -- | -- |
| Sulfate | 165.3 | 600 | 500 | 250 |
| Total dissolved solids | 500 | 1,000 | -- | 500 |
| Total filterable residue | 601 | -- | -- | -- |
| Water Kjeldahl nitrogen | 0.4 | -- | -- | -- |

## Corrective Actions/Regulatory Actions

The New Mexico Environment Department requires the site to continue monitoring groundwater semi-annually.

## GEORGIA-PACIFIC CORPORATION NEW YORK

### Facility Overview

Georgia-Pacific Corporation operates a paper finishing plant in the town of Warwick, Orange County, New York. An unnamed tributary approximately 300 feet from Wawayanda Creek is the nearest surface water body.

| | |
|---|---|
| Facility Name: | Georgia-Pacific Corporation |
| Location: | Warwick, New York |
| Waste Stream: | Process wastewater from paper finishing |
| Media Affected: | Groundwater and surface water |

### Wastes and Waste Management Practices

The facility discharges process wastewater into

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# HOLLINGSWORTH AND VOSE COMPANY NEW YORK

## Facility Overview

Hollingsworth and Vose Company is headquartered in East Walpole, Massachusetts and has two paper mills located in the towns of Easton and Greenwich, New York. The mills manufacture miscellaneous specialty papers, specifically, papers for oil, water, and air filter products. The Greenwich mill has been in operation since 1880 and produces approximately 18 tons of paper per day. The Easton mill produces approximately 44 tons of paper per day. Hollingsworth and Vose has owned the mills for over 40 years. The landfill was constructed in 1974 and is situated adjacent to the Batten Kill River.

| | |
|---|---|
| Facility Name: | Hollingsworth and Vose Company |
| Location: | Easton, New York |
| Waste Stream: | Paper mill sludge |
| Media Affected: | Groundwater |

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| | | | **Waste Sites (mg/kg)** |
|---|---|---|---|
| Arsenic | 29.7 | 35.60 | 7.0 |
| Chromium | 16.4 | 16.60 | 50 |
| Copper | -- | 2250 | 25 |
| Lead | 2930 | 1070 | -- |
| Mercury | -- | 0.26 | 0.1 |
| Nickel | -- | 28.8 | 13 |
| Thallium | -- | -- | 150 |
| Zinc | -- | 1770 | 20 |
| Benzene | -- | 0.03 | 0.06 |
| Toluene | -- | 0.027 | 1.5 |
| TPH | 3,600 | 170 | -- |
| Tetrachoroethene | 1.45 | -- | 1.4 |
| p-Xylene/m-Xylene | 0.04 | -- | 1.2 |

*Telephone conversation with the Technology Section, DEC.

**Corrective A(8.9(1)]TJTroet)7-0.96Tc-0 Tw14.3(--)]TJT*0.4(2)]TJT*[Benz)14.7(r)-7.3(2d-0.96Tc-0 Tw14.3(1)4[Benz)14.o4.4**

Summary prepared by New York Department of Environmental Conservation, July 1996.

Environmental Monitoring Plan, May 1996, Rust Environment and Infrastructure, Inc.

Hydrogeologic Assessment of the International Paper Ticonderoga Mill Landfill, January 1994, Eder Associates.

New York Department of Environmental Conservation, Solid Waste Division files, July 1996.

Written correspondence submitted by facility and/or State on draft version of release descriptions, October 1996

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## Corrective Actions/Regulatory Actions

Information was not readily available.

## Sources of Information

Annual/Quarterly Report, 1995.

Sampling Data, 1995.

Written correspondence submitted by facility and/or State on draft version of release descriptions, October 1996

New York State Department of Environmental Conservation Complaint Investigation Report, April 21, 1993.

Memorandum from Dutchess County Health Department to New York State Department of Environmental Conservation, 22, 1993.

Written correspondence submitted by facility and/or State on draft version of release descriptions, October 1996.

## Facility Overview

Alamac Knit Fabrics, Inc. is an apparel fabric manufacturing plant located in Hamilton, North Carolina, in Martin County. The approximate depth to groundwater is greater than 6 feet and the predominant soil texture is sand.

| | |
|---|---|
| Facility Name: | Alamac Knit Fabrics, Inc. |
| Location: | Hamilton, North Carolina |
| Waste Stream: | Processing sludge and wastewater |
| Media Affected: | Groundwater |

## Wastes and Waste Management Practices

Sludge is land applied to a 38 acre area by spray irrigation. Management practices apply solids at agronomic rates, or less, while maintaining a cover crop capable of

### Facility Overview

Borden Chemical Inc. is located in Fayetteville, Cumberland County, North Carolina. The facility is situated on predominantly loamy sands. There are no drinking water wells within 1/4 mile of the Borden plant site. There are, however, drinking water wells adjacent to the land application farm sites. For this reason, their permit requires that biomass land application activities be kept at least 400 feet from these homes and their associated drinking water wells.

| | |
|---|---|
| Facility Name: | Borden Chemical Inc. |
| Location: | Fayetteville, North Carolina |
| Waste Stream: | Biomass from biological treatment of thermoset resin wastewater |

### Wastes and Waste Management Practices

Borden Chemical operates a biological wastewater treatment facility which treats wastewater generated during thermorest resin manufacture. Approximately 79 dry tons/yr. of biomass from wastewater treatment is land applied on farmlands as a nutrient supplement. Biomass is land applied with sufficient buffer zones established to prevent runoff to surface water.

### Extent of Contamination

The sludge analysis indicates the presence of several compounds of concern: formaldehyde, several halogenate organics, phenols, and toluene. The concentrations of these compounds do not preclude land application, but the North Carolina Department of Environmental Management issued the permit with contingencies requiring groundwater monitori for related contaminants. Groundwater is monitored tri-annually at 6 wells. The table below identifies the constituents detected in groundwater sampling and the highest detected level of each constituent in downgradient wells. Ammonia-nitrogen, arsenic, chromium, formaldehyde (methanol), lead, nitrate, and total 1(um)-3(ling and t)7.1(he h3(ling h3(lingi)-

## Sources of Information

North Carolina Department of Environmental Management, Groundwater Section, Permits and Compliance Database Printout, August 18, 1995.

Written correspondence submitted by facility and/or State on draft version of release descriptions, October 1996.

## Facility Overview

Carolina Turkeys, a turkey processing facility, is located in Duplin County, North Carolina. The nearest surface water body to our location for monitoring procedures is an estuary which feeds the Northeast Cape Fear River and is located approximately 1500 - 2000 feet in distance away. The surficial aquifer is predominantly sands with medium to high infiltration capacities.

| | |
|---|---|
| Facility Name: | Carolina Turkeys |
| Location: | Duplin County, North Carolina |
| Waste Stream: | Turkey processing and rendering waste |
| Media Affected: | Groundwater |

## Wastes and Waste Management Practices

Carolina Turkeys has two waste water lagoons, one aerated 15 million gallon lagoon and one 41 million gallon holding lagoon. The water which is treated and aerated in the smaller lagoon feeds the larger holding lagoon until ready t applied to the permitted spray fields. Primary and secondary screened effluent comes to a 1-million gallon flow equalizati tank. Through dissolved air flotation units, oil and grease is then removed. This treated wastewater is then sent to the 15 million gallon aerated lagoon. The waste from these lagoons is then applied to approximately 560 (440 for water spray an 120 for sludge) acres of permitted spray irrigation disposal fields.

## Extent of Contamination

## Facility Overview

Facility Name: Frit Car and Equipment Company

Location: Bridgeton, North Carolina

Waste Stream: Process washwater

Media Affected: Groundwater

Frit Car and Equipment Company is located in Bridgeton, North Carolina in Craven County.

## Wastes and Waste Management Practices

Frit Car and Equipment Company has two sludge drying beds, a 45,000 gallon aerated storage tank, and a 1.5 acre sprayfield. No wastes are discharged to surface water.

## Extent of Contamination

The table below identifies the constituents detected in groundwater sampling and the highest detected level of ea constituent in downgradient wells. Groundwater is monitored tri-annually at four wells. Ammonia, chromium, phenol, phosphorous, and total organic carbon were found to be above North Carolina or Federal standards.

**GROUNDWATER CONTAMINANTS EXCEEDING NORTH CAROLINA OR FEDERAL DRINKING WATER STANDARDS**

| Contaminant | Highest Detected Level (mg/l) | NC Standard (mg/l) | MCL (mg/l) | SMCL (mg/l) |
|---|---|---|---|---|
| Ammonia-nitrogen | 0.5 | 0 | -- | -- |
| Chromium | 1.19 | 0.05 | 0.1 | -- |
| Phenol | 0.018 | 0 | -- | -- |
| Phosphorous (total) | 2.4 | 0 | -- | -- |
| TOC | 43.6 | 0 | -- | -- |

## Corrective Actions/Regulatory Actions

Information was not readily available.

## Sources of Information

North Carolina Department of Environmental Management, Groundwater Section, Permits and Compliance Database Printout, August 18, 1995.

Written correspondence submitted by facility and/or State on draft version of release descriptions, October 1996.

## Facility Overview

Appleton Papers Inc. operates an integrated fine paper mill at its Spring Mill in Roaring Spring, Blair Co., Pennsylvania. They manufacture coated paper for conversion into NCR Paper brand of carbonless paper, utilizing the Kraft pulping process. The nearest surface water body is Halter Creek.

| | |
|---|---|
| Facility Name: | Appleton Papers Inc. |
| Location: | Roaring Springs, Pennsylvania |
| Waste Stream: | Paper mill manufacturing wastewater |
| Media Affected: | Groundwater |

## Wastes and Waste Management Practices

Waste products of bark and wood fines from wood operations are burned in a power boiler. Wash-up water, overflows at the recausticizing plant, bleach plant materials, an
stock and coating preparations are processed through the waste treatment plant. Power boilers burn coal and natural ga
some of these wastes are processed through the waste treatment plant. The waste treatment plant treats all of the mill's
waste streams by primary sedimentation and secondary activated sludge. Liquid waste streams include bleach plant filtra

|  |  |  |  |  | **(mg/l)** |
|---|---|---|---|---|---|
| Barium | <0.05 | 2.0 | 2.0 | -- | -- |
| BEHP | 0.039 | -- | -- | -- | 0.0042 |
| Chloride | 31 | -- | -- | 250 | -- |
| Hardness | 150 | -- | -- | -- | -- |
| Nitrogen, nitrate | 1.8 | 10 | 10 | -- | -- |
| pH | 3.9-10.6 | 6.0-9.0 | -- | 6.5-8.5 | -- |
| Phenols | 22.0 | -- | -- | -- | 21.0 |
| Specific conduct-ance (umhos/cm) | 305 | -- | -- | -- | -- |
| TDS | 29,000 | 500 | -- | 500 | -- |
| TOC | 130 | -- | -- | -- | -- |
| Turbidity | 41,500 NTU | -- | -- | -- | -- |

Some of the reported data may be from a monitoring well suspected to be improperly installed. However, the fac continues to sample that well and monitoring data is provided to the State of Tennessee.

Since September of 1993, solid waste from the plant facility has been disposed of in Phase IV-A of the landfill. Since the new landfill was placed into use and Phases II and III were capped and closed, levels of phenol and BEHP hav continued to steadily decline

## Corrective Actions/Regulatory Actions

Phases II and III were capped and closed in 1994. Phase IV-A, a new state-of-the-art landfill, with a leachate collection and liner system has been in operation since September if 1993. The leachate from this phase of the landfill is collected and discharged to the local Cleveland POTW. In 1994, three additional monitoring wells were constructed due the expansion of the active waste area into Phase IV-A. Presently, twelve groundwater monitoring wells and four piezom wells are located at the landfill. These wells are currently sampled semi-annually in compliance with Tennessee Solid Wa regulations and analyzed for selected volatile and semi-volatile organic compounds, and for applicable inorganics. Analy results are submitted to the State of Tennessee following each monitoring event.

## Sources of Information

RMT Laboratories Report, Allied Signal, INC./ Bendix, April 1991.

RMT Laboratories Report, Allied Signal, INC./ Bendix, July 1991.

RMT Laboratories Report, Allied Signal, INC./ Bendix, June 1992.

Written correspondence submitted by facility and/or State on draft version of release descriptions, October 1996.

## CYTEC INDUSTRIES INC. TENNESSEE

### Facility Overview

| | |
|---|---|
| Facility Name: | Cytec Industries Inc. |
| Location: | Chattanooga, Tennessee |
| Waste Stream: | Processed silica |
| Media Affected: | Groundwater |

Cytec Industries Inc. (Cytec) is a vertically integrated, specialty chemicals company that serves a wide range of industries. Cytec manufactures liquid alum, which is an aqueous solution of hydrated aluminum sulfate. It is used primarily in paper making and as a precipitating agent in sewage treatment and water purification. The facility owner is Cytec Industries Inc. The Tennessee River runs adjacent to the western facility boundary. Although this area is termed floodplain, it is at an elevation of 660 feet which is above the 100-year flood level of 653.7 feet. Local groundwater moves towards the Tennessee River. There are no potable wells downgradient of the site prior to the Tenne River. The nearest potable well is reported to be over two miles from the site.

### Wastes and Waste Management Practices

Cytec Industries Inc. operates a 10 acre permitted class II disposal facility. Processed silica is the byproduct of liquid alum manufacturing process. Processed silica slurry is pumped from the manufacturing process to one of two pern sand bed filters. While one sand bed is being filled, the other sand bed provides final dewatering and drying so that the processed silica can be excavated from the sand bed and transported to the landfill located on the same property. The processed silica is then placed, spread, compacted, graded, covered and stabilized. Water, including rainwater, is reclair from both sand bed filters continuously and is returned to the manufacturing process. Each sand bed has 4,000 cubic yar of capacity and is normally cleaned out once every six to eight months at the design rate of 15,000 cubic yards per year. landfill was constructed over a former processed silica impound and is now characterized by 12 feet of processed silica underlain by silty, sandy clay.

### Extent of Contamination

The table below identifies the constituents analyzed in 1995 sampling and the highest detected level of each constituent in downgradient wells. Aluminum, lead, pH, and sulfate all exceeded regulatory groundwater standards. Groundwater sampling occurs quarterly.

**GROUNDWATER CONTAMINANTS COMPARED TO TENNESSEE OR FEDERAL DRINKING WATER STANDARDS**

| Contaminant | Highest Detected Level (mg/l) | TN Standard (mg/l) | MCL (mg/l) | SMCL (mg/l) |
|---|---|---|---|---|
| Aluminum | 0.75 | -- | -- | 0.05-0.2 |
| Arsenic | 0.012 | 0.05 | 0.05 | -- |
| Chromium | 0.039 | 0.1 | 0.1 | -- |
| Lead | 0.043 | 0.05 | 0.015* | -- |
| pH | 4.1 | 6.0-9.0 | -- | 6.5-8.5 |
| Sulfate | 4000 | -- | 500 | 250 |
| TDS | 396 | 500 | -- | 500 |

*Action level

## Corrective Actions/Regulatory Actions

Information was not readily available.

## Sources of Information

American Cyanamid Company Operation Manual, undated.

Final Hydrogeologic Evaluation, Tennessee Department of Public Health, Office of Solid Waste Management, undated.

Application for State Operation Permit, Department of Environment and Conservation, Division of Water Pollution Control 1995.

Davies Engineering Company, Inc. Sampling Data. 1995.

Closure Plan for American Cyanamid Company, undated.

Public Notice of proposed alum mud disposal site, undated.

Written correspondence submitted by facility and/or State on draft version of release descriptions, October 1996

**Facility Overview**

| | |
|---|---|
| Facility Name: | Associated Commodities Corp. |
| Location: | Maury, Tennessee |
| Waste Stream: | Aluminum slag and salt compound |
| Media Affected: | Groundwater |

Associated Commodities Corporation’s facility in Maury, Tennessee, processes aluminum smelting drosses/residues. The regional topography is typified by rolling hills which extend down to the flood plain of the Duck

| Contaminant | Highest Detected Level (mg/l) | TN Standard (mg/l) | MCL (mg/l) | SMCL (mg/l) |
|---|---|---|---|---|
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## HOLSTON ARMY AMMUNITION PLANT TENNESSEE

### Facility Overview

| | |
|---|---|
| Facility Name: | Holston Army Ammunition Plant |
| Location: | Kingsport, Tennessee |
| Waste Stream: | Mixture of ammunition processing wastes |
| Media Affected: | Groundwater |

Holston Army Ammunition Plant (HAAP) was constructed in 1942 to manufacture the high explosive RDX and formulations based on RDX. Holston AAP currently manufactures RDX and HMX (another high explosive) and formulations based on these two explosives. Holston AAP is located near Kingsport, in northeast Tennessee. The facility is underlain by two major rock units, the Mascot Dolomite and the Sevier Shale. The Mascot formation is highly fractured and jointed, and contains many solution channels. These solution channels often develop vertically and form sinkholes. Groundwater is found in the abundant fractures of the Sevier Shale. However, deeper fractures are usually se by calcium carbonate, and significant quantities of groundwater are generally not found below 300 feet. The facility is bis by the Holston Rivr, which flows generally from northeast to southwest. Holston AAP operates an Active Sanitary Landfil a Tar Pit.

### Wastes and Waste Management Practices

The wastes disposed of at HAAP consist of a mixture of materials from the manufacture of explosives (ammunitio used by the Army. The Active Sanitary Landfill has seven associated sampling wells. The Tar Pit has four associated sampling wells.

### Extent of Contamination

Manganese was found to be above Federal standards in third quarter 1995 sampling results for the active sanitar landfill. Groundwater sampling occurs quarterly.

<u>Active Sanitary Landfill</u>

**GROUNDWATER CONTAMINANTS EXCEEDING TENNESSEE OR FEDERAL DRINKING WATER STANDARDS**

| Contaminant | Highest Detected Level (mg/l) | TN Standard (mg/l) | MCL (mg/l) | SMCL (mg/l) |
|---|---|---|---|---|
| Manganese | 0.160 | -- | -- | 0.05 |

Manganese concentrations are naturally high in native soils in northeast Tennessee.

The table below identifies the constituents analyzed for in the third quarter 1995 sampling and the highest detecte level of each constituent in downgradient wells for the tar pit. e ActC0 Tc0 Tw(e)TjETQBT10.08 0 0 10.08 72tg.08 72tpsa

### Facility Overview

Facility Name: Monsanto Chemical Company
Location: Columbia, Tennessee
Waste Stream: Variety of solid industrial wastes
Media Affected: Groundwater

The Monsanto Chemical Company's Columbia Tennessee plant processed phosphate ore to extract elemental phosphorous for sale to customers and for use in other Monsanto operations external to the Columbia plant. The manufacturing facility operated almost 50 years prior to its shutdown in October 1986. Subsequently, elemental phosphorous produced at a sister plant was received in railroad tank cars, unloaded and repackaged into 55-gallon drums for sale. A local vendor crushed, sized, and shipped previously stockpiled furnace slag for sale. No solid waste streams were generated from the phosphorous repackaging or slag processing operations. In December 1995, the elem phosphorous repackaging operation was permanently shut down and the repackaging facility dismantled. Three addition plant facilities remain operational. They were installed in 1986/87 in preparation for plant closure and include a phosphor recovery distillation still, a phosphorous contaminated water treatment plant, and an on-site landfill.

### Wastes and Waste Management Practices

The plant presently operates a solid industrial waste landfill. The wastes currently being accepted by the landfill a

- Phosphorus contaminated equipment components;
- Office waste;
- Building demolition waste;
- Industrial demolition waste from process equipment operation and equipment repair; including scrap metal, rubber, plastic, glass, paper, and cardboard that may contain trace amounts of elemental phosphorus but are non-RCRA hazardous wastes;
- Scrap metal, rubber, plastic, glass, paper, and cardboard from the on-site plant vehicle repair shop; and
- Scrap shipping materials including wooden pallets, cardboard, plastic, and metal strapping.

| Contaminant | Highest Detected Level (mg/l) | TN Standard (mg/l) | MCL (mg/l) | SMCL (mg/l) |
|---|---|---|---|---|
| Chromium | <0.01 | 0.1 | 0.1 | -- |
| Cobalt | <0.05 | -- | -- | -- |
| Copper | <0.01 | -- | 1.3* | 1.0 |
| Fluoride | 0.36 | 4.0 | 4.0 | 2.0 |
| Lead | 0.014 | 0.05 | 0.015* | -- |
| Mercury | <0.0002 | 0.002 | 0.002 | -- |
| Nickel | 0.01 | 0.1 | 0.1 | -- |
| Selenium | <0.01 | 0.05 | 0.05 | -- |
| Silver | <0.01 | 0.01 | 0.01 | 0.1 |
| Thallium | <0.01 | 0.002 | 0.002 | -- |
| Vanadium | 0.017 | -- | -- | -- |
| Zinc | 0.07 | -- | -- | 5 |

*Action levels

**Corrective Actions/Regulatory Actions**

Information was not readily available.

**Sources of Information**

Letter from Monsanto Chemical Company to Division of Solid Waste Management, Tennessee Department of Environme and Conservation, September 20, 1994.

Letter from Tennessee Department of Environment and Conservation to Monsanto Chemical Company, October 18, 199

Groundwater Monitoring Analysis for Monsanto Chemical Company, 1994-1995.

Written correspondence submitted by facility and/or State on draft version of release descriptions, October 1996

| Contaminant | Highest Detected Level (mg/l) | TN Standard (mg/l) | MCL (mg/l) | SMCL (mg/l) |
|---|---|---|---|---|
| Zinc | 0.00008 | 0.001 | -- | 5.0 |

*Action levels

Some of the reported data may be from a monitoring well initially installed at the request of the Tennessee Solid Waste division to be a downgradient test well, but was later determined to not be downgradient of the landfill. Monitoring this well did continue however.

**Corrective Actions/Regulatory Actions**

Information was not readily available.

**Sources of Information**

Occidental Chemical Corp., 1994 Groundwater Sampling Results, undated.

Consulting Engineers, Inc., Description of Operation, undated.

Personal communication with the Tennessee Department of Environment and Conservation, August 1996.

Written correspondence submitted by facility and/or State on draft version of release descriptions, October 1996

Facility Name: Scepter, Inc.

Location: New Johnsonville, Tennessee

Waste Stream: Slag

Media Affected: Groundwater

## Sources of Information

Scepter, Inc. 1992 Quarterly Groundwater Monitoring Results.

Operating Manual, Industrial Landfill, Scepter, Inc., New Johnsonville, TN.

[redacted]

**Corrective Actions/Regulatory Actions**

Crushing and screening processes have been added to aid in the reduction of the stockpile mass and allow more confined storage of material. Additionally, the stockpile area has been reduced in size and waste from the crusher has be stockpiled in a more contained, readily controlled area. Further, concrete walls have been constructed to assist in containment and maintenance. Planning is underway for the implementation of a total recovery process to recycle, sell, and/or permanently dispose of all materials generated by Tennessee Aluminum Processors.

**Sources of Information**

Letter from Tennessee Department of Health and Environment to Tennessee Aluminum Processors, Inc., May 27, 1987.

Letter from Caldwell and Associates to Tennessee Department of Health and Environment, June 29, 1988.

1990-1993 Sampling Data, Caldwell and Associates.

Written correspondence submitted by facility and/or State on draft version of release descriptions, October 1996.

| Contaminant | Highest Detected Level (mg/l) | TN Standard (mg/l) | MCL (mg/l) | SMCL (mg/l) |
|---|---|---|---|---|
| Zinc | 0.743 | -- | -- | 5.0 |

*Action level

The concentrations for chromium, lead, nickel, and pH were detected at high concentrations in the facility background/upgradient well.

Measured sulfate, dissolved manganese and iron levels in the June 1994 sampling event exceeded only the Secondary Maximum Contaminant Levels (SMCL). It is important to note that the national secondary drinking water regulations (40 CFR 123) control contaminants in drinking water that primarily affect the aesthetic qualities relating to pub

### Facility Overview

The Anzon America, Inc. facility in Laredo, Texas is currently owned and operated by Anzon Inc. and has been the site of metals refining operations since the Texas Mining and Smelting Company began operations in 1928. The property was sold to the United States government in 1947, who, in the same year sold it to National Lead Industries. National Lead operated the site until 1977, when it shut down for approximately 18 months. Anzon Inc. acquired the facility in 1978 and resumed operations. Las

Facility Name: Anzon America, Inc.

Location: Laredo, Texas

Waste Stream: Antimony smelting slag

Media Affected: Groundwater and surface water

### Facility Overview

Elf Atochem, a French chemical company, bought this facility in 1989; the site has manufactured pesticides and insecticides for 50 years. A municipal lake and several

Facility Name: Elf Atochem

Location: Bryan, Texas

Waste Stream: Process wastewater

Media Affected: Groundwater and surface water

### Facility Overview

The Robroy Industries site is a corrosion resistant electrical conduit and fitting manufacturer located near Gilmer, Texas. Prior to 1983, the facility employed zinc plating and galvanizing in its manufaturing process. Since 1983, the facility's manufacturing process has been primarily a coating operation, utilizing PVC and polyurethanes.

| | |
|---|---|
| Facility Name: | Robroy Industries - Texas, Inc. |
| Location: | Gilmer, Texas |
| Waste Stream: | Neutralized spent acid sludge |
| Media Affected: | Groundwater |

### Wastes and Waste Management Practices

The facility is a large quantity generator of hazardous waste according to the Waste Registration Summary Repor
The following information regarding the waste management practices at the facility was extracted from the Phase III/IV progress report. The facility, constructed in 1962, operated two landfills to dispose of neutralized spent acid sludge from former zinc plating and galvanizing operations. Both landfills are now closed. Immediately adjacent to the main landfill (S
A) is a closed process water holding pond. In the 1960s the site disposed of spent acid in an evaporation/holding pond a
with its rinse water and cooling water. In 1976 the site began neutralizing the acid then disposing of the resultant sludge i
clay-lined landfill at Site B. In 1977, the acid holding pond was lined with clay and converted to the Site A landfill. Electroplating operations ceased in 1978, and galvanizing operations ceased in 1983. Both landfills remained open for fu
use. In 1985, EPA sued Robroy for inadequate closure plans and RCRA violations at the landfills. The suit was dropped when Robroy demonstrated that the sludge in the Site A and Site B landfills is non-hazardous. A full groundwater investigation and closure plan was initiated.

### Extent of Contamination

Data presented in the table below, were extracted from a 1989 groundwater monitoring data report. In addition to the parameters listed below, Site A has high specific conductance.

As shown in the table below, chloride, iron, manganese, pH, and sulfate exceeded Federal drinking water standards.

**GROUNDWATER CONTAMINANTS COMPARED TO FEDERAL DRINKING WATER STANDARDS**

| Contaminant | Highest Detected Level (mg/l) | MCL (mg/l) | SMCL |
|---|---|---|---|
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### Facility Overview

Facility Name: Southwestern Barge Fleet Service, Inc.

Location: Highlands, Texas

Waste Stream: Washwaters, oil sludge, waste paper, and debris

Media Affected: Groundwater

The Southwestern Barge Fleet Service facility is a chemical and petroleum barge cleaning and repair facility located in Highlands, Texas. The San Jacinto River is located near the site (exact distance unknown).

### Wastes and Waste Management Practices

The facility is a large quantity hazardous waste generator according to the Waste Registration Summary Report. The following information regarding the waste management practices at the facility was extracted from the Site Assessment Plan. A storage impoundment was used to hold washwaters, crude oil, and No. 6 fuel oil recovered dur the cleaning of barges. This unit was backfilled with waste paper and construction debris from the site. In 1979 the impoundment was covered with one to two feet of cement kiln flue dust and capped with two to four feet of clayey soil; the the unit was covered with topsoil and vegetative cover.

### Extent of Contamination

The following information regarding the extent of contamination at the facility was extracted from the Site Assessment Report. Subsequent to closure, oily liquids were found discharging at several locations adjacent to the impoundment. The chromium exceedances may be indicative of naturally occurring poor groundwater quality, and do not reflect contamination from the former impoundment.

As shown in the table below, aluminum, chromium, trans-1,2-dichloroethene, iron, manganese, selenium, and vin chloride exceeded Federal water standards.

**GROUNDWATER CONTAMINANTS COMPARED TO FEDERAL DRINKING WATER STANDARDS**

| Contaminant | Highest Detected Level (mg/l) | MCL (mg/l) | SMCL (mg/l) |
|---|---|---|---|
| Aluminum | 9.17 | -- | 0.05-0.2 |
| Antimony | <0.01 | 0.006 | -- |
| Arsenic | <0.01 | 0.05 | -- |
| Barium | 0.626 | 2.0 | -- |
| Benzene | 14.9 | 0.005 | -- |
| Beryllium | <0.005 | 0.004 | -- |
| Cadmium | <0.01 | 0.005 | -- |
| Calcium | 597 | -- | -- |
| Chromium | 0.088 | 0.1 | -- |
| Cobalt | <0.05 | -- | -- |
| Copper | <0.06 | 1.3 | 1.0 |
| Cyanide | 0.081 | 0.2 | -- |
| 1,1-Dichloroethane | 0.608 | -- | -- |
| trans-1,2-Dichloroethene | 1.56 | 0.005 | -- |
| 2,4-Dimethylphenol | 16.1 | -- | -- |
| Iron | 25.5 | -- | 0.3 |
| Magnesium | 213 | -- | -- |
| Manganese | 5.58 | -- | 0.05 |
| Mercury | <0.0008 | 0.002 | -- |
| Naphthalene | 2.24 | -- | -- |

| Contaminant | Highest Detected Level (mg/l) | MCL (mg/l) | SMCL (mg/l) |
|---|---|---|---|
| Nickel | <0.06 | 0.1 | -- |
| Phenol | 5.5 | -- | -- |
| Potassium | 49.7 | -- | -- |
| Selenium | 0.051 | 0.05 | -- |
| Silver | <0.008 | -- | 0.1 |
| Sodium | 3,620 | -- | -- |
| Thallium | <0.002 | 0.002 | -- |
| Vanadium | <0.06 | -- | -- |
| Vinyl chloride | 8.6 | 0.002 | -- |
| Zinc | 0.126 | -- | 5 |

### Corrective Actions/Regulatory Actions

According to the Site Assessment Plan, three oil/water recovery sumps were installed within the limits of the form impoundment in order to prevent further discharges.

### Sources of Information

Texas Natural Resource Conservation Commission Risk Reduction Rules, Chapter 335.

Phone conversation with Texas Natural Resource Conservation Commission, Enforcement Coordination and Litigation Division. September 14, 1995.

Texas Natural Resource Conservation Commission, Information Resources Division, Waste Registration Summary Repo database query. September 6, 1995.

Texas Natural Resource Conservation Commission, Industrial and Hazardous Waste Division, facility files. Retrieved September 18, 1995.

Site Assessment Plan, Southwestern Barge Fleet Service, Inc., Highlands, Texas. Prepared by Southwestern Laboratori Inc. October 19, 1992.

**Facility Overview**

Facility Name: Texas Instruments, Inc.

Location: Dallas, Texas

Waste Stream: Wastewater

Media Affected: Groundwater

## CHESAPEAKE PAPER PRODUCT COMPANY VIRGINIA

### Facility Overview

Chesapeake Paper Products Company (CPPC) owns and operates a captive industrial solid waste facility located in rural King William County, Virginia. The facility is located within a 275 acre site that is approximately 5 miles northwest of the Town of West Point on the west side of SR30. It is bounded by SR30 to the north, the Norfolk Southern Railroad to the south, land owned by the Pamunkey Game Club to the west, and other lands of CPPC and private owners to the east. The land between the Norfolk Southern Railroad right-of-way and the Pamunkey River is also owned by CPPC. Adjacent lands are either forested or used for agricultural purposes.

| | |
|---|---|
| Facility Name: | Chesapeake Paper Product Company |
| Location: | King William, Virginia |
| Waste Stream: | Industrial non-hazardous solid waste |

The facility consists of two permitted landfills identified as Mann #2 (permit #255) and Mann #3 (permit #543). Ma #2 is an active landfill that covers 11 acres and began operation on or about September 25, 1978. It reached its capacity June 1993 and is currently in post-closure care. The nearest surface body of water is the Pamunkey River which is 1400 to the south. Mann #3 is an active three phase landfill with a design capacity of approximately 50 years. Phase 1 covers acres and began operation in May 1993 and is expected to reach its capacity in about 17 years. Phases 2 and 3 will cove 35.4 acres when constructed. The nearest surface body of water is the Pamunkey River which is 700 feet to the south.

### Wastes and Waste Management Practices

All waste received at the facility is non-hazardous industrial waste generated by CPPC. Waste streams include a from coal and wood-fired boilers, construction debris, secondary fiber and paper waste, occasional dewatered sludge fro wastewater treatment operations, and other non-hazardous industrial wastes. Mann #2 groundwater is monitored by one upgradient and four downgradient wells. Mann #3 is monitored by four upgradient and six downgradient wells.

### Extent of Contamination

Groundwater is monitored at one upgradient and three downgradient wells. The table below identifies the highes level of each constituent detected in downgradient wells. Iron and zinc were found to be above Virginia or Federal standa

**GROUNDWATER CONTAMINANTS EXCEEDING VIRGINIA OR FEDERAL DRINKING WATER STANDARDS**

| Contaminant | Highest Detected Level (mg/l) | VA Standard (mg/l) | MCL (mg/l) | SMCL (mg/l) |
|---|---|---|---|---|
| Arsenic | 0.0063 | 0.05 | -- | -- |
| Barium | 0.046 | 2 | -- | -- |
| Iron | 1.6 | -- | -- | 0.3 |
| Magnesium | 0.6 | -- | -- | -- |
| Sulfates | 16.9 | -- | -- | -- |
| TDS | 190 | -- | -- | 500 |
| TOC | 1.7 | -- | -- | -- |
| Zinc | 0.057 | 0.05 | -- | 5 |

### Corrective Actions/Regulatory Actions

Mann #2 entered Virginia's Phase 2 monitoring program on February 19, 1993 and has continued with an approv modified Phase 2 monitoring program to date as the result of one Phase 3 monitoring event in September 1994.

### Sources of Information

Groundwater Monitoring Plan for the Chesapeake Corp. Mann # 2 Industrial Waste Landfill, May 1992.

Chesapeake Paper Products Company, Phase 2 Background Data, Mann # 2 Landfill, June 1994.

Chesapeake Paper Products Company, Phase 2 Background Data, Mann # 2 Landfill, September, 1994.

Virginia Solid Waste Management Facilities List - Industrial Waste Landfills in Phase 2 Monitoring Program, August 22, 1

Drinking Water Regulations and Health Advisories, US EPA, Office of Water, February 1996.

Virginia Solid Waste Management Facilities List - Industrial Waste Landfills, June 17, 1996.

Virginia Solid Waste Management Facilities List - Industrial Waste Landfills in Phase 2 GW Monitoring, June 17, 1996.

Written correspondence submitted by facility and/or State on draft version of release descriptions, October 1996.

to modify the landfill permit for the post closure period. A Phase III groundwater monitoring plan, as required by the VSW
has been proposed in the permit modification.

## Sources of Information

Georgia-Pacific Groundwater Sampling, June 24, 1992.

Georgia-Pacific Groundwater Sampling, October 28, 1992.

Phase 2 Monitoring, January 17, 1994.

Georgia-Pacific Corp. Industrial Waste Disposal Facility, Annual Groundwater Monitoring Report, February 28, 1994.

Georgia-Pacific Groundwater Sampling, September 28, 1994.

Georgia-Pacific Groundwater Sampling, January 23, 1995.

Virginia Solid Waste Management Facilities List - Industrial Waste Landfills in Phase 2 Monitoring Program, August 22, 1

Georgia-Pacific Groundwater Sampling, February 1996.

Drinking Water Regulations and Health Advisories, US EPA, Office of Water, February 1996.

Virginia Solid Waste Management Facilities List - Industrial Waste Landfills, June 17, 1996.

Virginia Solid Waste Management Facilities List - Industrial Waste Landfills in Phase 2 GW Monitoring, June 17, 1996.

Written correspondence submitted by facility and/or State on draft version of release descriptions, October 1996.

### Facility Overview

| | |
|---|---|
| Facility Name: | Hercules Inc. |
| Location: | Allegheny, Virginia |
| Waste Stream: | Waste propylene and latex |

Hercules Inc. is located in Allegheny, Virginia. The soils at the site are alluvial sediments consisting primarily of silts and fine sands which coarsen downwards into silty and clayey gravel and silty sand with gravel at the base above bedrock. The bedrock below these alluvial soils is a black shale of the Millboro Formation of the Devonian age. The shale is encountered at depths of 8.5 to 20 feet below grade.

### Wastes and Waste Management Practices

Hercules Inc. has an on-site industrial landfill which began operating in 1965 and has been inactive since 1993.

Drinking Water Regulations and Health Advisories, US EPA, Office of Water, February 1996.

Virginia Solid Waste Management Facilities List - Industrial Waste Landfills, June 17, 1996.

Virginia Solid Waste Management Facilities List - Industrial Waste Landfills in Phase 2 GW Monitoring, June 17, 1996.

Facility Name: Consolidated Papers Kraft Division

There is a groundwater gradient control system in place for all four landfill areas. Groundwater from Area 1 wells extracted and treated at a wastewater treatment plant adjacent to the landfill. A clay cutoff was installed around Area 1.

**Sources of Information**

Wisconsin Department of Natural Resources, Bureau of Solid and Hazardous Waste Management, Solid Waste Manage Section, Groundwater and Environmental Monitoring System database printout, August 15, 1995.

Wisconsin Department of Natural Resources, Bureau of Solid and Hazardous Waste Management, Solid Waste Manage Section, Solid and Hazardous Waste Inventory Management System database printout, August 22, 1995.

Meeting with Wisconsin DNR hydrogeologist, August 21, 1995.

Written correspondence submitted by facility and/or State on draft version of release descriptions, October 1996.

## CONSOLIDATED PAPERS WATER QUALITY CENTER WISCONSIN

### Facility Overview

|  |  |
|---|---|
| Facility Name: | Consolidated Papers Water Quality Center |
| Location: | Wisconsin Rapids, Wisconsin |
| Waste Stream: | Paper mill sludge |
| Media Affected: | Groundwater |

Consolidated Papers Water Quality Center (WQC) is a paper mill located in Wisconsin Rapids, Wisconsin. Cranberry Creek runs adjacent to the site, and the Wisconsin River is 2,600 feet away.

* Action level

### Corrective Actions/Regulatory Actions

The site has installed extraction wells downgradient, which seem to be effective in reversing the groundwater flow The groundwater is removed to a wastewater treatment plant adjacent to the site.

### Sources of Information

Wisconsin Department of Natural Resources, Bureau of Solid and Hazardous Waste Management, Solid Waste Manager Section, Groundwater and Environmental Monitoring System database printout, August 15, 1995.

Wisconsin Department of Natural Resources, Bureau of Solid and Hazardous Waste Management, Solid Waste Manager Section, Solid and Hazardous Waste Inventory Management System database printout, August 21, 1995.

Meeting with Wisconsin DNR hydrogeologist, August 21, 1995.

Written correspondence submitted by facility and/or State on draft version of release descriptions, October 1996

| GROUNDWATER CONTAMINANTS COMPARED TO WISCONSIN OR FEDERAL DRINKING WATER STANDARDS | | | | |
|---|---|---|---|---|
| Sulfate | 11,000 | 124 | 500 | 250 |
| Toluene | 1.7 | 0.068 | 1 | 2 |
| Total suspended solids | 380 | -- | -- | -- |
| Xylenes | 3 | 0.124 | 10 | -- |
| Zinc | 0.09 | 0.25 | -- | 5 |

* Action level

### Corrective Actions/Regulatory

**Sources of Information**

Wisconsin Department of Natural Resources, Bureau of Solid and Hazardous Waste Management, Solid Waste Manage Section, Groundwater and Environmental Monitoring System database printout, August 15, 1995.

Wisconsin Department of Natural Resources, Bureau of Solid and Hazardous Waste Management, Solid Waste Manage Section, Solid and Hazardous Waste Inventory Management System database printout, August 22, 1995.

Meeting with Wisconsin DNR hydrogeologist, August 22, 1995.

Written correspondence submitted by facility and/or State on draft version of release descriptions, October 1996.

### Facility Overview

| | |
|---|---|
| Facility Name: | Flambeau Paper Corporation |
| Location: | Eisenstein, Wisconsin |
| Waste Stream: | Paper mill sludge |

Flambeau Paper Corporation is a paper mill located in Eisenstein, Wisconsin. Flambeau River is 1,200 feet from the site.

### Wastes and Waste Management Practices

The disposal site is an 18-acre landfill that is currently closed. Groundwater is monitored quarterly. The nearest drinking water well is located 1,400 feet from the site.

### Extent of Contamination

The facility is in a highly contaminated area. Adjacent areas formerly contained sulfide liquor lagoons, which are thought to be the source of sulfate contamination.

As shown in the table below, chloride, iron, pH, and sulfate exceeded Wisconsin or Federal water standards.

**GROUNDWATER CONTAMINANTS COMPARED TO**
**WI(0A)24(R)(1TS-5.I)3 T36(A)24(Rp.D)]TJ3.54 -2.()3 Tcw Tc4(Rp.D)(DER.198 (L158TDRD)]TJ3KD)]TJ**

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|---|---|
| Facility Name: | Georgia-Pacific - Tomahawk Mill |
| Location: | Tomahawk, Wisconsin |
| Waste Stream: | Mixed Paper Mill Waste |
| Media Affected: | Groundwater |

## Facility Overview

The Tomahawk Mill is a paper mill located in Tomahawk, Wisconsin. Located on a peninsula, the site is 500 feet from the Wisconsin River and 1600 feet from the Spirit River flowage.

## Wastes and Waste Management Practices

The disposal site is a 30-acre unlined landfill, which is now closed. Portions of the landfill are covered with silty clay, bentonite amended soil, or geomembrane. There is also a lined landfill adjacent to the unlined disposal site, which is not believed to be causing contamination. Groundwater is monitored quarterly. The nearest drinking water is about 700 feet from the site.

## Extent of Contamination

As shown in the table below, cadmium, chloride, iron, manganese, nitrite as N, pH, sulfate, and zinc exceeded Wable bvt of C(0.0062(5i43.6(m)-5.92(n)c-2(0.38)Tum)549-Gonta(nt4)-5.6-of C8-N6nta)G)TheOAT5.6(ER CO)5718w[TheANT

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## Facility Overview

The Kohler Company site is an industrial waste landfill. The Sheboygan River is 150 feet from the site.

## Wastes and Waste Management Practices

The 53-acre landfill, located on a 82-acre parcel is unlined. Groundwater is monitored quarterly. The nearest drinking water well is located one-half mile from the site. From the 1950's through 1975, the site received solvents, oil, and plating wastes.

| | |
|---|---|
| Facility Name: | Kohler Co. |
| Location: | Sheboygan County, Wisconsin |
| Waste Stream: | Waste foundry sand cores, pottery cull and molds and other non-hazardous industrial wastes. |
| Media Affected: | Groundwater and surface water |

## Extent of Contamination

Pre-RCRA, dike failures occurred and the Sheboygan River was contaminated. The extent of contamination of th Sheboygan River is difficult to measure. The impact to groundwater is a result of releases from the landfill waste mass. Liquids disposed in the landfill and leachate from the site have entered the groundwater system. The impact to groundwa results from a phenolic resin used as a binder for foundry sand molds, as well as other industrial waste received at the lar

As shown in the table below, aluminum, arsenic, barium, cadmium, chloride, chromium (total), iron, lead, manganese, nickel, phenol, sulfate, and total dissolved solids exceeded Wisconsin or Federal water standards.

**GROUNDWATER CONTAMINANTS COMPARED TO WISCONSIN OR FEDERAL DRINKING WATER STANDARDS**

| Contaminant | Highest Detected Level (mg/l) | WI Standard (mg/l) | MCL (mg/l) | SMCL (mg/l) |
|---|---|---|---|---|
| Aluminum | 1.36 | -- | -- | 0.05-0.2 |
| Antimony | 0.32 | -- | -- | -- |
| Arsenic | 0.008 | 0.005 | 0.05 | -- |
| Barium | 10.7 | 0.2 | 2 | -- |
| Beryllium | 0.010 | -- | 0.004 | -- |
| Boron | 82 | -- | -- | -- |
| Cadmium | 0.07 | 0.0005 | 0.005 | -- |
| Calcium | 386 | -- | -- | -- |
| Chloride | 148 | 125 | -- | 250 |
| Chromium (total) | 0.048 | 0.01 | 0.1 | -- |
| Copper | 0.12 | 0.13 | 1.3* | 1 |
| Iron | 0.39 | 0.15 | -- | 0.3 |
| Lead | 0.006 | 0.0015 | 0.015* | -- |
| Magnesium | 127 | -- | -- | -- |
| Manganese | 0.37 | 0.025 | -- | 0.05 |
| Mercury | 0.0002 | 0.0002 | 0.002 | -- |
| Molybdenum | 0.0006 | -- | -- | -- |
| Nickel | 0.31 | -- | 0.1 | -- |
| pH | 7.7 | 6.5-8.5 | -- | 6.5-8.5 |
| Phenol | 6 | 1.2 | -- | -- |
| Phosphorous | 0.41 | -- | -- | -- |
| Potassium | 16 | -- | -- | -- |
| Silver | 0.0091 | 0.1 | -- | 0.1 |
| Sodium | 546 | -- | -- | -- |
| Strontium | 6.5 | -- | -- | -- |
| Sulfate | 778 | 125 | 500 | 250 |
| Tin | 0.03 | -- | -- | -- |
| Titanium | 0.03 | -- | -- | -- |

| GROUNDWATER CONTAMINANTS COMPARED TO<br>WISCONSIN OR FEDERAL DRINKING WATER STANDARDS | | | | |
|---|---|---|---|---|
| Total dissolved solids | 2,700 | -- | -- | 500 |
| Vanadium | 0.442 | -- | -- | -- |
| | | | | |

Wisconsin Department of Natural Resources, Bureau of Solid and Hazardous Waste Management, Solid Waste Manage
Section, Solid and Hazardous Waste Inventory Management System database printout, August 22, 1995.

Meeting with Wisconsin DNR hydrogeologist, August 22, 1995.

Written correspondence submitted by facility and/or State on draft version of release descriptions, October 1996.

## NIAGARA OF WISCONSIN PAPER CORP. WISCONSIN

### Facility Overview

The Niagara Paper Mill is located in Marinette County, Wisconsin. Monitoring wells are located within 50 feet of the Menominee River. The facility is located along the side of the river.

Facility Name: Niagara of Wisconsin Paper Corp.
Location: Marinette County, Wisconsin
Waste Stream: Paper mill sludge
Media Affected: Groundwater

### Wastes and Waste Management Practices

The landfill is closed, with no other industry in the immediate vicinity. The landfill was completely capped in the last two years. Groundwater is monitored quarterly.

# POPE & TALBOT WISCONSIN INC. LANDFILL WISCONSIN

## Facility Overview

|  |  |
|---|---|
| Facility Name: | Pope & Talbot Wisconsin Inc. Landfill |
| Location: | Eau Claire County, Wisconsin |
| Waste Stream: | Paper mill sludges |
| Media Affected: | Groundwater |

The Pope & Talbot landfill is located in Eau Claire County, Wisconsin. Six Mile Creek is 200 feet from the site.

## Wastes and Waste Management Practices

The 19-acre landfill began receiving waste in 1978. Currently, the site has a three-foot clay liner and leachate collection system (Phase 3 area). Previously, the site dewatered the sludge, compacted it, and used it as a liner (Phases 1 and 2 areas). The sludge liner is suspected to have developed fractures and leachate permeated the compacted waste liner.

Groundwater is monitored quarterly. The nearest drinking water well is located 1,350 feet from the site.

## Extent of Contamination

A breach in the compacted sludge liner in Phases 1 and 2 and leachate handling practices resulted in an impact t groundwater. The paper mill manufactures recycled paper, and therefore, must use solvents to de-ink the recycled paper Many of the contaminants found in the groundwater are process solvents used in the de-inking phase. Private drinking w wells, located approximately 1,000 feet from the facility, were contaminated with volatile organic compounds (VOCs) and There is no evidence that organisms in the surface water have been impacted.

As shown in the table below, benzene, cadmium, chloride, chromium, 1,1-dichlorethylene, trans-1,2-dichloroethylene, iron (dissolved), manganese, naphthalene, nitrate/nitrite as N, pH, sodium, toluene, trichloroethylene, an vinyl chloride exceeded Wisconsin or Federal water standards.

**GROUNDWATER CONTAMINANTS COMPARED TO WISCONSIN OR FEDERAL DRINKING WATER STANDARDS**

| Contaminant | Highest Detected Level (mg/l) | WI Standard (mg/l) | MCL (mg/l) | SMCL (mg/l) |
|---|---|---|---|---|
| Ammonia as N | 19 | -- | -- | -- |
| Benzene | 0.0015 | 0.0005 | 0.005 | -- |
| Bromodichloromethane | 0.0001 | 0.036 | 0.1 | -- |
| n-Butylbenzene | 0.00078 | -- | -- | -- |
| sec-Butylbenzene | 0.00042 | -- | -- | -- |
| Cadmium | 0.001 | 0.0005 | 0.005 | -- |
| Calcium | 32 | -- | -- | -- |
| Calcium carbonate | 5,300 | -- | -- | -- |
| Carbon tetrachloride | 0.0001 | 0.0005 | 0.005 | -- |
| Chloride | 210 | 125 | -- | 250 |
| Chlorobenzene | 0.0017 | -- | -- | -- |
| Chloroethane | 0.003 | 0.08 | -- | -- |
| Chloroform | 0.0001 | 0.0006 | 0.1 | -- |
| Chloromethane | 0.00033 | -- | -- | -- |
| o-Chlorotoluene | 0.016 | -- | -- | -- |
| p-Chlorotoluene | 0.00027 | -- | -- | -- |
| Chromium | 0.082 | 0.01 | 0.1 | -- |
| Dibromochloromethane | 0.0001 | 0.043 | -- | -- |
| m-Dichlorobenzene | 0.0001 | 0.125 | 0.6 | -- |

## Facility Overview

| | |
|---|---|
| Facility Name: | Richland Center Foundry |
| Location: | Richland Center, Wisconsin |
| Waste Stream: | Foundry sand |
| Media Affected: | Groundwater |

The Richland Center Foundry is an industrial spent sand landfill in Richland Center, Wisconsin. The Pine River is an average of 350 feet away from the mouth foot of the landfill.

## Wastes and Waste Management Practices

The 3.7 acre landfill received foundry sand waste from 1975 until its closure in 1990. Phases I, II, and III of the landfill are unlined but are clay capped according to applicable regulations; phase IV is both lined and capped. Eleven groundwater monitoring wells are tested biannually an leachate wells are checked monthly to verify their dry condition. There are no drinking wells near the site.

## Extent of Contamination

The groundwater has exceedances of Wisconsin groundwater standards for iron and chloride, as well as high conductivity and chemical oxygen demand. No specific data were available. It is possible that the high iron levels are du natural causes and that the high chloride levels are due to the practice of "salting" Highway 14 during the winter months.

## Corrective Actions/Regulatory Actions

As part of its closure plan, the site installed a multi-layered cap of clay and cover soils. No further action is anticipated.

## Sources of Information

Wisconsin Department of Natural Resources, Bureau of Solid and Hazardous Waste Management, Solid Waste Manage Section, Solid and Hazardous Waste Inventory Management System database query, August 21, 1995.

Meeting with Wisconsin DNR hydrogeologist, August 21, 1995.

Written correspondence submitted by facility and/or State on draft version of release descriptions, October 1996

## Corrective Actions/Regulatory Actions

A soil cap was placed over the site upon closure and construction documentation of the closure was approved by the State on March 15, 1984. The State completed a Potential Hazardous Waste Site-Preliminary Assessment of the lan in June 1984 and ranked the landfill as a low priority. As part of a cooperative agreement between the USEPA and the S a Site Screening Inspection (SSI) was conducted at the landfill by the State on April 2, 1991. In December, 1995, the Sta issued a Plan Modification Approval to address exceedances of state standards for sulfates in groundwater at the site. T Plan Modification required an Environmental Contamination Assessment be prepared and conducted at the site, which is currently underway.

## Sources of Information

Wisconsin Department of Natural Resources, Bureau of Solid and Hazardous Waste Management, Solid Waste Manage Section, Groundwater and Environmental Monitoring System database printout, August 15, 1995.

Wisconsin Department of Natural Resources, Bureau of Solid and Hazardous Waste Management, Solid Waste Manage Section, Solid and Hazardous Waste Inventory Management System database printout, August 22, 1995.

Meeting with Wisconsin DNR hydrogeologist, August 22, 1995.

Written correspondence submitted by facility and/or State on draft version of release descriptions, October 1996.

Wisconsin Department of Natural Resources, Bureau of Solid and Hazardous Waste Management, Solid Waste Manager
Section, Solid and Hazardous Waste Inventory Management System database printout, August 21, 1995.

Meeting with Wisconsin DNR hydrogeologist, August 22, 1995.

Written correspondence submitted by facility and/or State on draft version of release descriptions, October 1996

# WAUSAU PAPER MILLS WISCONSIN

## Facility Overview

The Wausau Paper Mill is located in Brokaw, Wisconsin. The Wisconsin River is 1,000 feet from the site.

| | |
|---|---|
| Facility Name: | Wausau Paper Mills |
| Location: | Brokaw, Wisconsin |
| Waste Stream: | Paper mill sludge |
| Media Affected: | Groundwater |

## Wastes and Waste Management Practices

The disposal site is a 6-acre landfill. The landfill is divided into three cells. Cell I is unlined and has no leachate collection system. Cell II is lined and has a leachate collection system. Cell III has a five-foot clay liner and a leachate collection system. Groundwater is currently monitored quarterly but may be changed in part to semi-annually. The nearest drinking water well is 2,650 feet side gradient from the site.

## Extent of Contamination

The contamination is thought to be caused by Cell I of the landfill. According to the Wisconsin Department of Natural Resources (DNR) hydrogeologist, there are exceedances of Wisconsin groundwater quality standards for the following parameters: alkalinity, chemical oxygen demand, iron, manganese, and hardness.

As shown in the table below, chloride and iron exceeded Wisconsin or Federal water standards. The standard fo iron has also been exceeded at several upgradient (background) wells.

**GROUNDWATER CONTAMINANTS COMPARED TO WISCONSIN OR FEDERAL DRINKING WATER STANDARDS**

| Contaminant | Highest Detected Level (mg/l) | WI Standard (mg/l) | MCL (mg/l) | SMCL (mg/l) |
|---|---|---|---|---|
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# SECTION A.2:

# CONSTRUCTION AND DEMOLITION LANDFILL RELEASE DESCRIPTIONS

| | | | | |
|---|---|---|---|---|
| Lead | 90 | 25 | 15* | -- |
| Magnesium | 94,900 | 35,000 | -- | -- |
| Manganese | 33,200 | 300 | -- | 50 |
| Sodium | 178,000 | 20,000 | -- | -- |
| TDS | 1,630,000 | 500,000 | -- | 500,000 |
| Zinc | 391 | 300 | -- | 5000 |

*Value is action level for lead at the tap

**Discussion**

Ground water at the perimeter of the landfill was found to contain several contaminants at levels above their drink water standards.

Municipal well fields are located about 1.25 to 3 miles from the site. Off-site groundwater monitoring was not conducted as part of this study. According to the investigators, data from this one round of sampling do not conclusively determine whether or not the C&D landfill is affecting groundwater quality near the site.

No disposal of hazardous waste (as defined in 6NYCRR Part 371) was documented during the PSA. The PSA recommended closing the Garofalo C&D site, and capping it to reduce infiltration and provide surface water control.

**Source**

Final Preliminary Site Assessment: Garofalo C&D Site; New York State Department of Environmental Conservation (NYSDEC); November 1991.

## QUALLA ROAD LANDFILL CHESTERFIELD COUNTY, VIRGINIA

**Media Affected:** Groundwater, Surface Water

### Overview of Site/Site History

The Qualla Road Landfill is an active 33-acre C&D landfill located in a mainly agricultural area in Chesterfield County, Virginia. The landfill opened in 1983 with an 11-acre area, and 22 acres were added in 1988. To date, 16 of tho acres have received waste. The facility is owned by a private farmer and leased to Sanifill, Inc. The landfill capacity is estimated to be 1.523 million cubic yards over a design life of 12 years.

Two fires have been reported at the landfill, one in 1990 and one in 1993. Both were quickly extinguished.

### Facility Operations

The Qualla Road Landfill accepts C&D waste, brick, concrete rubble, brush, tree trimmings, and stumps. Approximately 40 percent of the waste at the site is land-clearing debris, which is currently disposed on approximately te unlined acres. The remaining 60 percent is building material and demolition waste and is disposed on approximately six acres. Prohibited wastes include hazardous waste, liquids, garbage, refuse, agricultural waste, industrial waste, paper

**TABLE 1**
**SURFACE WATER CONTAMINANTS EXCEEDING FEDERAL AWQC**

| Contaminant/Parameter | Highest Detected Level (μg/l) | Fresh Chronic AWQC (μg/l) |
|---|---|---|
| Iron | 252,000 | 1,000 |
| Lead | 113 | 7* |
| **Parameter** | **Lowest** | **AWQC** |
| | | |

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|---|---|---|---|
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Letter from Scott Bullock, Department of Environmental Quality, Commonwealth of Virginia to Gregory Cekander, Sanifill, February 2, 1994.

Memorandum from Scott Bullock, Department of Environmental Quality, Commonwealth of Virginia, to Timothy Torrez, Q Road Landfill, January 12, 1994.

Memorandum from Charles Plott, Landfill Manager, Qualla Road Landfill, to Robert Timmons, Department of Environme Quality, Commonwealth of Virginia, April 28, 1993.

Memorandum to the file from Berry Wright, Department of Waste Management, Commonwealth of Virginia, August 25, 1

Memorandum from Charles Plott, Landfill Manager, Qualla Road Landfill, to Robert Timmons, Department of Environme

## SCHUYLKILL DEBRIS LANDFILL PRINCE GEORGE COUNTY, VIRGINIA

**Media Affected:** Groundwater

### Overview of Site/Site History

The Schuylkill Debris Landfill comprises approximately seven acres near the western edge of the Appomattox Ri in Prince George County. The landfill received its permit to accept C&D wastes in November 1984 and closed in 1988. I owned and operated by the U.S. Army Quartermaster Center and Fort Lee. A few leachate seeps were discovered in 19 but they led to no obvious visual signs of contamination.

### Facility Operations

The landfill is a permitted debris facility. An October 1989 questionnaire revealed that the facility has accepted wood, stumps, brick, concrete, and other inert construction and demolition debris material.

### Facility Design

The source document provides no information on facility design.

### Site Environment and Hydrogeology

The source document provides no information on site environment or hydrogeology.

### Summary of Environmental Damages

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**Sources**

Laboratory Report, Schuylkill, Montgomery Laboratories, December 16, 1992.

Memorandum from Thomas L. Kowalski, Environmental Inspector, to Department of Waste Management File, December 1992.

Memorandum from Jonathan P. Adams, Lieutenant, U.S. Army, to Richard Burton, Department of Environmental Quality, 7, 1994.

Memorandum from William M. Munson, Lieutenant Colonel, U.S. Army, to Linda Lightfoot, Department of Waste Management, October 11, 1989.

Solid Waste Management Permit, Commonwealth of Virginia, Department of Health, December 11, 1984.

1st Quarter Groundwater Analysis, Environmental Laboratories, Inc., April 30, 1992.

2nd Quarter Groundwater Analysis, Environmental Laboratories, Inc., July 23, 1992.

| | | | |
|---|---|---|---|
| Manganese | 710 | -- | 50 |
| Sulfate | 1,900,000 | -- | 250,000 |
| Total dissolved solids (TDS) | 3,780,000 | -- | 500,000 |

**Discussion**

Adverse on-site groundwater quality impacts from demolition waste disposal were documented at this landfill. Of site groundwater monitoring was not conducted.

**Source**

Investigation of Groundwater Impacts at Demolition Waste Landfills, Wisconsin Department of Natural Resources, June 1

# TERRA ENGINEERING DEMOLITION WASTE LANDFILL — DANE COUNTY, WISCONSIN

**Media Affected:** Groundwater

## Overview of Site/Site History

The Terra Engineering Demolition Landfill is about 4.1 acres in size. It is located in a drained marshy area in Dar County near the city of Madison, Wisconsin. This site was licensed in 1971 for demolition waste only, and one owner has operated the site since 1972. The company expects to be able to fill at the present rate for at least 10 more years.

## Facility Operations

Since 1972, the site has been filled only with waste materials from the company's construction and demolition projects. The main fill materials have been reinforced and unreinforced concrete, wood, masonry, brick, asphalt pavemer glass, steel and metal pieces, and brush. Some asphalt and scrap metal has been sorted out for the company to sell or reuse.

## Facility Design

No information is presented in the source document about the design of the landfill.

## Site Environment and Hydrogeology

The landfill is in a drained marshy area bounded on the north and east by drainage ditches. Surface water is rout around the fill on the southern end of the site. The land slopes towards the southeast.

The glacial material underlying the site is undifferentiated glacial deposits consisting of ground moraine. The unconsolidated material below the surface includes layers of brown sand, silt, and clay along with some sand seams and and gravel lenses. About 100 feet below these unconsolidated deposits lies Trempealeau and Franconia sandstone bedr which is underlain by Cambrian sandstone down to Precambrian crystalline bedrock. The Cambrian sandstone acts as th principal aquifer for most Dane County residents.

Groundwater is close to the surface at the site; the measured depth to ground water is between 2.5 and 10 feet. Regional movement of groundwater deep in the sandstone aquifer is southwest towards the Yahara River, which is three miles away. Locally, there is a definite eastward gradient. The groundwater flow is very complex due to the heterogeneo nature of the glacial deposits.

## Summary of Environmental Damages

Five groundwater monitoring wells were installed at the site, one within the demolition debris and the others sidegradient to the fill. All wells were sampled periodically for two years. One of the sidegradient wells had elevated leve manganese, sulfate, and total dissolved solids (TDS); the other three sidegradient wells were generally unaffected. The v installed within the demolition debris had elevated levels of many inorganics; five were detected at levels above Federal drinking water standards (primary or secondary MCLs). These are shown in Table 1.

**TABLE 1**
**GROUNDWATER CONTAMINANTS EXCEEDING FEDERAL DRINKING WATER STANDARDS**

| Contaminant | Highest Detected Level (µg/l) | MCL (µg/l) | SMCL (µg/l) |
|---|---|---|---|
| Chloride | 380,000 | -- | 250,000 |
| Iron | 6,400 | -- | 300 |
| Manganese | 1,400 | -- | 50 |
| Sulfate | 600,000 | -- | 250,000 |

| | | | |
|---|---|---|---|
| TDS | 3,340,000 | -- | 500,00 |

**Discussion**

Adverse on-site groundwater quality impacts from demolition waste disposal were documented at this landfill. Of site groundwater monitoring was not conducted.

**Source**

Investigation of Groundwater Impacts at Demolition Waste Landfills; Wisconsin Department of Natural Resources, June 1

# SECTION A.3:

[redacted]

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