TOXICS USE AND HAZARDOUS WASTE GENERATION PRACTICES IN OREGON

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Submitted to:

The Oregon Department of Environmental Quality
Hazardous and Solid Waste Division
811 SW 6th Avenue
Portland, Oregon 97204

and

U.S. Environmental Protection Agency
Region X
1200 Sixth Avenue
Seattle, Washington 98101

Submitted by:

Science Applications International Corporation
8400 Westpark Drive
McLean, Virginia 22102

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LIST OF EXHIBITS

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STANDARD INDUSTRIAL CLASSIFICATION (SIC) CODE TRANSLATIONS

Please note that a number of the analyses in this report have been presented by SIC Code. This table serves as a reference for looking up the translations to the SIC Codes presented in this report.

SIC Code	Name of Industrial Group
20	Food and Kindred Products
22	Textile Mill Products
24	Lumber and Wood Products
25	Furniture and Fixtures
26	Paper and Allied Products
27	Printing and Publishing
28	Chemicals and Allied Products
29	Petroleum and Related Products
30	Rubber and Miscellaneous Plastic Products
31	Leather and Leather Products
32	Stone, Clay, and Glass Products
33	Primary Metal Industries
34	Fabricated Metal Products
35	Machinery Except Electrical
36	Electronic and Other Equipment
37	Transportation Equipment
38	Instruments and Related Products
39	Miscellaneous Manufacturing Industries
40	Railroad Transportation
42	Trucking and Warehousing
48	Communication
49	Electric, Gas, and Sanitary Services
50	Durable Goods
51	Nondurable Goods
55	Auto Dealers and Service Stations
75	Auto Repair, Services, and Garages
95	Administration for Environmental Quality

EXECUTIVE SUMMARY

The Oregon Legislative Assembly passed the Toxics Use Reduction and Hazardous Waste Reduction Act, which was signed into law on July 24, 1989. The act mandates toxics users (i.e., companies that use SARA[1] 313 toxic substances and/or generate hazardous wastes) to develop toxics use and hazardous waste reduction plans and to set performance goals. The act defines toxics use reduction as

> *"in-plant changes in production or other processes or operations, products or raw materials that reduce, avoid, or eliminate the use or production of toxic substances without creating substantial new risks to public health, safety, and the environment..."*

and it defines hazardous waste reduction as

> *"any recycling or other activity applied after hazardous waste is generated that is consistent with the general goal of reducing present and future threats to public health, safety and the environment and that results in: (A) the reduction of total volume or quantity of hazardous waste generated that otherwise should be treated, stored, or disposed of; (B) the reduction of toxicity of hazardous waste that would otherwise be treated, stored, or disposed of; or (C) both the reduction of total volume or quantity and the reduction of toxicity of hazardous waste...."*

The law also requires the Department of Environmental Quality (DEQ) to provide toxics users and generators with technical assistance and to submit two reports to the legislature on the progress being made toward toxics use and hazardous waste reduction, the status of technical assistance programs, and an analysis and recommendation for program changes. The first of these reports must be submitted to the legislature by January 1, 1991.

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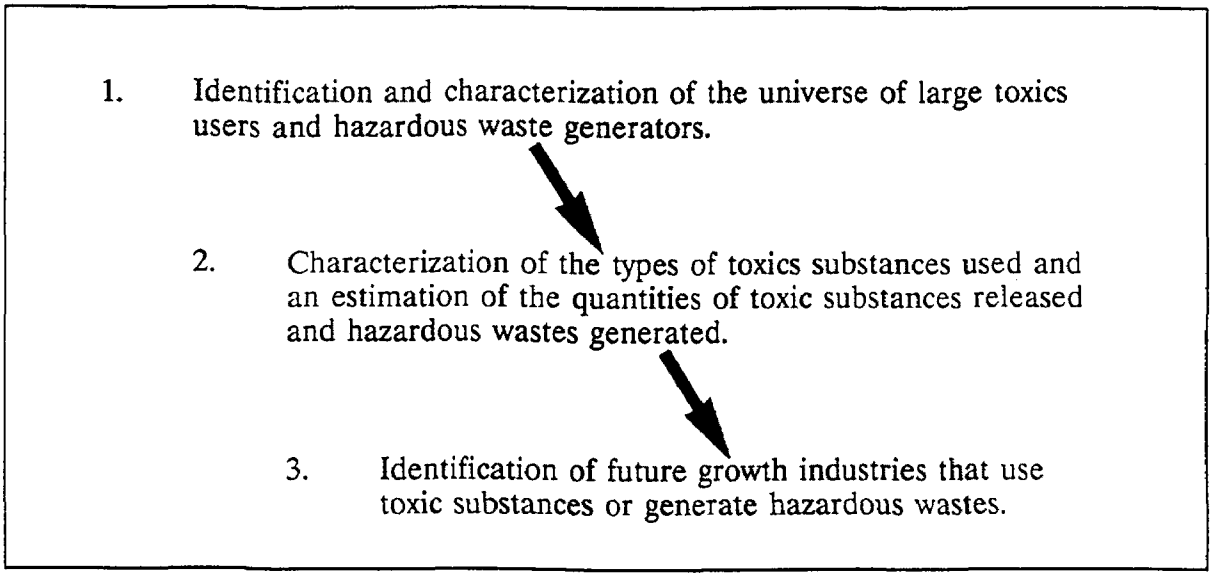
[1] SARA stands for the Superfund Amendments and Reauthorization Act.

In preparing the first report to the legislature, the DEQ has identified that one of the objectives -- reporting on the progress made toward toxics use and hazardous waste reduction -- cannot be carried out using the existing information sources. Instead, the DEQ has decided to include in the first legislative report a characterization of Oregon toxics users, which includes three groups -- large toxics users, large quantity generators, and small quantity generators -- and a discussion of the existing data gaps that prevent the measuring progress made toward toxics use and hazardous waste reduction. This characterization also may form a basis for targeting technical assistance efforts.

This report has been prepared to characterize toxics users and hazardous waste generators and to identify data gaps. This report is divided into four sections:

- Section 1 provides the background to this report, including a discussion of the Toxics Use Reduction and Hazardous Waste Reduction Act and associated regulations.
- Section 2 provides a detailed discussion of the data sources used for the analysis and the associated limitations in using the data.
- Section 3 presents the analyses of the data and major findings.
- Section 4 identifies data gaps that prevent full characterization of toxics users and hazardous waste generation practices and presents suggestions for modifying existing reporting mechanisms to collect more appropriate data.

A number of data sources were used to identify the potential universe of toxics users as well as to characterize toxics usage and waste generation patterns. The data sources include the 1988 Toxics Release Inventory System (TRIS), the 1988 DEQ Quarterly Reports, and 1990 and projected business activity data from the Oregon Executive Department. In presenting the results, this report takes a three-step approach, which can be summarized as follows:



SUMMARY OF FINDINGS

1. Identification of the universe of large toxics users and hazardous waste generators.

The final rules promulgated by the DEQ requires the following three groups of toxics users to complete toxics use and hazardous waste reduction plans and to complete annual progress reports:

- **Large toxics users,** which are companies that meet SARA 313 reporting requirements by using more than 10,000 pounds of a SARA 313 toxic substance in one year or manufacture/process more than 25,000 pounds of a SARA 313 toxic substance in one year.

- **Large quantity generators** (LQGs), which are companies that generate in any calendar month more than 2,200 pounds of a Resource Conservation and Recovery Act (RCRA)-regulated or State-regulated hazardous waste, more than 2.2 pounds of an acute hazardous waste [as specified in 40 CFR, § 251.5 (e)(1)] or more than 220 pounds of acute hazardous spill debris [as specified in 40 CFR § 261.5 (e)(2)].

- **Small quantity generators** (SQGs), which are companies that (1) generate in every calendar month more than 220 pounds but less than 2,200 pounds of RCRA-regulated or State regulated hazardous waste.

Data were available for only a subset of large toxics users (those that use more than 10,000 pounds or manufacture/process more than 50,000 pounds of a SARA 313 toxic substance) and for only those LQGs and SQGs that use manifests to transport hazardous waste offsite (see Exhibit E-1). Based on the data, an estimated 928 companies, at a minimum, will be required to complete these plans and submit progress reports, while a subset -- the large toxics users, the LQGs, and an unknown percentage of SQGs -- will be required to set performance goals for reducing toxics substance use and/or hazardous waste generation. The 928 companies can be divided into 207 large toxics users, and 805 hazardous waste generators, with 84 companies that overlap between the two groups. Of the 805 hazardous waste generators, 120 companies are LQG's and 685 companies are SQGs. Forty percent (49) of the LQGs and 5 percent (35) of the SQGs comprise the 84 companies that are both hazardous waste generators and large toxics users.[2] Georgraphically, over 90 percent of the large toxics users and hazardous waste generators are located in the western half of the State, concentrated primarily in the Portland area.

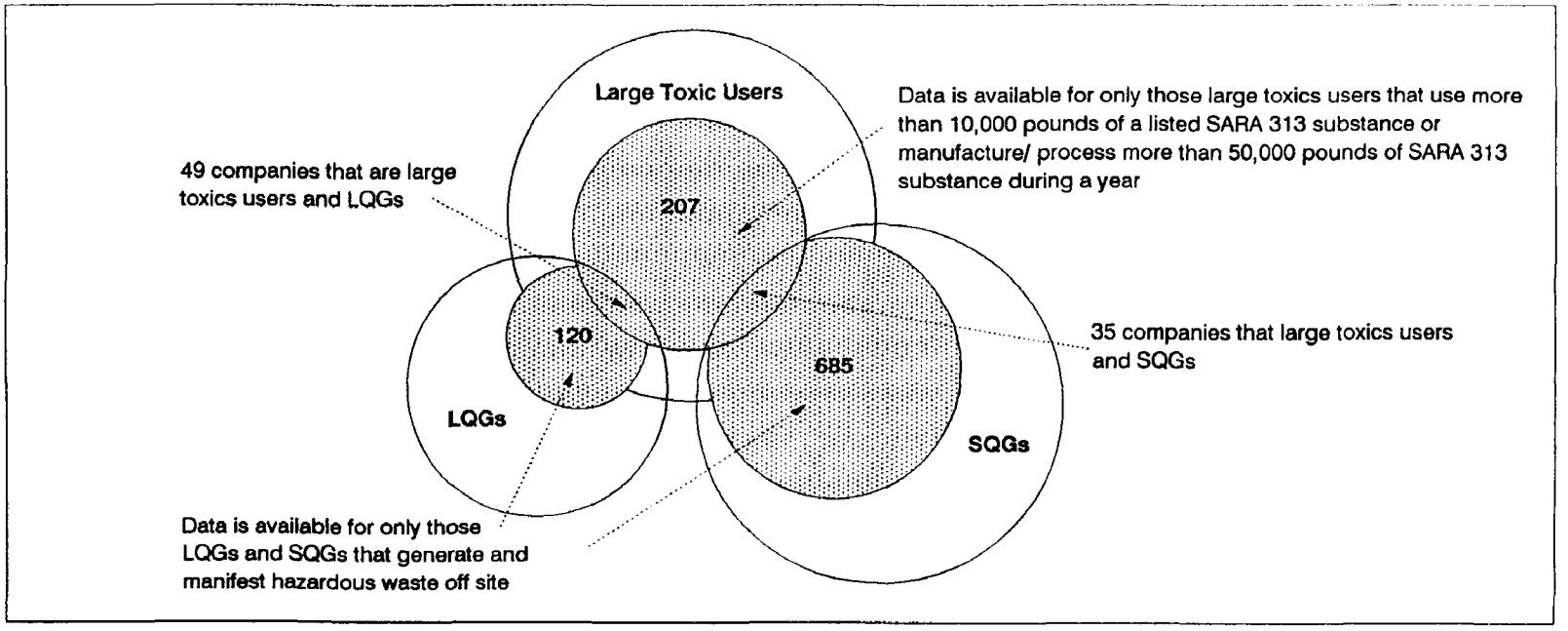
When presenting the characterization data, the 928 toxics users are grouped into two categories: 207 large toxics users and 805 hazardous waste generators, realizing that 84 companies straddle between these two groups. In examining the distribution of companies among industry groups, the data show (see Exhibit E-2) that

- Of 207 large toxics users, over 85 percent are represented in nine industry groups: lumber and wood products (36 companies), chemicals and allied products (30 companies), fabricated metal products (27 companies), primary metals (19 companies), electronic and electrical (17 companies), food and kindred products (14 companies), paper and allied products (13 companies), rubber and miscellaneous products (12 companies), and transportation equipment (11 companies).

[2] An unknown percentage of the SQGs also include conditionally exempt generators (CEQs) [i.e., generators that generate less than 220 pounds of hazardous waste in every month of the calendar year.] Due to the format of the DEQ Quarterly Reports from which the data was extracted, it is not possible to identify the exact number of CEGs included in the count of SQGs. Because CEGs are not required is comply with DEQ Quarterly Reporting processing, the DEQ believes the CEGs as a percentage of SQGs is small.

Exhibit E-1

The Universe of Oregon Toxics Users



Universe of Toxics Users

Large Toxics Users = Companies that use greater than 10,000 pounds per year of a SARA 313 toxic substance or manufacture/process more than 25,000 pounds of a SARA 313 substance per year

Large Quantity Generators (LQG) = Companies that generate in one or more months during a year more than 2,200 pounds of RCRA-regulated or State-regulated hazardous waste, more than 2.2 pounds of acute hazardous waste, or more than 220 pounds of acute hazardous spill debris.

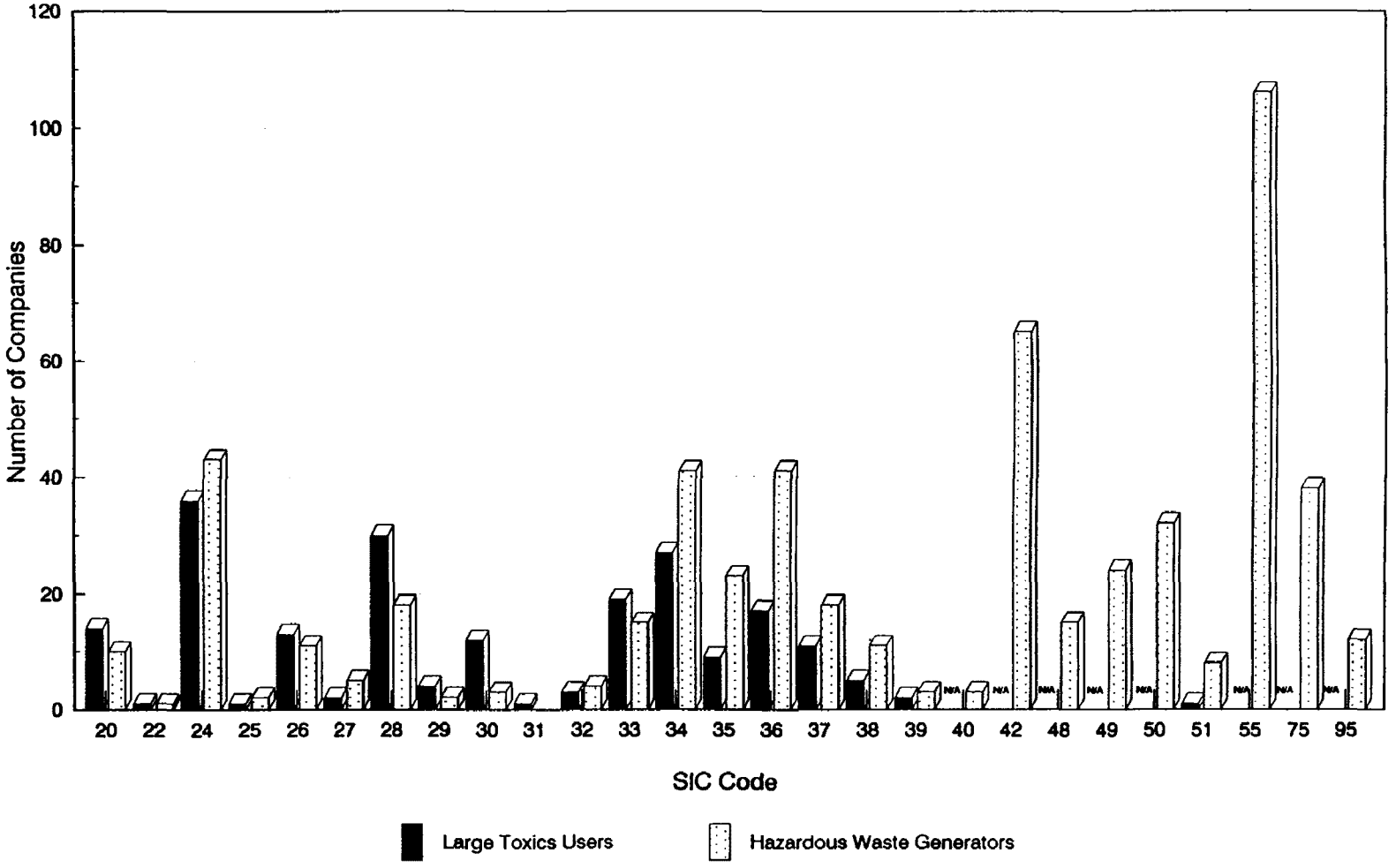
Small Quantity Generators (SQG) = Companies that generate in every single month during a year between 220 and 2,200 pounds of RCRA-regulated or State-regulated hazardous waste.

Shaded area represents those companies for which characterization and release data is available

Source of data: 1988 Toxic Release Inventory System Reports and 1988 DEQ Quarterly Reports

Exhibit E-2

Number of Oregon Toxics Users by Type of Toxics User and SIC Code



N/A = SARA 313 does not require facilities in these industries to report

Source: 1988 Toxic Release Inventory System Reports
1988 DEQ Quarterly Reports

- The 805 LQGs and SQGs that manifest and transport waste offsite are concentrated in five industry groups: auto dealers and gasoline service stations (106 companies), motor freight transportation and warehousing (65 companies), lumber and wood products (43 companies), fabricated metals (41 companies), electrical and electronic (41 companies), and automotive repair (38 companies).

2. Characterization of types of toxic substances used and an estimation of the quantities of toxic substances released and hazardous wastes generated.

In 1988, Oregon's large toxics users processed, manufactured, or used over 87 different SARA 313 toxic substances.[3] The three most frequently used toxic substances by large toxics users were sulfuric acid, acetone, and toluene. Other frequently used chemicals include ammonia, chlorine, formaldehyde, hydrochloric acid, methanol, methyl ethyl ketone, xylene, and 1,1,1-trichloroethane.

TRIS, which is the source of data on frequency of SARA 313 toxic substance use, does not provide data on the quantities of these substances used by companies. This information is considered key for analyzing toxics use patterns in Oregon and is one of the data gaps addressed in this report. Though not a good indicator of quantities used, TRIS does provide data on the quantities of toxic substances released to the environment from manufacturing, processing, or using toxic substances.

Of the 207 large toxics users, 197 companies reported releasing over 45-million pounds of SARA 313 toxic substances directly into the environment (i.e., land, air, or water) or to other offsite locations with nearly 50 percent of the releases going into the air. The data show that a variety of toxic substances are released to the air, either through stack or nonpoint (fugitive) emissions. Toxic substances that comprise the major releases to the air include aluminum oxide, toluene, acetone, styrene, methanol, and chlorine. In contrast, a few toxic substances dominate releases to land, water, publicly owned treatment works (POTW), and other off-site destinations.

[3] "SARA 313 toxic substances" and "toxic substances" are used interchangeably throughout this report.

As an example, aluminum oxide comprises over 50 percent of the toxic substances released to land while methanol is the most dominant toxic substance released to POTWs, comprising over 75 percent of the total quantity of toxic substances released.

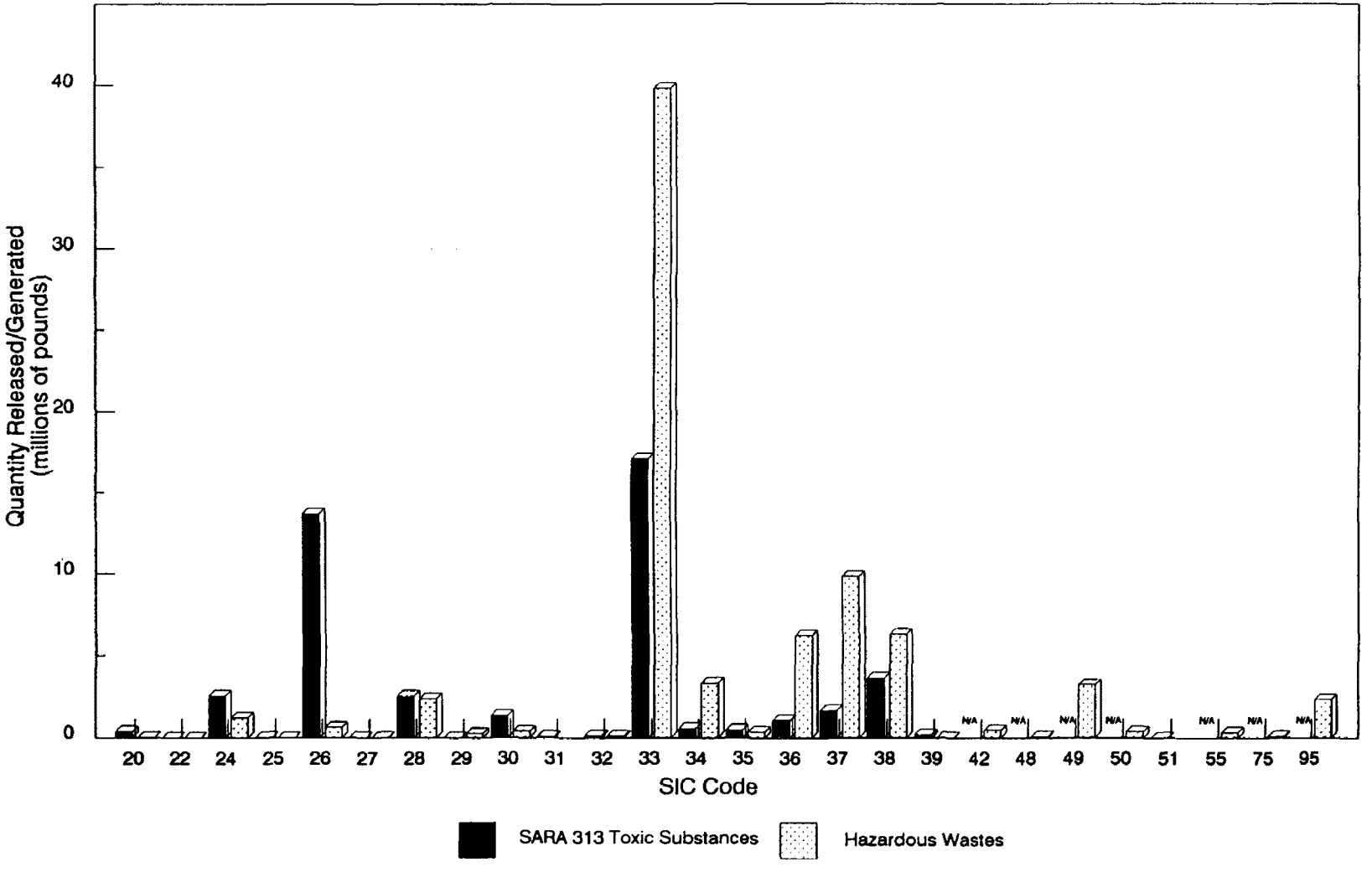
In comparison to the 45-million pounds released by large toxics users, LQGs and SQGs generated and manifested a total of 82-million pounds of hazardous waste offsite during 1988. These generators transport various types of federally and State-regulated hazardous wastes offsite. K wastes (wastes generated from specific sources) account for the largest quantity of hazardous waste generated, all of which are generated (13,700 tons or 27.4-million pounds) by the primary metal industry. The next largest group of wastes are the D wastes (wastes that exhibit one of the four hazardous waste characteristics), followed by X wastes, which are State-regulated wastes.

The data also show that for some industries an inverse relationship exists between the number of companies in an industry group and the quantity of toxic substances released or hazardous wastes generated. In other words, certain industry groups contain a large number of facilities that release relatively small quantities of toxic substances or likewise generate relatively little hazardous waste. In contrast, there are other industries that contain few facilities which release and/or generate large quantities of toxic substances or hazardous wastes (see Exhibit E-3). For example, industries such as the auto dealers and service stations (SIC 55), motor freight transportation and warehousing (SIC 42), the automotive repair (SIC 75), and the lumber and wood products (SIC 24) industries are each represented by a large number of generators but generate relatively little hazardous waste. The largest quantities of hazardous wastes are generated by primary metals (SIC 33), transportation equipment (SIC 37), instruments and related products (SIC 38), and electronic and electrical equipment (SIC 36) industries.

Similarly, certain industries contain a relatively large number of large toxics users but release relatively small quantities of SARA 313 toxic substances to the environment. Lumber and wood products (SIC 24), chemical and allied products (SIC 28), and fabricated metal products (SIC 34) industries are comprised of a large number of toxics

Exhibit E-3

Quantity of SARA 313 Toxic Substances Released and Hazardous Wastes Generated by Oregon Toxics Users by Type of Toxics User and SIC Code



N/A = SARA 313 does not require facilities in these industries to report

Source: 1988 Toxic Release Inventory System Reports
1988 DEQ Quarterly Reports

users (greater than 25 companies) but release a relatively small quantity of toxic substances to the environment. The major releasers of SARA 313 toxic substances are the pulp and paper industry and the primary metals industry. Because no data exist on the quantities of toxic substances used, it is not known to what degree an inverse relationship exists between the number of companies and quantities of toxic substances used in these industry groups.

3. Identification of future growth industries that use toxic substances or generate hazardous wastes.

Projections into 1995 show that the majority of manufacturing industries (SIC Codes 20 to 39) are expected to remain fairly stable. The only manufacturing industries expected to show any high growth are the machinery products (SIC 35) and electronics and electrical products (SIC 36) industries. These industries are shown to be users of toxic substances or generators of hazardous waste, and therefore, increases are expected in the quantities of toxic substances released or hazardous wastes generated if no reduction techniques or procedures are implemented.

The Oregon Executive Department projects, however, high growth for certain nonmanufacturing industry sectors (all other SIC Codes). Specifically, economic growth is projected for the trade industry (SIC 50-58), the services industry (SIC 70-89), and the transportation and communication industry (SIC 40-49). It is not known to what degree businesses in these industry groups will contribute to toxics use and releases in the future. Businesses in the trade and service industries are not required to supply data on SARA 313 toxic substance uses and releases. Businesses in the transportation and communications industries are required to report use and release information, but in 1988 no large toxics users in this industry group reported using SARA 313 toxic substances. There are, however, hazardous waste generators in these three industry groups, and it is expected that increased growth among these generators will lead to larger quantities of hazardous wastes generated by these industries if no hazardous waste reduction procedures and techniques are implemented.

SUMMARY OF DATA GAPS AND POTENTIAL DATA COLLECTION MECHANISMS FOR FILLING INFORMATION NEEDS

Major data gaps prevent the DEQ from fully characterizing the current universe of large toxics users and hazardous waste generators and effectively measuring toxics use and hazardous waste reduction. Specifically, the data gaps are as follows:

1. The data are incomplete for developing an accurate count of large toxics users and hazardous waste generators.

2. The data are incomplete on the quantities of toxic substances used by toxics users.

3. The data are incomplete for describing chemical use and waste releases from smaller facilities.

4. The format of the TRIS data for quantities of releases under 1,000 pounds does not permit an accurate estimate of the quantities of toxic substances released to the environment.

5. The data are incomplete for measuring progress made toward toxics use reduction and hazardous waste reduction.

Section 4 discusses these data gaps in more detail and provides suggestions for modifying current reporting mechanisms to collect better data for DEQ's purposes. As discussed in Section 4, minor modifications to the TRIS reporting form (form R) would result in collecting types of information needed to bridge DEQ's data gaps, particularly points 1 and 2 above. Furthermore, the final rule requires toxics users to submit annual progress reports which provide additional information to fill in DEQ's data gaps. Specifically, the reports require the universe of toxics users to provide information on the types and quantities of SARA 313 toxic substances used and hazardous wastes generated. The annual progress reports also allow toxics users to report on their toxics use and hazardous waste reduction efforts.

1. INTRODUCTION

1.1 OVERVIEW OF STATUTE AND REGULATION

In an effort to encourage industry to implement pollution prevention measures, the Oregon Legislative Assembly passed the Toxics Use Reduction and Hazardous Waste Reduction Act that was signed into law on July 24, 1989. The act provides a nonregulatory approach to encourage industry to shift its focus from pollution control to pollution prevention (i.e., promote reduction in using toxic chemicals and producing hazardous wastes). Specifically, the act states that the most appropriate approach to pollution prevention is to

- Provide technical assistance to toxics users and generators
- Require toxics users to develop plans for reducing toxic substance use and hazardous waste generation and to develop measurable performance goals
- Survey and monitor the use of toxic substances and the generation of hazardous wastes.

The act gives the Oregon Department of Environmental Quality (DEQ) the authority to provide technical assistance to toxics users and hazardous waste generators and to develop guidelines for preparing toxic use reduction and hazardous waste reduction plans. The act also gives the DEQ the authority to require large toxics users, LQGs, and SQGs to develop and implement reduction plans as well as to submit periodic progress reports. In addition, the DEQ is required to submit a report to the State Legislative Assembly on the status of implementing the act. In the report, the DEQ must discuss the status of the technical assistance program, the progress being made toward reducing quantities of toxic substances used and hazardous wastes generated, and an analysis and recommendations for program changes. The DEQ must submit a report by January 1, 1991, and then another report by January 1, 1993.

In response to the statute, the DEQ promulgated a final rule on August 20, 1990, that required three groups of facilities -- large toxics users, LQGs, and SQGs -- to complete toxics use and hazardous waste reduction plans (also referred to as reduction plans). Specifically, the rule requires all large toxics users and LQGs to develop and implement a reduction plan by September 1, 1991, and all SQGs to develop and implement a plan by September 1, 1992. In keeping with the statute's intent, the first group (large toxics users) is defined as

> *"any facility that is required to comply with Section 313 of Title III of the Superfund Amendments and Reauthorization Act (SARA) of 1986."*

Under SARA 313, companies that manufacture or process more than 25,000 pounds of a listed SARA 313 toxic substance in a calendar year or use more than 10,000 pounds of a listed toxic substance in a calendar year must report.

The second group, LQGs, is defined as

> *"any facility that (1) generates in any one calendar month more than 2,200 pounds of RCRA-regulated and State-regulated hazardous waste or more than 2.2 pounds of an acute hazardous waste [as specified in 40 CFR § 251.5 (e)(1)], or more than 220 pounds of acute hazardous waste spill debris [as specified in 40 CFR § 261.5(e)(2)].*

Finally, the third group, SQGs, is defined as

> *"any facility that (1) generates in every calendar month no more than 2,200 pounds of RCRA-regulated or State-regulated hazardous waste but greater than 220 pounds.*

Conditionally exempt generators (CEGs) (i.e., facilities generating less than 220 pounds per month) are exempt from the rule's requirement to develop reduction plans. In the final rules, these three groups are referred to as "toxics users."

In addition to developing toxics use and waste reduction plans, the rule specifies certain toxics users and hazardous waste generators to develop measurable goals for reducing toxic substance use and hazardous waste generation. The development of performance goals is limited to a subset of toxics users:

- A user of a listed SARA 313 toxic substance in quantities greater than 10,000 pounds per year
- A user of a toxic substance comprising more than 10 percent of the total quantity of toxic substances used and is in quantities greater than 1,000 pounds per year.
- A LQG that generates a hazardous waste comprising more than 10 percent (by weight) of the total hazardous wastes generated in a year.

The rule also requires large toxic users and LQGs to complete annual progress reports with the first submittal by September 1, 1992, for the 1991 calendar year and SQGs to complete annual progress reports with the first submittal by September 1, 1993, for the 1992 calendar year.

1.2 OBJECTIVES OF THE REPORT

As stated in the previous section, the two DEQ reports to the Legislative Assembly must cover the status of the technical assistance program as well as the progress Oregon toxics users and generators are making toward reducing toxics use and waste generation. In preparing the first report, the DEQ has little information available for assessing the progress being made by industry toward reduction. This is due to the fact that existing reporting mechanisms do not provide adequate data for the State to evaluate such progress and the fact that data from forthcoming progress reports will not be available until September 1992 at the earliest. The DEQ, therefore, made a decision to analyze the existing data in order to characterize the Oregon toxics users and generators to the extent permitted by the data, and then to identify the existing data

gaps that prevent assessing the progress being made toward toxics use and hazardous waste reduction.

This report was prepared in response to the DEQ's two objectives mentioned above. This report first analyzes the existing data to identify and characterize Oregon toxics users and hazardous waste generators and to identify the types and quantities of toxic substances used and hazardous wastes generated in the State. Next it identifies existing data gaps that prevent evaluating the progress of toxics use and hazardous waste reduction in the State and proposes alternative approaches to collecting such data.

The remainder of this report is divided into four sections. Section 2 describes the methodology that was taken to collect and analyze the data available on toxics use and hazardous waste generation in Oregon. Section 2 also summarizes the quality of the data, including any caveats or limitations of which the reader of this report should be aware. Section 3 presents the results of the analysis. Section 4 summarizes the data gaps in existing reporting mechanisms and proposes alternative ways of measuring toxics use and waste reduction.

2. METHODOLOGY AND DATA LIMITATIONS

This section describes the methodology that was used to analyze the data and the limitations of the data in interpreting findings. The primary data sources used for the analyses include the following:

- The 1988 Toxic Release Inventory System (TRIS), an information system developed to support SARA 313 reporting requirements, was used to identify and characterize large toxics users, identify types of toxic substances used, and estimate quantities of toxic substances released to the environment;
- The 1988 DEQ Quarterly Reports, a State reporting mechanism, was used to identify hazardous waste generators that manifest hazardous waste (i.e., wastes generated and transported offsite) and the quantities and types of hazardous wastes transported off site; and
- The Oregon Covered Employment and Payrolls by Industry and County Report and the Oregon Economic and Revenue Forecast (Oregon Business Data) data were used to identify growth patterns among industries.

Other sources that were examined for this effort but were not used include the 1987 Hazardous Waste Biennial Reports, the 1986 Hazardous Waste Generator Survey, the Hazardous Waste Data Management System (HWDMS), and the Oregon State Fire Marshall Hazardous Substance Employer Survey (referred to as SARA 312 reports).

The 1987 Biennial Reports for Oregon initially were considered for identifying the numbers of hazardous waste generators and quantities and types of hazardous wastes generated. This source was not used because problems were encountered with the information system used to manage the data. Specifically, the reports generated by the information system indicated that there was no hazardous waste generated and managed onsite in Oregon. Because DEQ knows that the State does have generators that manage hazardous waste onsite, the Biennial Reports were not used for the analysis in this

report. The Generator Survey, which also was considered a source for identifying hazardous waste generation patterns, was not used because only non-Confidential Business Information (CBI) data was available, which resulted in data being available for only nine facilities -- too few observations for using in any type of analysis to characterize generators statewide.

HWDMS was initially examined to identify the universe of hazardous waste generators -- LQGs, SQGs, and CEGs -- in Oregon. However, the DEQ determined that HWDMS did not represent accurately the universe because it contained a number of one-time notifications from generators, many of which may not be generating hazardous waste.

The SARA 312 Reports were examined for information on the quantities of toxic substances used by Oregon companies. Though the SARA 312 Reports do provide such quantitative information, the format prevents the data from being easily analyzed. Specifically, the quantitative data is presented in ranges and in various units of measures, depending on whether the substance is in a liquid, gas, or solid state. Furthermore, the SARA 312 Reports cover all chemical substances requiring a Material Safety Data Sheet, which far exceeds the scope of SARA 313 listed toxic substances. The database that was used to manage the SARA 312 Reports could not be programmed easily to present the data in format for analysis and therefore this source of information was not used. Exhibit 2-1 summarizes the content of the existing information sources and their data gaps with regard to the analysis, while Exhibit 2-2 shows the types of analyses conducted and how the selected data sources were used to support each analysis.

Exhibit 2-1.

Existing Information Sources and Data Gaps

Name of Information Source	Type of Facilities Covered	Types of Data Collected	Agency Receiving Information	Significant Data Gaps for Analysis
1988 Toxic Release Inventory System (TRIS)	"Large Toxics Users" Companies in SIC groups 20 through 39 which manufacture/process more than 50,000 pounds per year of a SARA 313 listed substance or use more than 10,000 pounds of a SARA 313 listed substance per year.	• Facility identifying information • Name of POTWs and other off-site locations receiving toxic substances transferred as waste • Toxic substances identifying information • Activities and use of toxic substances • Maximum amount of substances on-site any time during calendar year • Quantity of substances released during calendar year by media or off-site location • Methods and efficiency of waste stream treatment • Type of waste minimization activities.	EPA-Headquarters	• 1988 TRIS does not provide data on large toxics users that manufacture between 25,000 and 50,000 pounds of a SARA 313 listed substance during a year; however data on this group of toxics users will be provided in 1989. • No data on quantities of SARA 313 listed substances manufactured, processed, or used onsite.
The Oregon State Fire Marshall Hazardous Substance Employer Survey (SARA 312 Reports)	Companies that generate, use, store, or dispose of any hazardous material in quantities greater than 500 pounds, 55 gallons, or 200 cubic feet and for which a MSDS is required.	• Company identifying information • Quantities of chemical substances on hand and used on-site during year • Method of storage and degree of chemical hazard.	State Fire Marshal	• Quantities reported in ranges and in various units of measure. • Difficult to access information on one chemical.
1987 Hazardous Waste Biennial Reporting System	LQGs companies that generate greater than 2,200 pounds of hazardous waste in any one calendar month or generate greater than 2.2 pounds of acute hazardous waste, or 220 pounds of actue hazardous spill debris. (See page 1-2 for full definition.)	• Company identifying information • Types and quantities of hazardous wastes generated • Quantities of hazardous wastes managed on-site versus quantities of wastes transported offsite • Types of methods employed to manage hazardous wastes • Quantities of hazardous wastes minimized.	DEQ	• No data on SQGs or CEGs • Low response on waste minimization questions • Problems with information system that generates reports; indicates no hazardous waste managed on-site.

Exhibit 2-1.

Existing Information Sources and Data Gaps (continued)

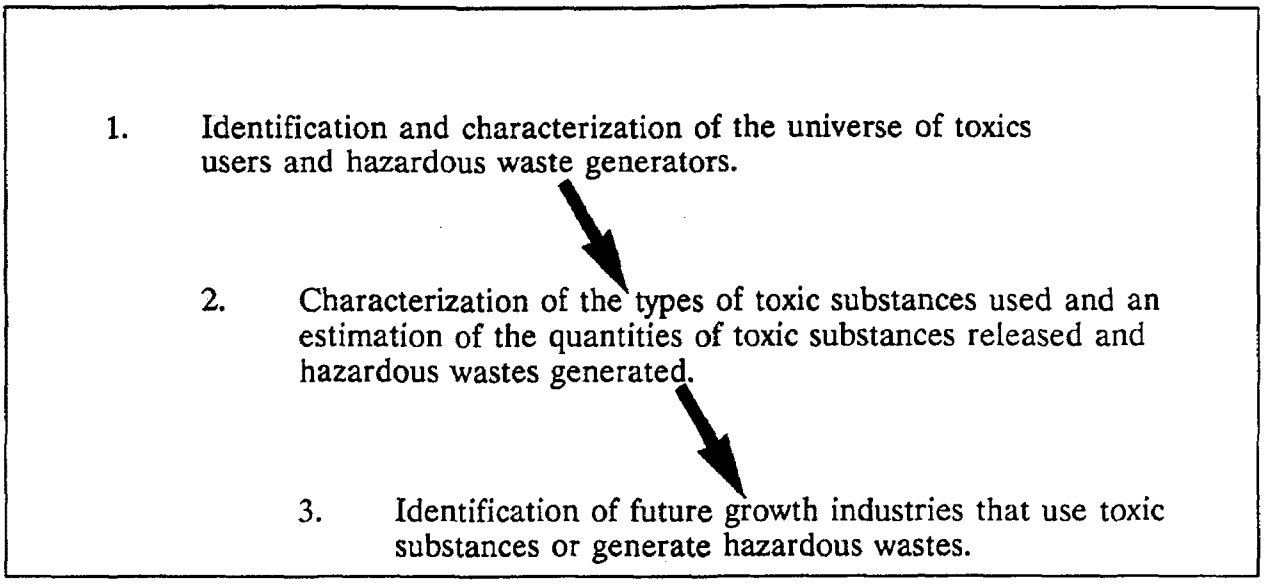
Name of Information Source	Type of Facilities Covered	Types of Data Collected	Agency Receiving Information	Significant Data Gaps for Analysis
1988 DEQ Quarterly Reports	LQGs and SQGs that manifest and transport hazardous waste offsite.	• Company identifying information • Types and quantities of hazardous wastes transported offsite.	DEQ	• Incomplete data on hazardous generators that: • Manage waste on-site • Recycle waste off-site • Export waste out of state.
Hazardous Waste Data Management System (HWDMS)	LQGs, SQGs, CEGs	• Company identifying information • Status as generator	DEQ	• Out-dated information; includes companies which do not generate • Under represents CEGs.
Oregon Personal Income by Major Source and Earnings Industry (1969-1989)	Businesses in SIC groups 01 through 66.	• Total earnings by SIC which includes labor, returns to capital, and returns to natural resources.	Bureau of Economic Analysis	• Does not include projected earnings data.
1988 Oregon Covered Employment and Payrolls by Industry and County	Businesses in SIC groups 01 through 99 subject to Oregon's Employment Division Law.	• Number of employees and wages by SIC and by county.	State Employment Division of the Department of Human Resources	• Does not include projected employment.
1990 Oregon Economic and Revenue Forecast	Businesses in SIC groups 20 through 97	• Number of employees by SIC • Personal income • Housing starts • Population growth.	Oregon Executive Department	• No significant data gaps.

Exhibit 2-2.

Description of Analyses and Types of Data Sources Used

Section	Type of Analyses	Data Source Used for Analyses
3.1	Identification and Characterization of Universe:	
	Number of Large Toxics Users	1988 TRIS contains large toxics users (use greater than 10,000 pounds per year of a SARA 313 or manufacture/process more than 50,000 pounds of substance per year).
	Number of Hazardous Waste Generators (LQGs and SQGs)	1988 DEQ Quarterly Reports
	Location and SIC Code of Large Toxics Users	1988 TRIS
	Location and SIC Code of Generators	1988 DEQ Quarterly Reports
	Business Activities of Users and Generators	Oregon Business Data
3.2	Identification and Quantification of Toxic Chemicals Used and Released	
	Types of Chemicals Used and Frequency of Use	1988 TRIS
	Releases of Chemicals into the Environment by Media and Type of Chemical	1988 TRIS
3.3	Identification and Quantification of Hazardous Waste Generated and Transported Offsite	
	Total Quantities of Waste Generated and Transported	1988 DEQ Quarterly Reports
	Quantities of Waste Generated by RCRA Waste Code	1988 DEQ Quarterly Reports

The data were analyzed using a three-step approach:



This three step approach provides the DEQ with an initial characterization of the toxics user universe. Furthermore, it presents the data in such a manner that DEQ can begin to identify industries that should receive technical assistance. The sections that follow provide a more detailed description of how the data sources were used to conduct each type of analysis and the restrictions in interpreting the results.

2.1 IDENTIFICATION AND CHARACTERIZATION OF THE TOXICS USER AND HAZARDOUS WASTE GENERATOR UNIVERSE IN OREGON

The first step in the analysis was to identify the universe of Oregon large toxics users and hazardous waste generators (LQGs and SQGs), referred to collectively as toxics users, that are subject to the development and implementation of the toxics use and reduction plans and the subset of toxics users that must set performance goals for reducing quantities of toxics used and wastes generated. After estimating the number of large toxics users and hazardous waste generators in Oregon, available data were then used to describe the large toxics users and hazardous waste generators by location and industry groups.

The 1988 TRIS data base and the 1988 DEQ Quarterly Report were used to identify the toxics users in Oregon. The TRIS data base contains large toxic users that use a SARA listed toxic substance in quantities greater than 10,000 pounds per year or manufacture (or process) more than 50,000 pounds per year of SARA chemical substance. The DEQ Quarterly Reports, on the other hand, were used to count the number of LQGs and SQGs in the State that generated and manifested hazardous waste offsite.

Although these information sources provide the best available data for identifying the universe of Oregon toxic users subject to the rule, the numbers presented in Section 3.1 should still be viewed as an estimate for the following reasons:

- The 1988 TRIS data base contains responses from 207 companies that manufacture/process a listed SARA 313 substance in quantities greater than 50,000 pounds per year. An amendment to SARA 313 lowers the limit for reporting which requires companies that manufacture/process in quantities greater than 25,000 pounds per year to report. The final rule promulgated by the DEQ defines large toxics users according to the SARA 313 amendment. Consequently, the 1988 TRIS database is likely to be an underestimation of the total number of large toxics users. It should, however, be noted that the 1989 TRIS database will account for companies that manufacture/process between 25,000 and 50,000 pounds of a listed substances and therefore the 1989 database can be used in the future to update the estimates in this report.

- The 1988 DEQ Quarterly Reports only represent those LQGs and SQGs that generate and manifest hazardous wastes offsite. The Quarterly Reports do not capture hazardous waste generators that generate and manage waste onsite, recycle waste offsite, or transport waste out of State. Nevertheless, the 1988 Quarterly Reports serve as a good indicator of active hazardous waste generators.

2.2 CHARACTERIZATION OF TYPES AND QUANTITIES OF TOXIC SUBSTANCES RELEASED AND HAZARDOUS WASTES GENERATED

The next step ideally would be to conduct an analysis by industry group in which quantities and types of toxic substances used in a process are identified and then tracked

through to the quantities appearing in the resulting waste stream. Given the available data, this type of analysis is impossible to conduct for several reasons:

- The TRIS data base and the SARA 312 reports were the available sources for identifying types and quantities of toxic substances by facilities in each industry group. Although TRIS provides information that identifies types and frequencies of toxic substances used by industry group, it does not provide any information on the quantities used during a month or year. The TRIS data base does provide data on the quantities of toxic substances release but this information cannot be used to infer the quantities of toxic substances used. The SARA 312 Reports, on the other hand, provide quantitative-use information. However, as pointed out, the data are reported in ranges and in three units of measure and cover a much larger scope of toxic substances than required by SARA 313 or the DEQ's final rule. Because the data base used to manage the SARA 312 Reports is cumbersome to use, the SARA 312 Report quantity data were not used.

- The only data available for calculating quantities of hazardous waste generated were the 1988 DEQ Quarterly Reports and the 1988 Biennial Reports. Both of these sources lacked information on quantities of hazardous waste generated and managed onsite. Therefore, data were available only on the RCRA regulated wastes managed offsite.

The evaluation of the data sources revealed that the 1988 TRIS data base provides the best overview of onsite industry activities as they relate to the frequency of use of toxic substances and resulting releases to the environment while the 1988 DEQ Quarterly Reports provide the most appropriate data for describing types and quantities of hazardous wastes generated. Therefore, these sources of information serve as the focus of the analysis to describe toxics-use patterns and releases as well as hazardous waste generation patterns. The use of both information sources, however, still does not provide the type of data for a "flow-through" analysis; i.e., identifying toxic substances used in a process and tracking the substances through to releases. This is primarily due to the fact that the toxic substances listed under SARA 313 do not correspond with the list of hazardous constituents in RCRA wastes.

Section 3.2 discusses the frequency of chemicals used and the total quantities released to the environment. To present the frequency data in a more meaningful manner, the types of chemicals used are classified in three ways: (1) by type of compound (e.g., volatile organic compound, semi-volatile organic compound, inorganic compound), (2) by level of toxicity as ranked by the Registry of Toxic Effects of Chemical Substances (1985-1986), and (3) an indicator of carcinogenicity as identified by EPA. These classification schemes, though not perfect, are designed to provide readers with some type of rough measure -- other than volume -- for identifying and ranking toxic substances of concern.

2.3 IDENTIFICATION OF FUTURE GROWTH INDUSTRIES THAT USE TOXIC SUBSTANCES OR GENERATE HAZARDOUS WASTES

The next step was to identify those future growth industries where increases in toxic substance releases and hazardous waste generation could occur versus those industries whose growth is expected to remain stable or decrease. The assumption being made is that there is a positive relationship between a firm's business activities and the quantities of toxic substances used and hazardous wastes generated. As the level of business activities increase, the quantities of toxic substances released and hazardous wastes generated correspondingly increase. This relationship does not take into account changes in technology and procedures resulting in toxics use and hazardous waste reduction. For this reason, it is useful in indicating those industries where toxics use and waste generation may increase if reduction techniques are not implemented.

Industry employment data from 1987 projected through 1995 was used as a proxy for measuring the level of business activities in industry groups. Current and projected employment data were available through the *Oregon Covered Employment and Payrolls by Industry and County Report* and the *Oregon Economic and Revenue Forecasts*. Employment was not an ideal proxy for measuring the level of business activities because a number of industries may increase output without changing the level of employment. Other proxies, such as industry earnings, were considered more appropriate for measuring business activity or output. The State, however, does not publish projected earnings data and therefore employment data, for which projects were available, were selected as the proxy.

3.1 IDENTIFICATION AND CHARACTERIZATION OF THE TOXICS USER AND GENERATOR UNIVERSE

3.1.1 Identification of the Universe

As a first step in characterizing toxics users, it is essential to identify the large toxics users and hazardous waste generators that will be impacted by DEQ's final rules. Exhibit 3-1 depicts the relationship between the groups of toxics users -- large toxic users, LQGs and SQGs -- and the estimated number in each group for which characterization data are available.

At a minimum, an estimated 928 companies meet the rule's requirements to develop toxics use and hazardous waste reduction plans. The 928 companies can be divided into 207 large toxics users and 805 hazardous waste generators, with 84 companies that overlap between the two groups. Of the 805 hazardous waste generators, 120 companies are LQGs 685 companies are SQGs.[4] Forty percent (49) of the LQGs and 5 percent (35) of the SQGs comprise the 84 companies that are both hazardous waste generators and large toxics users.

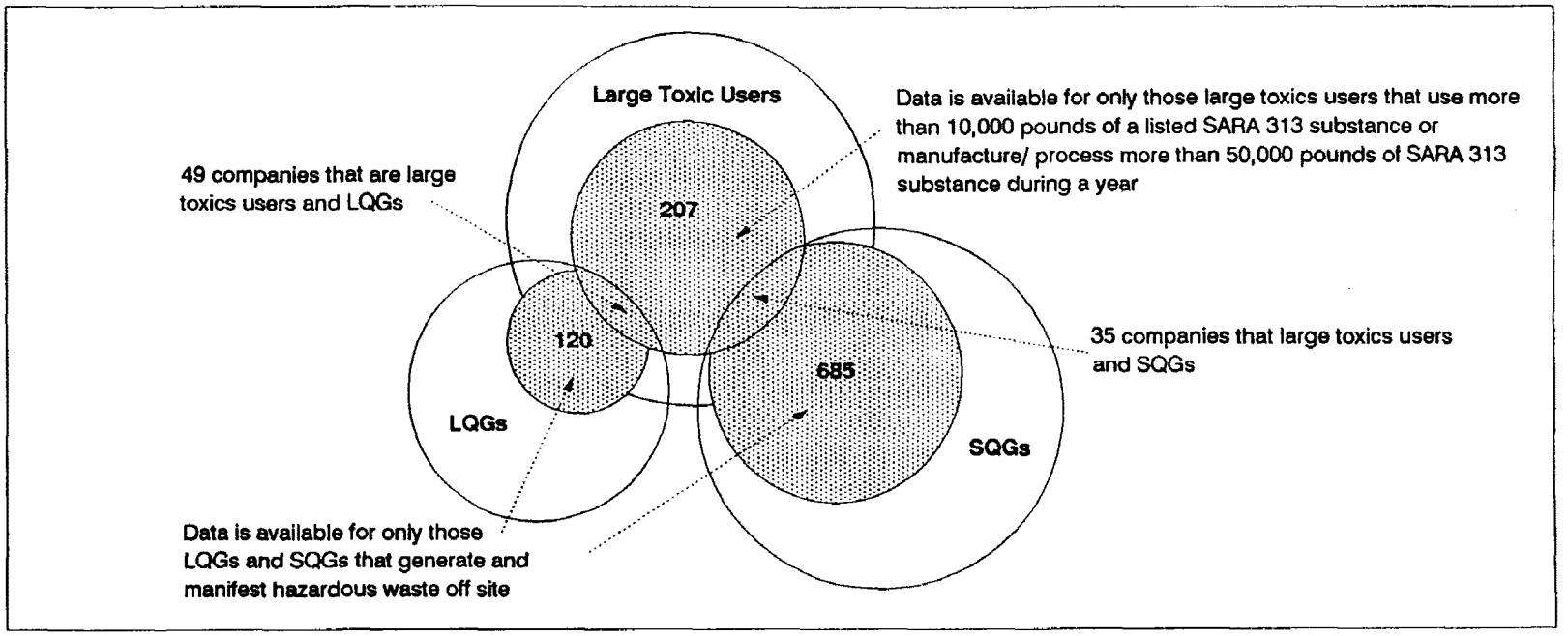
It is expected that the number of companies in each of these groups is underrepresented. As pointed out in Section 2, the 1988 TRIS data, which was used to estimate the number of large toxics users, does not reflect companies that manufacture or process listed substances in quantities between 25,000 and 50,000 pounds per year. Furthermore, the number of LQGs and SQGs include only those companies that generate and manifest (transport) hazardous waste offsite. Therefore, the 941 companies can be viewed as a lower bound estimate of the number of toxics users required to complete toxics use and hazardous waste reduction plans.

These 928 companies also will need to complete annual progress reports. The large toxics users and LQGs must submit annual progress reports by September 1992, and the SQGs must submit reports by September 1993. A subset of these companies also will need to develop performance goals. Based on the existing data sources, it was impossible to identify accurately and count the subset of toxics users that would need to develop

[4] An unknown percentage of SQGs also include conditionally exempt generators (CEQS) [i.e. generators that generate less than 220 pounds of hazardous waste in every month of the calendar year.] Due to the format of the DEQ Quarterly Reports from which the data was extracted, it is not possible to identify the exact number of CEGs included in the count of SQGs. Because CEGs are not required to comply with DEQ Quarterly Reporting processing, the DEQ believes that CEGs as a percentage of SQGs is small.

Exhibit 3-1

The Universe of Oregon Toxics Users



Universe of Toxics Users

Large Toxics Users = Companies that use greater than 10,000 pounds per year of a SARA 313 toxic substance or manufacture/process more than 25,000 pounds of a SARA 313 substance per year

Large Quantity Generators (LQG) = Companies that generate in one or more months during a year more than 2,200 pounds of RCRA-regulated or State-regulated hazardous waste, more than 2.2 pounds of acute hazardous waste, or more than 220 pounds of acute hazardous spill debris.

Small Quantity Generators (SQG) = Companies that generate in every single month during a year between 220 and 2,200 pounds of RCRA-regulated or State-regulated hazardous waste.

Shaded area represents those companies for which characterization and release data is available

Source of data: 1988 Toxic Release Inventory System Reports and 1988 DEQ Quarterly Reports

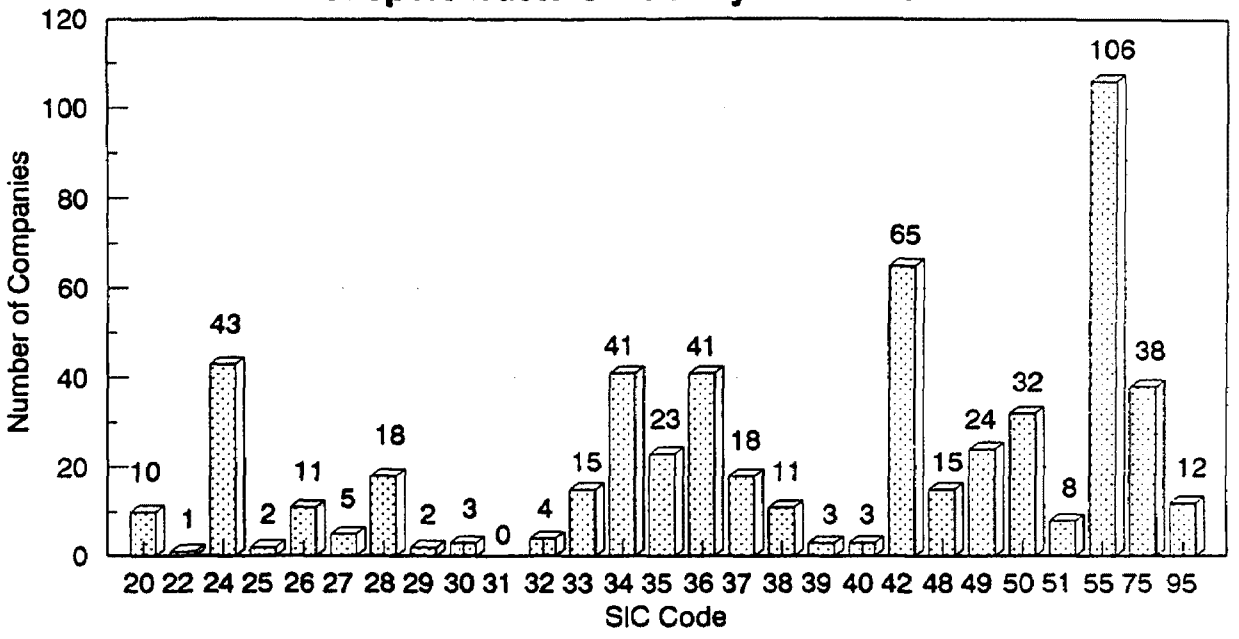
performance goals. However, enough information is available to estimate the range inthe number of companies that would need to comply with performance goals. As specified under the law, the following groups of toxics users must set performance goals: (1) a toxics user of a listed toxic substance in quantities greater than 10,000 pounds in a calendar year, (2) a toxics user of a substance in quantities of greater than 1,000 pounds in a calendar year that constitutes 10 percent or more of the total toxic substances used in a year, and (3) a LQG that generates a hazardous waste comprising at least 10 percent of the total waste generated. Based on this criteria, all 207 large toxics users, LQGs, and a percentage of SQGs must set performance goals.

For the purposes of the analysis that follows, the 941 toxics users are analyzed according to two groups -- 207 large toxics users and 805 hazardous waste generators -- realizing that 84 of the companies straddle between two groups. These 84 companies are believed to be regulated highly, and it would be interesting to analyze toxics use and waste generation patterns separately for this group of toxics users. But due to the limitations of the data and resources available for this report, analyzing the 84 companies separately was not possible.

3.1.2 Characterization of Generators and Toxics Users by SIC Code and Location

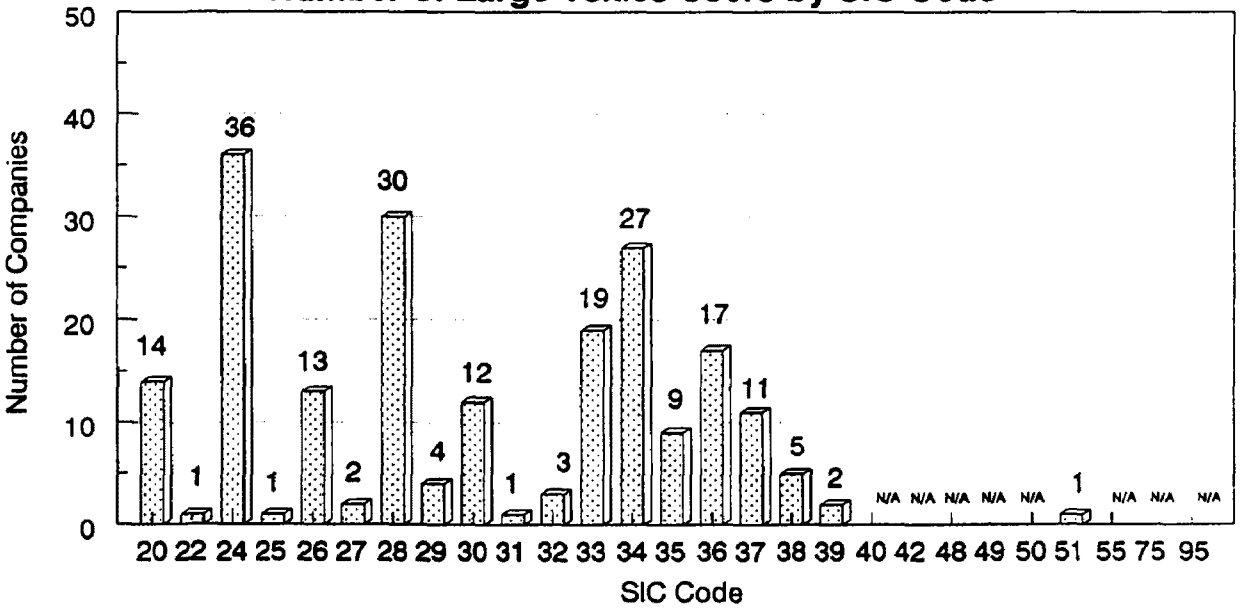
Based on the 1988 Oregon DEQ Quarterly Reports, 805 Oregon hazardous waste generators manifested (i.e., transported) waste offsite in 1988. Exhibit 3-2 displays the number of hazardous waste generators that transport waste offsite for a subset of industry groups while Appendix A, Table 1 provides the number of hazardous waste generators for all industry groups. In 1988, five industry groups each contained over 40 hazardous waste generators. The auto dealers and service stations industry (SIC 55) had the largest number of hazardous waste generators with 106 facilities. There were 65 hazardous waste generators in the motor freight transportation and warehousing industry (SIC 42), 43 generators in the lumber and wood products industry (SIC 24), and 41 generators each in the fabricated metal products industry (SIC 34) and the electronic and electrical equipment industry (SIC 36). Several other industry groups in the State had between 30 and 40 hazardous waste generators; however, the average number of facilities by industry group was 12.9 when SIC 00 (unknown; 119 facilities) was not included.

Exhibit 3-2
Number of Hazardous Waste Generators that Transport Waste Off-site by SIC Code



Source: 1988 DEQ Quarterly Reports

Exhibit 3-3
Number of Large Toxics Users by SIC Code



N/A=SARA 313 does not require facilities in these industries to report.

Source: 1988 Toxic Release Inventory System Reports

In 1988, 19 industry groups represented the 207 toxics users in Oregon. Nine of these industry groups accounted for over 85 percent of the large toxics users. The lumber and wood products industry (SIC 24) had the largest number of large toxics users, with 36 facilities in 1988. Other industry groups with a large number of large toxics users in 1988 include the chemicals and allied products industry (SIC 28), the fabricated metal products industry (SIC 34), the primary metal industries (SIC 33), and the electronic and electrical equipment industry (SIC 36). Two of the industry groups -- lumber and wood products and fabricated metal products -- which contain large numbers of large toxics users also exhibit the largest number of generators. Exhibit 3-3 shows that the other 10 industry groups each had less than 10 toxics users in 1988.

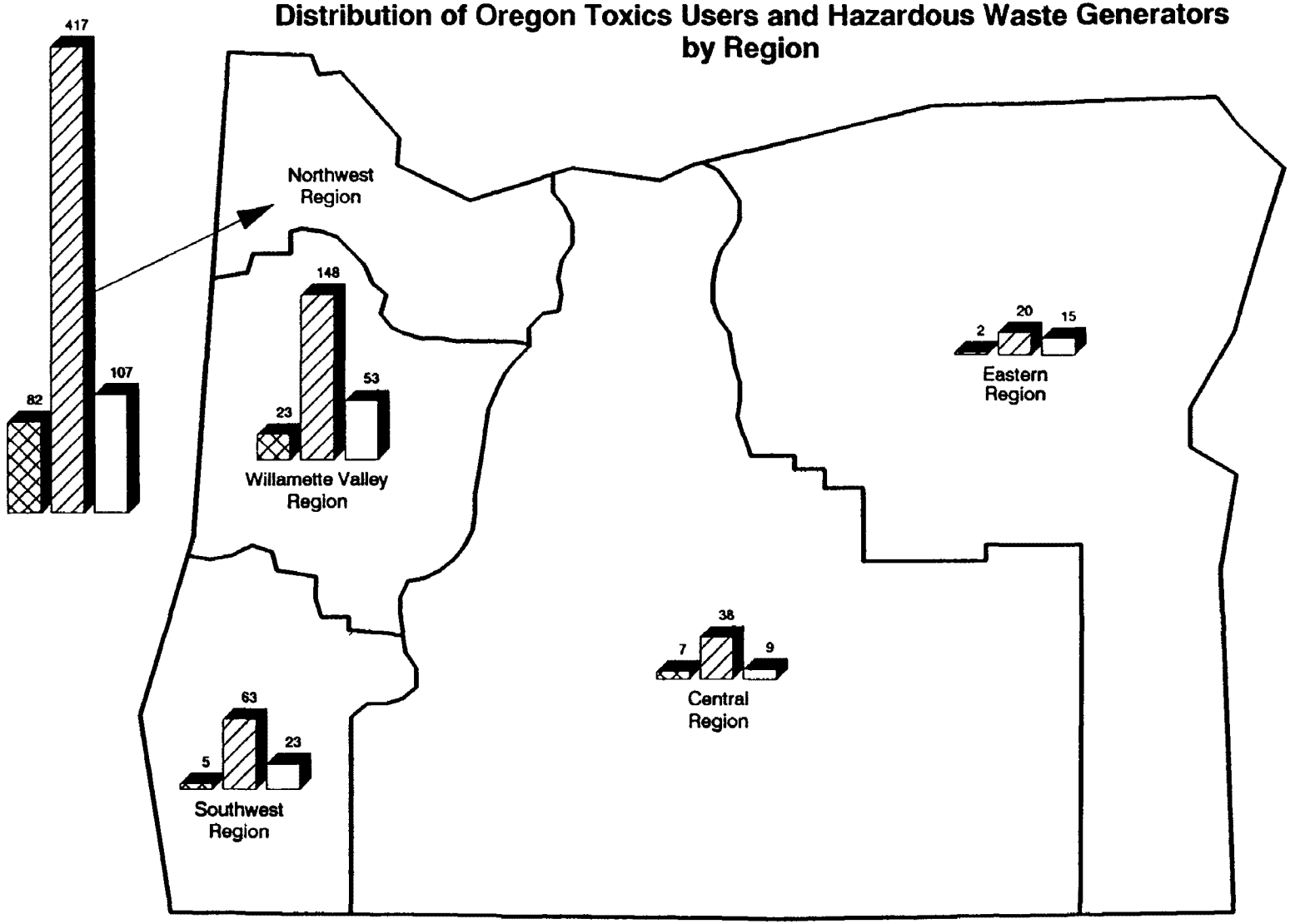
Exhibit 3-4 illustrates that the majority of the large toxics users, LQGs, and SQGs are located in the northwestern corner of Oregon. Fifty-two percent of the large toxics users, 69 percent of the LQGs, and 61 percent of the SQGs are located in the northwest region of the State encompassing Clackamas, Clatsop, Columbia, Multnomal, Tillamook, and Washington counties. Furthermore, over 90 percent of all large toxics users, LQGs, and SQGs reside in the western third of the State.

3.2 TYPES AND QUANTITIES OF TOXIC SUBSTANCES USED AND RELEASED TO THE ENVIRONMENT

3.2.1 Major Toxic Substances Used by Toxics Users

Of the 87 toxic substances reported under TRIS (SARA 313), the toxic substances used most frequently by large toxics users include acetone, ammonia, chlorine, formaldehyde, hydrochloric acid, methanol, methyl ethyl ketone, sulfuric acid, toluene, xylene, and 1,1,1-trichloroethane. Sulfuric acid, acetone, and toluene, the three most commonly used toxic substances, are used at 52 facilities, 40 facilities, and 38 facilities, respectively. The paper and allied products industry (SIC 26), the fabricated metal products industry (SIC 34), and the electronic and electrical equipment industry (SIC 36) use sulfuric acid most frequently, while the lumber and wood products industry (SIC 24) and the chemicals and allied products industry (SIC 28) use acetone and toluene most frequently.

Exhibit 3-4
Distribution of Oregon Toxics Users and Hazardous Waste Generators by Region



☒ *LQGs* ☑ *SQGs* ☐ *Large (TRIS) Toxics Users*

Source: 1988 Oregon DEQ Quarterly Reports and 1988 Toxic Release Inventory System Reports

Exhibit 3-5 details the frequency of use of each toxic substance reported under SARA 313 by industry group.

When examining industry release data, it is important to realize that many factors should be considered in targeting specific wastes for toxics use or hazardous waste reduction efforts. Such factors as toxicity, environmental persistence, and/or mobility might be the factors of greatest concern when establishing a priority for reducing the use or release of specific toxic substances or hazardous wastes. Physical/chemical nature, toxicity, and carcinogenicity are three indicators of the priority that might be assigned in targeting toxic substances for reduction efforts.

Such factors as environmental persistence and mobility are directly related to the physical and chemical properties of the constituent. Exhibit 3-6 classifies the toxic substances identified by TRIS by generic chemical groupings. These groupings provide general insight to the nature of the compounds. For example, volatile organic compounds are likely to migrate to the atmosphere when discharged to the environment.

Exhibit 3-7 ranks the toxic substances identified by the TRIS data by increasing level of toxicity. The LD_{50} for rats has been used as the indicator of toxicity for this ranking. LD_{50} (lethal dose) refers to the dose of compound needed to kill 50 percent of the study population. Mammalian lethal dose numbers are commonly used by EPA as a measurement of the hazard that a chemical poses to human health and the environment. The LD value for a compound can be used as an input parameter for a disposal scenario model that can be used to predict unacceptable exposure concentrations.

Exhibit 3-7 also indicates whether the identified toxic substance is carcinogenic. These data are based upon EPA determinations through animal studies regarding carcinogenicity in humans. Toxicity and carcinogenicity are not analogous; there are important differences between the two. Most importantly, a carcinogen does not display a threshold or an experimentally derived dose-response curve, which means that <u>any</u>

Exhibit 3-5

Frequency of Use By Chemical Per SIC Code

	20	22	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	51	Total
Sulfuric acid	1	0	1	0	10	0	6	0	1	1	0	6	11	1	11	1	1	1	0	52
Acetone	0	0	8	0	7	0	8	0	3	0	0	3	0	0	2	6	3	0	0	40
Toluene	0	0	12	1	2	0	11	1	0	0	0	0	6	2	0	2	2	0	0	39
Ammonia	7	0	6	0	7	0	5	0	0	1	0	3	1	0	3	0	0	0	0	33
Xylene (mixed isomers)	0	0	8	1	0	0	7	1	0	0	0	0	5	2	2	2	0	0	1	29
Methanol	0	0	3	0	12	0	8	1	0	0	0	0	1	0	1	1	1	0	0	28
Formaldehyde	0	0	15	0	3	0	8	0	0	0	0	0	0	0	1	0	0	0	0	27
1,1,1-trichloroethane	0	0	1	0	2	2	4	0	1	0	0	2	2	3	2	4	2	0	0	25
Hydrochloric acid	1	0	1	0	4	0	4	0	0	0	0	3	4	2	3	0	1	0	0	23
Chlorine	7	0	0	0	8	0	1	0	0	0	0	4	2	0	0	0	0	0	0	22
Methyl ethyl ketone	0	0	8	1	0	0	4	0	0	0	0	1	4	0	0	3	1	0	0	22
Phosphoric acid	2	0	2	0	5	0	2	0	0	0	0	0	2	1	2	1	0	0	0	17
Freon 113	0	0	0	0	0	0	0	0	0	0	0	4	0	3	7	0	2	0	0	16
Aluminum oxide	0	0	0	0	0	0	0	0	1	0	1	11	1	1	0	0	0	0	0	15
Nitric acid	0	0	0	0	1	0	1	0	0	0	0	4	3	1	3	0	1	0	0	14
Copper	0	0	3	0	1	0	0	0	0	0	0	4	2	0	3	0	1	0	0	14
Glycol ethers	0	0	0	0	1	0	5	0	0	0	0	2	0	0	3	1	1	0	0	13
Styrene	0	0	0	0	0	0	4	0	4	0	0	0	0	0	0	4	0	1	0	13
Phenol	0	0	4	0	1	0	6	0	0	0	0	1	0	0	0	0	0	0	0	12
Chromium	0	0	1	0	1	0	0	0	0	1	0	6	1	0	1	1	0	0	0	12
Trichloroethylene	0	0	0	0	0	0	0	0	3	0	0	3	3	0	2	0	1	0	0	12
Chromium compounds	0	0	2	0	1	0	2	0	0	0	0	4	1	0	0	1	0	0	0	11
Copper compounds	0	0	3	0	1	0	1	0	0	0	0	2	1	0	2	0	1	0	0	11
Dichloromethane	0	0	0	0	0	0	2	0	5	0	1	1	0	2	0	0	0	0	0	11
Manganese	0	0	0	0	0	0	0	0	0	0	0	7	2	0	0	1	0	0	0	10
Methylenebis(phenylisocyanate)	0	0	1	0	0	0	1	0	2	0	0	1	1	2	0	1	0	0	0	9
Ethylene glycol	0	0	0	0	1	0	4	1	0	0	0	1	0	0	1	1	0	0	0	9
Hydrogen fluoride	0	0	0	0	0	0	0	0	0	0	0	5	0	0	2	1	0	0	0	8
Zinc (fume or dust)	0	0	2	0	1	0	0	0	0	0	0	2	1	0	0	0	1	0	0	7
Catechol	0	0	0	0	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7
Lead compounds	0	0	0	0	0	0	1	0	0	0	0	2	0	0	2	1	0	0	0	6
Zinc compounds	0	0	1	0	0	0	0	1	0	0	1	1	2	0	0	0	0	0	0	6
Aluminum (fume or dust)	0	0	0	0	0	0	0	0	0	0	0	5	1	0	0	0	0	0	0	6
Barium compounds	0	0	0	0	1	0	2	0	0	0	1	1	0	0	1	0	0	0	0	6
Nickel	0	0	0	0	0	0	0	0	0	0	0	3	1	0	0	1	0	0	0	5
Methyl isobutyl ketone	0	0	1	0	0	0	2	0	0	0	0	1	1	0	0	0	0	0	0	5

Exhibit 3-5 (cont.)

Frequency of Use By Chemical Per SIC Code

	20	22	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	51	Total
Nickel compounds	0	0	0	0	0	0	0	0	0	0	0	4	1	0	0	0	0	0	0	5
Cyanide compounds	0	0	0	0	0	0	0	0	0	0	0	2	2	0	0	1	0	0	0	5
Pentachlorophenol	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5
N-butyl alcohol	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	1	1	0	0	4
Butyl benzyl phthalate	0	0	0	0	0	0	1	0	0	0	0	3	0	0	0	0	0	0	0	4
Naphthalene	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
Ammonium sulfate	0	1	2	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	4
Chlorine dioxide	2	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
Anthracene	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
Dibenzofuran	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
Ammonium nitrate	0	0	1	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	3
Asbestos (friable)	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	1	0	0	0	3
Tetrachloroethylene	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	1	0	0	3
Arsenic compounds	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
Chloroform	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
Lead	1	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	3
Methyl methacrylate	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	1	0	0	0	3
Toluene-2,4-Diisocyanate	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	2
Arsenic	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Manganese compounds	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	2
Vinyl acetate	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	2
Butyl acrylate	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	2
Biphenyl	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Epichlorohydrin	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	2
Cobalt compounds	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	2
1,2,4-trimethylbenzene	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	2
Phthalic anhydride	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
Ethylbenzene	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1
Dibutyl phthalate	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
Toluene-2,6-Diisocyanate	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1
NA	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
Benzene	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1
Polychlorinated biphenyls	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Vanadium (fume or dust)	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1

Exhibit 3-5 (cont.)

Frequency of Use By Chemical Per SIC Code

	20	22	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	51	Total
Silver compounds	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
Methyl acrylate	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
Antimony	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
Mercury	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
Titanium tetrachloride	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
Di(2-ethylhexyl) phthalate	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1
Cumene	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1
Decabromodiphenyl oxide	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1
Propylene	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Cyclohexane	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1
Dimethyl phthalate	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
Maleic anhydride	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
Compound beta (solid)	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
Isopropyl alcohol	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Antimony compounds	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1
2,4-D	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
4,4'-methylenebis(2-chloroaniline)	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1
Total:	22	1	109	3	85	2	118	11	26	3	4	112	66	20	56	37	22	2	2	701

Source: 1988 Toxic Release Inventory System Reports

Exhibit 3-6

Classification of Toxic Substances in 1988 Oregon TRIS Report

VOLATILE ORGANICS:	CAS No.
Non-halogenated, Non-aromatic compounds:	
Acetone	67-64-1
Butyl acrylate	141-32-2
n-Butyl alcohol	71-36-3
Cyclohexane	110-82-7
Formaldehyde	50-00-0
Isopropyl alcohol	67-63-0
Methanol	67-56-1
Methyl acrylate	96-33-3
Methyl ethyl ketone (2-butanone)	78-93-3
Methyl isobutyl ketone (4-methyl-2-pentanone)	108-10-1
Methyl methacrylate (methyl 2-propenoate)	80-62-6
Propylene	115-07-1
Vinyl acetate	108-05-4
Halogenated, Non-aromatic compounds:	
Chloroform	67-66-3
Dichloromethane	75-09-2
Epichloroethylene (1-chloro-2,3-epoxypropane)	106-89-8
Freon 113 (1,1,2-trichloro-1,2,2-trifluoroethane)	76-13-1
1,1,1-Trichloroethane	71-55-6
Tetrachloroethylene	127-18-4
Trichloroethylene	79-01-6
Non-halogenated, Aromatic compounds:	
Benzene	71-43-2
Biphenyl	92-52-4
Catechol (2-hydroxyphenol)	120-80-9
Cumene (isopropyl benzene)	98-82-8
Ethylbenzene	100-41-4
Naphthalene	91-20-3
Styrene	100-42-5
Toluene	108-88-3
1,2,4-Trimethylbenzene	95-63-6
Xylenes (mixed isomers)	1330-20-7
Halogenated, Aromatic compounds:	
2,4-D (2,4-dichlorophenoxyacetic acid)	94-75-7
4,4'-Methylenebis(2-chloroaniline) (MBOCA)	101-14-4

Exhibit 3-6 (continued)

Classification of Toxic Substances in 1988 Oregon TRIS Report

SEMIVOLATILE ORGANICS:	CAS No.
Non-halogenated, Non-aromatic compounds:	
Ethylene Glycol	107-21-1
Halogenated, Non-aromatic compounds:	
None	
Non-Halogenated, Aromatic compounds:	
Anthracene	120-12-7
Butyl benzyl phthalate	85-68-7
Dibenzofuran	132-64-9
Dibutyl phthalate	84-74-2
Di(2-ethylhexyl) phthalate (DEHP)	117-81-7
Dimethyl phthalate	131-11-3
Methylenebis(phenylisocyanate)	101-68-8
Phenol	108-95-2
Toluene-2,4-diisocyanate	584-84-9
Toluene-2,6-diisocyanate	91-08-7
Halogenated, Aromatic compounds:	
Decabromodiphenyl oxide	1163-19-5
Pentachlorophenol	87-86-5
Polychlorinated biphenyls (PCBs)	1336-36-3
Acid anhydrides:	
Maleic anhydride	108-31-6
Phthalic anhydride	85-44-9
INORGANICS:	
Strong acids:	
Hydrochloric acid	7647-01-0
Nitric acid	7697-37-2
Phosphoric acid	7664-38-2
Sulfuric acid	7664-93-9
Stong bases:	
Sodium hydroxide	1310-73-2

Exhibit 3-6 (continued)

Classification of Toxic Substances in 1988 Oregon TRIS Report

INORGANICS (continued):	CAS No.
Heavy metals:	
Aluminium	7429-90-5
Antimony	7440-36-0
Arsenic	7440-38-2
Chromium	7440-47-3
Copper	7440-50-8
Lead	7439-92-1
Manganese	7439-96-5
Mercury	7439-97-6
Nickel	7440-02-0
Vanadium	7440-62-2
Zinc	7440-66-6
Inorganic compounds:	
Aluminium oxide	1344-28-1
Ammonia	7664-41-7
Ammonium nitrate	6484-52-2
Ammonium sulfate	7783-20-2
Asbestos	1332-21-4
Chlorine	7782-50-5
Chlorine dioxide	10049-04-4
Hydrogen fluoride	7664-39-3
Titanium tetrachloride	7550-45-0
Unknown:	
Trade secret	

Exhibit 3-7
Ranking of Toxic Substances by Increasing Toxicity and Carcinogenicity

Toxic Substance	LD50 (PPM)	Carcinogenic
FREON 113	43000	+
DI(2-ETHYLHEXYL) PHTHALATE	30700	+
CYCLOHEXANE	12705	+
1,1,1-TRICHLOROETHANE	10300	No
BENZENE	10000	Yes
MANGANESE	9000	No
DIBUTYL PHTHALATE	8000	No
METHYL METHACRYLATE	7872	+
ANTIMONY	7000	No
DIMETHYL PHTHALATE	6800	+
TOLUENE-2,6-DIISOCYANATE	5800	+
TOLUENE-2,4-DIISOCYANATE	5800	+
ACETONE	5800	No
METHANOL	5628	+
ISOPROPYL ALCOHOL	5045	+
TOLUENE	5000	No
STYRENE	5000	+
AMMONIUM NITRATE (SOLUTION)	4820	+
ETHYLENE GLYCOL	4700	+
PHTHALIC ANHYDRIDE	4020	+
TRICHLOROETHYLENE	3670	Yes
ETHYLBENZENE	3500	No
BIPHENYL	3280	+
TETRACHLOROETHYLENE	3005	+
AMMONIUM SULFATE (SOLUTION)	3000	+
VINYL ACETATE	2920	+
METHYL ETHYL KETONE	2737	No
BUTYL BENZYL PHTHALATE	2330	Yes
SULFURIC ACID	2140	+
DICHLOROMETHANE	2136	Yes
METHYL ISOBUTYL KETONE	2080	+
PHOSPHORIC ACID	1530	+
CUMENE	1400	+
POLYCHLORINATED BIPHENYLS	1295	Yes
HYDROGEN FLUORIDE	1278	+
NAPHTHALENE	1250	+
CATECHOL	1084	+
1,2,4-TRIMETHYLBENZENE	1000	+
BUTYL ACRYLATE	900	+
HYDROCHLORIC ACID	900	+
4,4'-METHYLENEBIS(2-CHLOROANILINE)	880	Yes
FORMALDEHYDE	800	Yes
N-BUTYL ALCOHOL	790	+

Exhibit 3-7 (continued)

Toxic Substance	LD50 (PPM)	Carcinogenic
SODIUM HYDROXIDE (SOLUTION)	500	+
ANTHRACENE	430	No
MALEIC ANHYDRIDE	400	+
2,4-D	370	+
AMMONIA	350	+
PHENOL	317	+
CHLORINE	293	+
CHLORINE DIOXIDE	292	+
METHYL ACRYLATE	277	+
EPICHLOROHYDRIN	90	Yes
PENTACHLOROPHENOL	27	+
VANADIUM (FUME OR DUST)	10	No
XYLENE	7.71	No
CHLOROFORM	3.8	Yes
TITANIUM TETRACHLORIDE	0.46	+
METHYLENEBIS(PHENYLISOCYANATE)	0.178	+
PROPYLENE	*	+
LEAD	*	Yes
ALUMINUM (FUME OR DUST)	*	+
CHROMIUM	*	Yes
ALUMINUM OXIDE	*	+
ARSENIC	*	Yes
NITRIC ACID	*	+
MERCURY	*	No
ASBESTOS	*	Yes
ZINC (FUME OR DUST)	*	+
COPPER	*	No
NICKEL	*	Yes**
DECABROMODIPHENYL OXIDE	*	Yes
DIBENZOFURAN	*	No

* No available LD50 data.

+ Chemical has not been evaluated by the U.S. Environmental Protection Agency for carcinogenicity

** by inhalation; unknown for oral route

Source: The Registry of Toxic Effects of Chemical Substances, 1985-1986.

dose of a carcinogen poses a risk to health. Conversely, a toxicant must surpass a certain threshold before its effect is toxic.

Of the three most commonly used toxic substances, acetone and toluene have been determined by EPA not to be human carcinogens. To date, sulfuric acid has not been evaluated for carcinogenicity by EPA. Sulfuric acid is the most toxic of the three most frequently used toxic substances with an LD_{50} of 2,140 ppm. Toluene and acetone are less toxic with LD_{50}s of 5,000 ppm and 5,800 ppm, respectively. For SARA 313 substances that were evaluated for toxicity, methylenebis (phenylisocyanate) was the most toxic substance (LD_{50} = 0.178) used by Oregon facilities. Nine facilities used this toxic substance and released approximately 7,200 pounds of the substance into the environment (0.016 percent of the total quantity of toxic substances released in 1988).

Both Exhibit 3-6 and 3-7 indicate the type of factors that might be used to target compounds by the potential hazard that each poses based on physical/chemical nature, toxicity, and carcinogenicity. These three groupings are not intended to provide a comprehensive description of these compounds. To develop a comprehensive description would require the study of additional factors and would depend on the nature of the toxic substance, the environmental media impacted, and the nature of the problem currently caused by the contaminant. For example, such factors as partition coefficients (Henry's Law constant), toxicity to aquatic life, and, anaerobic degradation mechanisms might be important considerations when ranking chemicals that are discharged to surface waters and commonly accumulate in river and lake sediments.

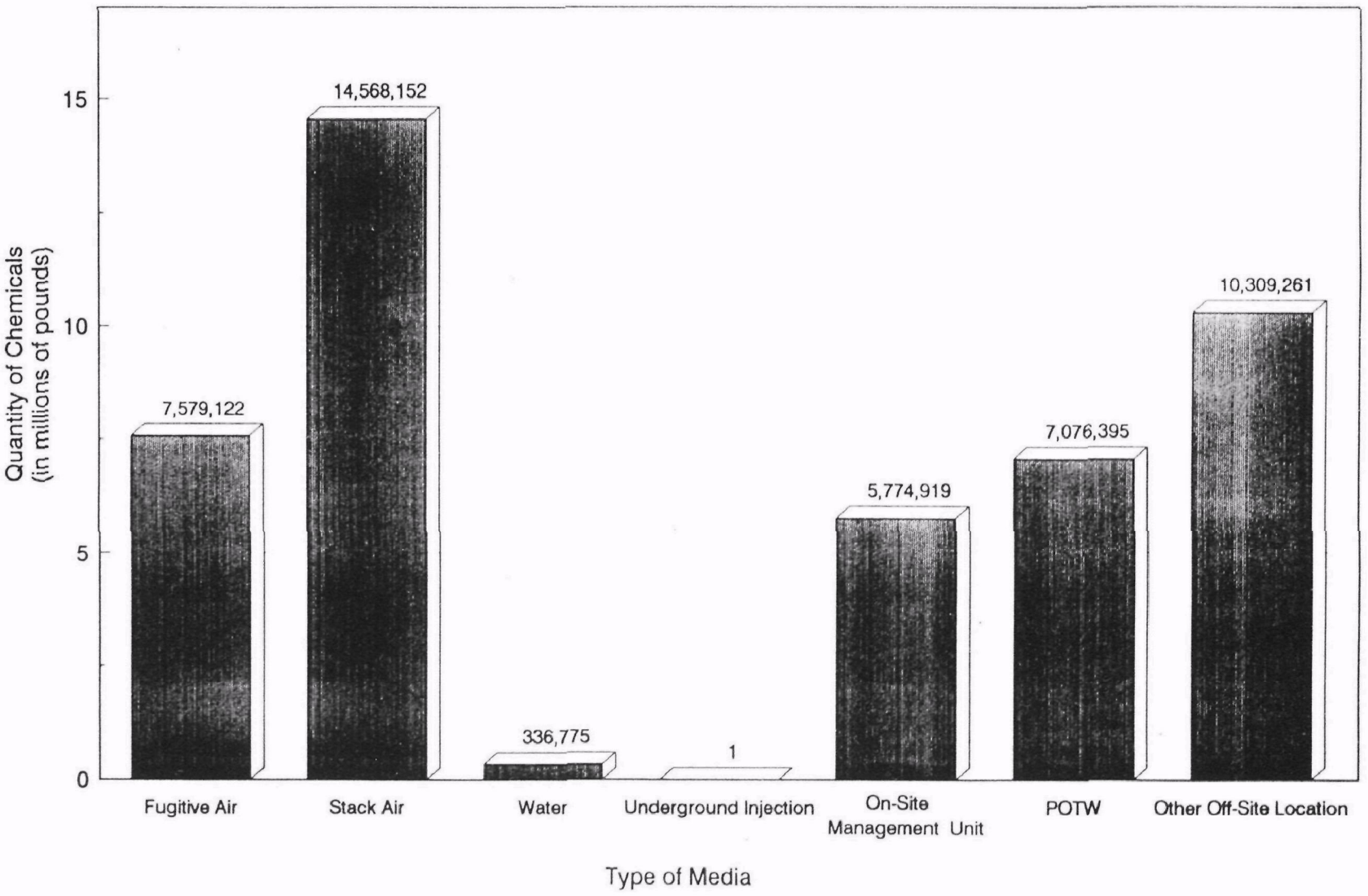
3.2.2 Quantities of Toxic Substances Released to the Environment

As illustrated in Exhibit 3-8, large toxics users released over 45-million pounds of toxic substances[5] to various media in 1988. Note again that the large toxics users are represented by those facilities that reported under SARA 313 for 1988, which includes

[5] Includes quantities of released toxic substances reported under SARA 313 only.

Exhibit 3-8

Quantity of Chemicals Released by Type of Media



Source: 1988 Toxic Release Inventory System Reports

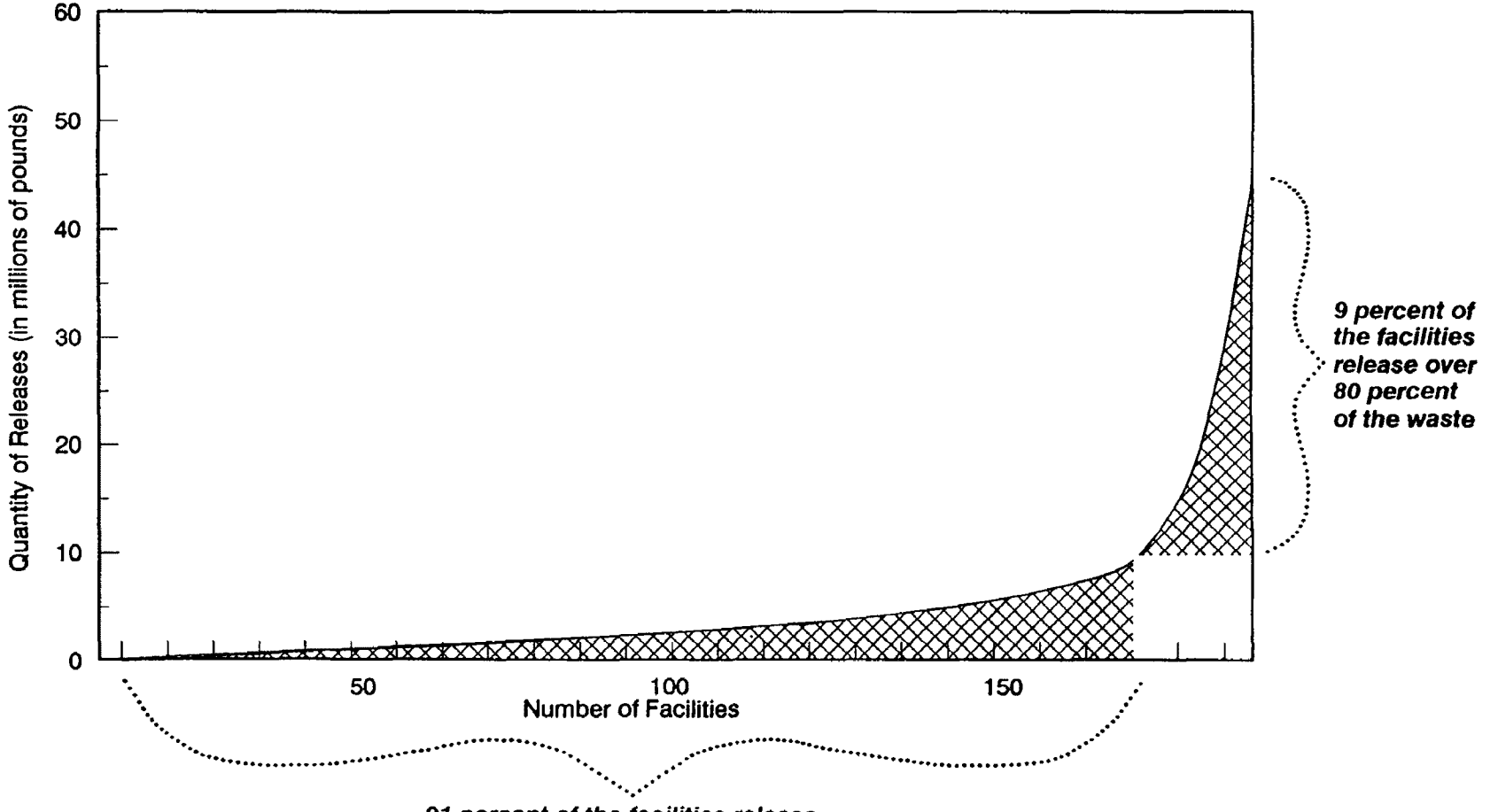
only users of greater than 10,000 pounds of a toxic substance per year and manufacturers and processors of more than 50,000 pounds per year.

The largest quantity of toxic substances was released as stack or point-source air emissions and represents 34 percent of the total quantity of toxic substances released to the environment in 1988. Additionally, large quantities of toxic substances were released to onsite land management units and other offsite locations, discharged to a POTW, or released as fugitive air (nonpoint source air) emissions. However, only an estimated 337,000 pounds of toxic substances (<1 percent of the total quantity released) were discharged to streams or water bodies; virtually no toxic substances were injected underground.

On a company basis, a small percentage of companies account for the majority of toxic substances released to the environment. Exhibit 3-9 illustrates this skewed distribution of releases. As shown in the exhibit, approximately 9 percent of the companies account for over 80 percent of the total releases into the environment. This distribution is important to note in terms of the minimizing volumes of releases into the environment because toxics use and waste reduction practices implemented among the subset of very large toxics users can result in significant reduction in the volume of environmental releases.

Exhibit 3-10a through 3-10f show the toxic substances that contributed most significantly to the releases for each medium. Of the stack and point-source air emissions, 22 percent of the total quantity of toxic substances released to this medium was methanol, 17 percent was acetone, and 8 percent was toluene. Aluminum oxide, toluene, and acetone were the toxic substances released in the largest quantities as fugitive air emissions and contributed 19 percent, 15 percent, and 11 percent to the total quantity released to this medium, respectively. Aluminum oxide represented 62 percent of the total releases to onsite land, while methanol and ammonia represented 19 percent and 12 percent, respectively. Aluminum oxide also was the largest contributor to toxic substance releases to other offsite locations (59 percent) with zinc compounds also contributing significantly (22 percent) to offsite releases. Forty-four percent of the total releases to

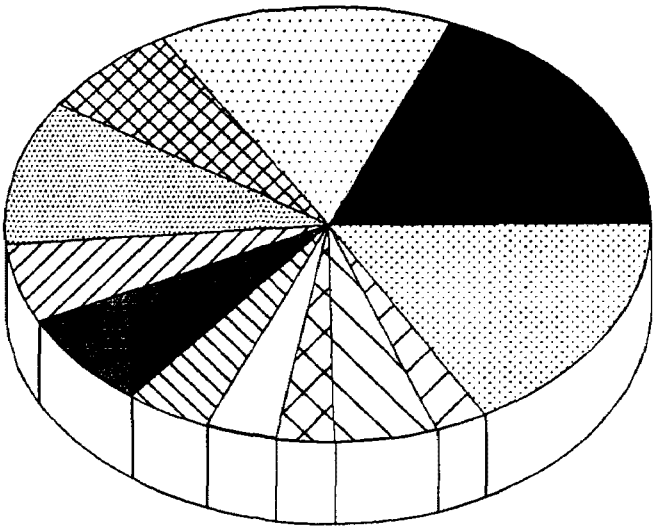
Exhibit 3-9
Cumulative Distribution of Releases by the Quantity Released per Facility



Source: 1988 Toxic Release Inventory System Reports

Exhibit 3-10
Releases to Media by Chemical

A. Fugitive Air



- Aluminum Oxide
- Toluene
- Styrene
- Acetone
- 1,1,1, Trichloroethane
- Methanol
- Freon 113
- Formaldehyde
- Methyl Ethyl Ketone
- Trichloroethylene
- Methyl Isobutyl Ketone
- Other

B. Stack Air

- Methanol
- Acetone
- Toluene
- Chlorine
- Chlorine Dioxide
- Ammonia
- Methyl Ethyl ketone
- Trichloroethylene
- Styrene
- Aluminum Oxide
- Xylene
- Dichloromethane
- Freon 113
- Chloroform
- Other

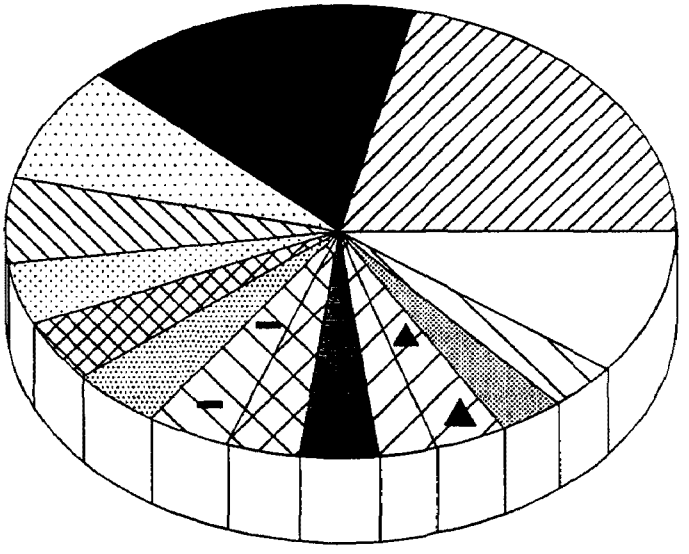
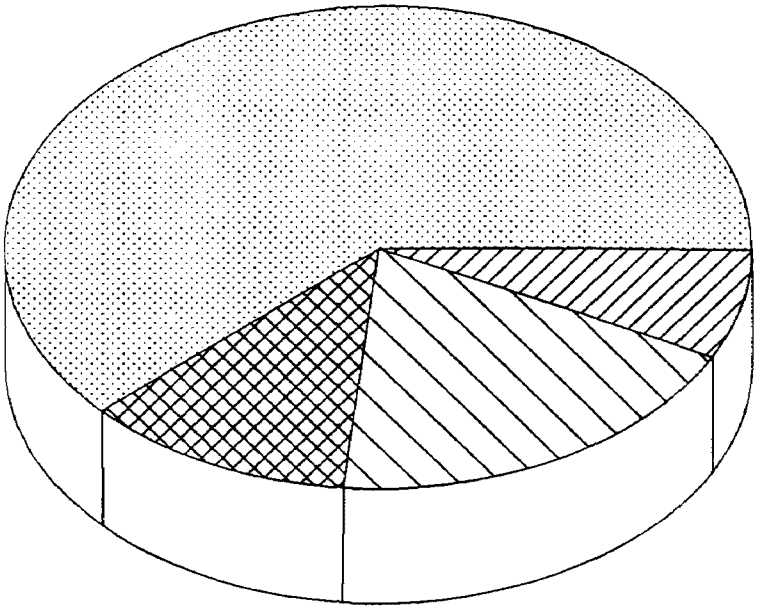
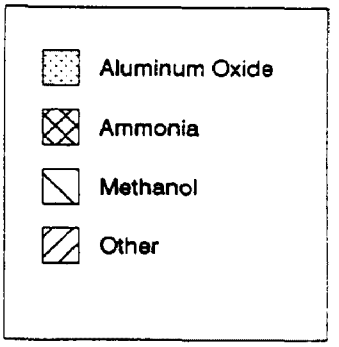


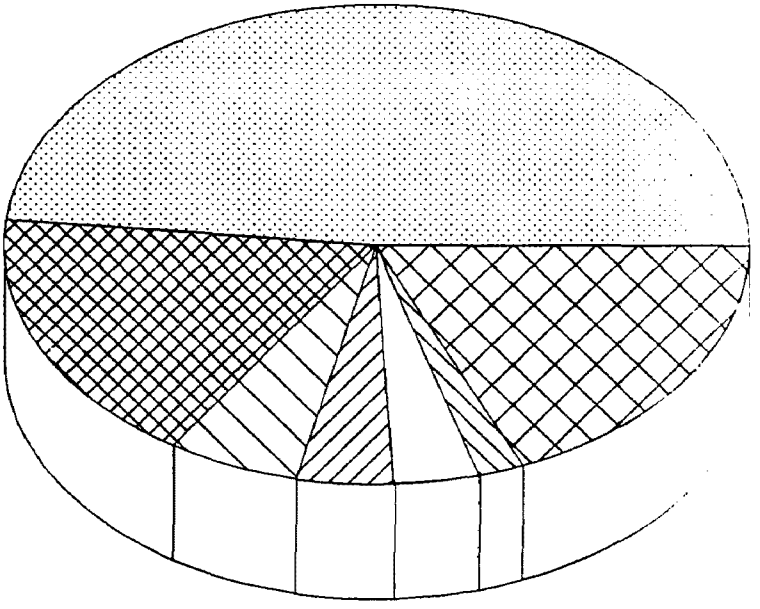
Exhibit 3-10 (cont.)
Releases to Media by Chemical

C. Land





D. Other Off-Site



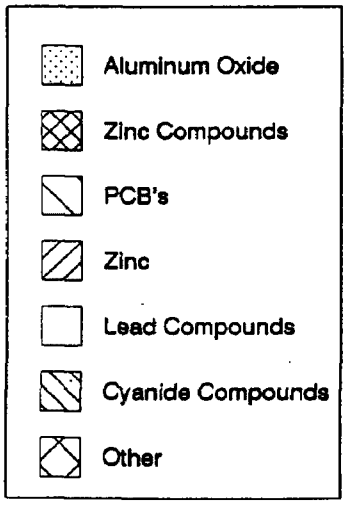
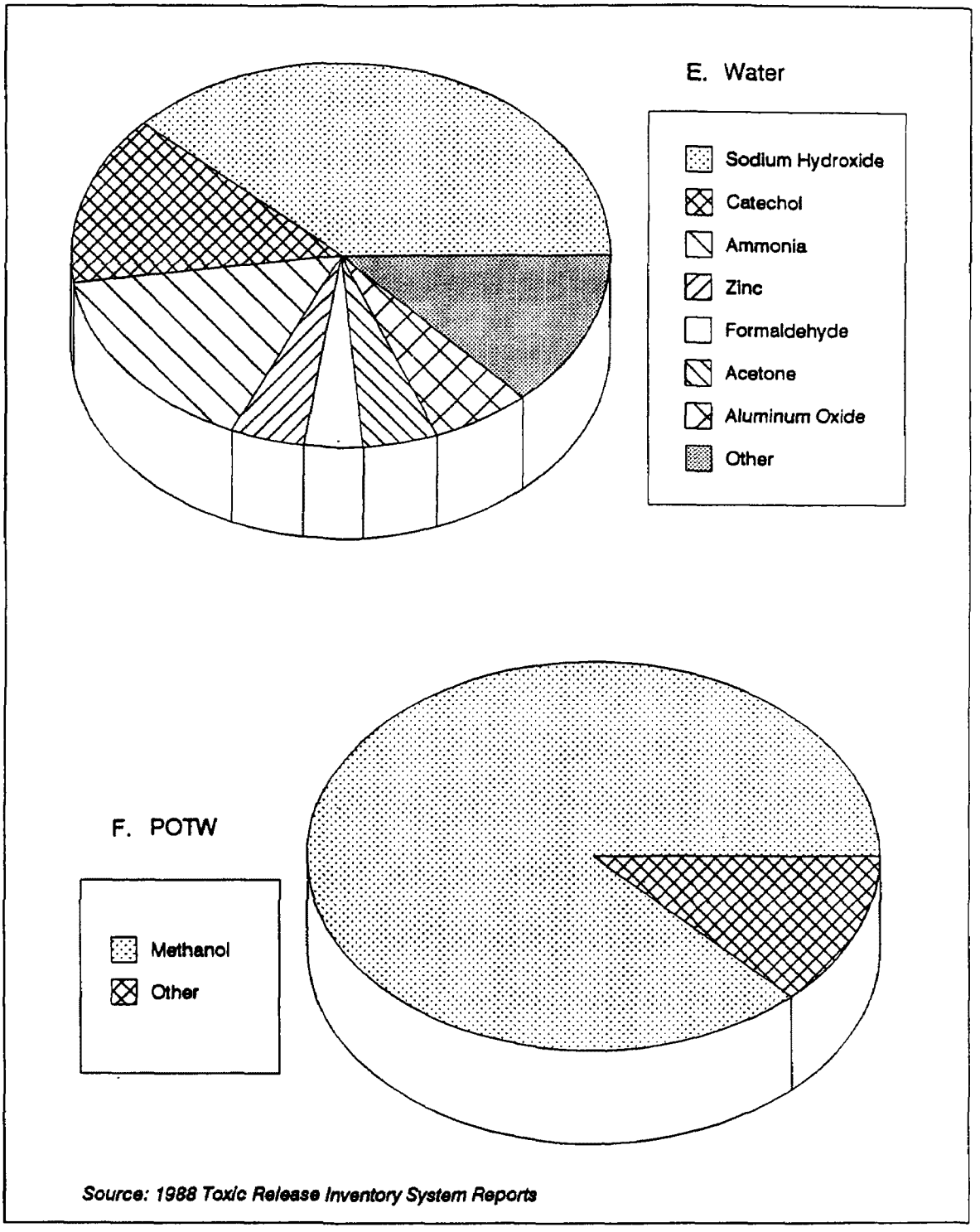


Exhibit 3-10 (cont.)
Releases to Media by Chemical



Source: 1988 Toxic Release Inventory System Reports

water consisted of sodium hydroxide. Several other chemicals, including catechol and ammonia, also contributed significantly to the discharges to water. Discharges to POTWs were primarily methanol (87 percent) with the remainder of the discharges comprising small quantities of several other chemicals.

3.2.3 Contribution to Releases by Industry Group

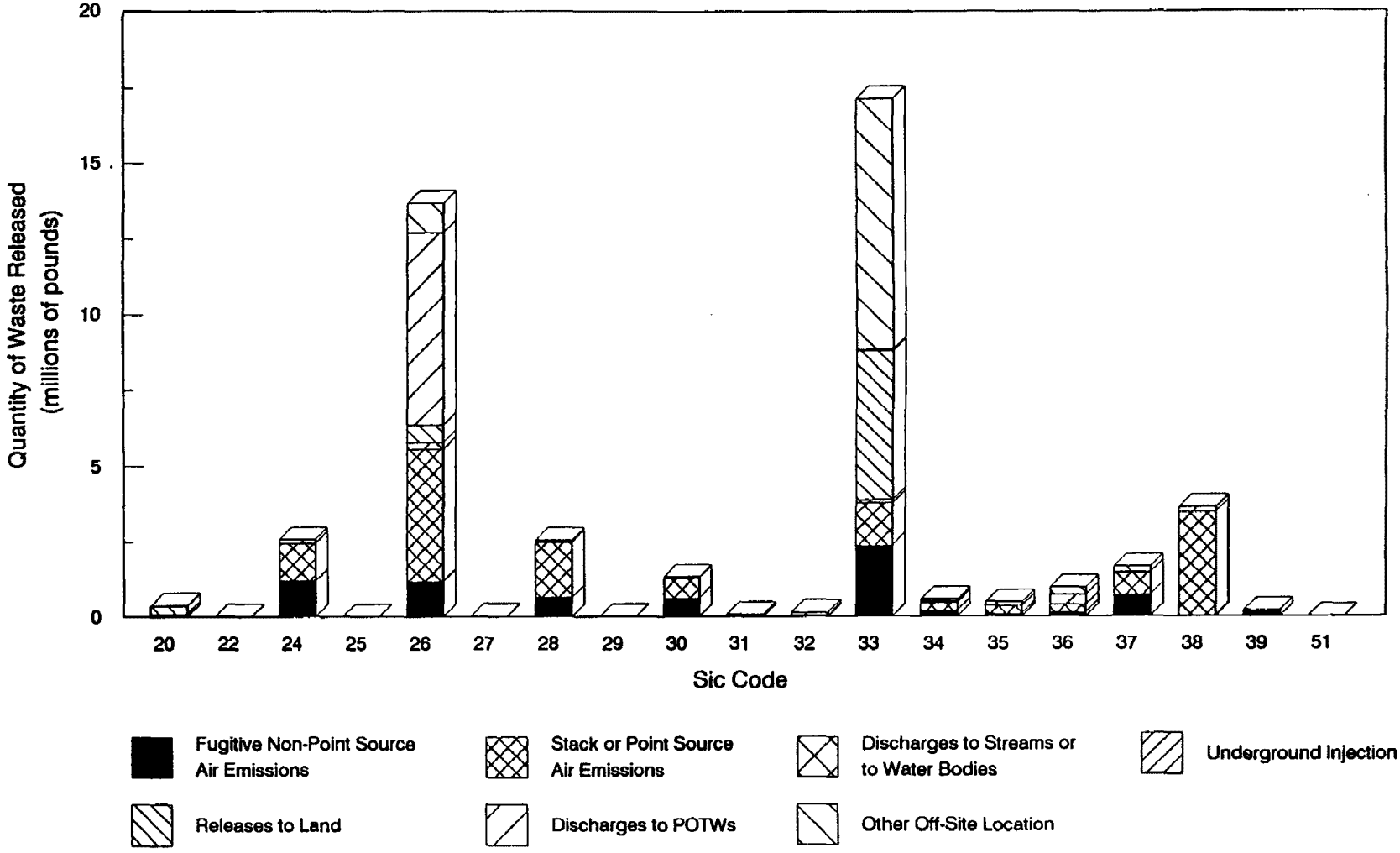
Of the 45-million pounds of toxic substances released to the environment in 1988, 30,900,000 pounds (68 percent of the total releases) were released by two industry groups. The primary metal industries (SIC 33) released 17,160,000 pounds of toxic substances (38 percent of the total releases); the paper and allied products industry (SIC 26) released a total of 13,700,000 pounds (30 percent of the total releases). Exhibit 3-11a displays the quantities of toxic substances released by each industry group of interest as well as the disposition of these releases. (See Appendix A, Table 4 for data on specific media releases from industry groups.)

Of the releases by the primary metals industries, 48 percent were to other offsite locations, 29 percent were to onsite land management units, and 14 percent were fugitive or nonpoint source air emissions. Forty-six percent of the releases by the paper and allied product industry were discharges to POTWs; 32 percent were stack or point-source air emissions. Nine percent of the releases by this industry were fugitive or nonpoint source air emissions. The instruments and related products industry (SIC 38) also contributed significantly to releases to the environment in 1988. An estimated 94 percent of the releases by this industry were stack or point-source air emissions.

Exhibit 3-11b shows, by industry group, the major toxic substances that made up the releases in 1988. (See Appendix A, Table 5, for specific data on releases of toxic substances by industry groups.) The releases by the primary metals industry in 1988 consisted mainly of aluminum oxide, 68 percent of the total quantity released by this industry was aluminum oxide. Additionally, zinc compounds contributed to 11 percent of the total releases from this industry group. For the paper and allied products

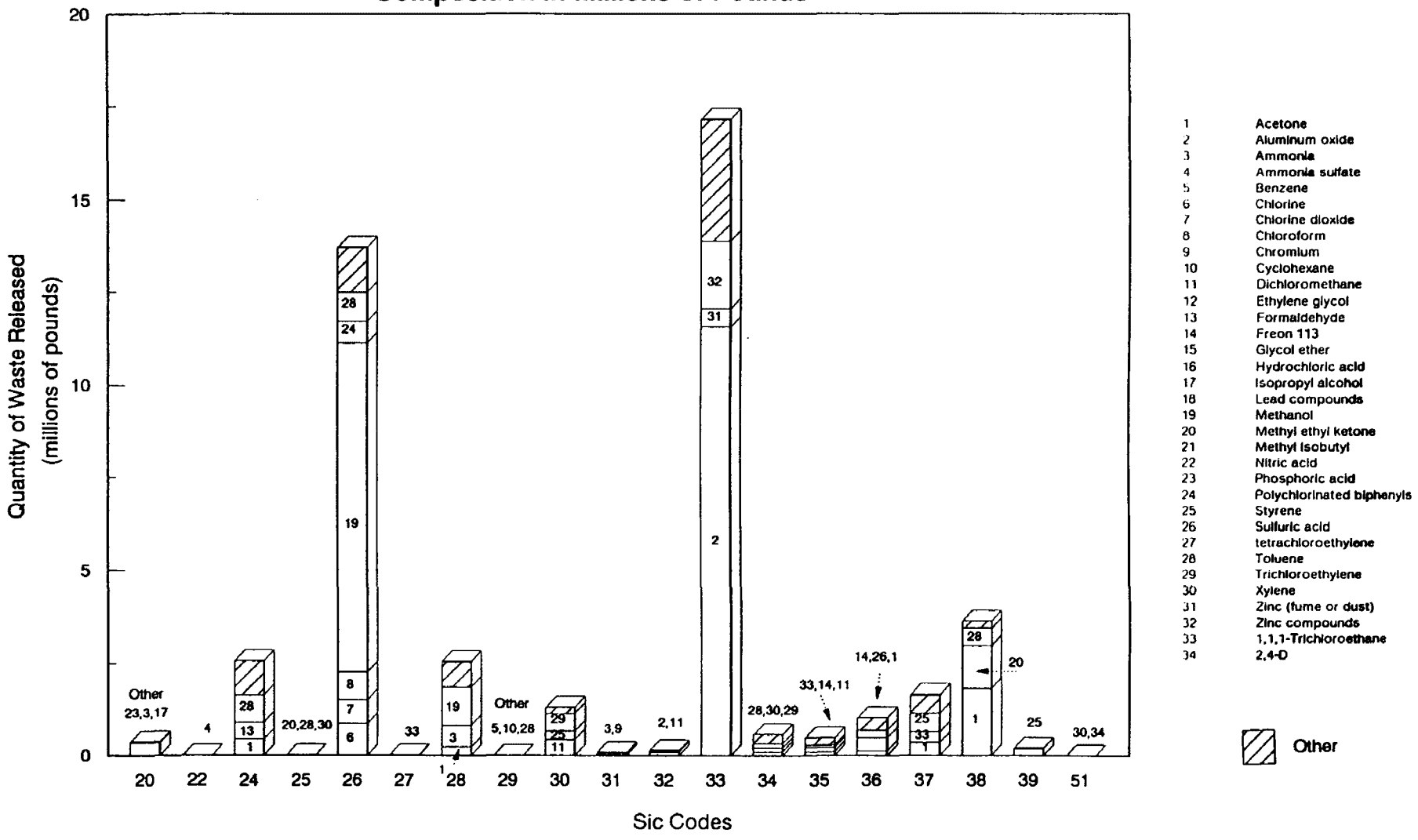
Exhibit 3-11a

Releases by Industry Group: Disposition in Millions of Pounds



Source: 1988 Toxic Release Inventory System Reports

Exhibit 3-11b
Releases by Industry Group:
Composition in Millions of Pounds



Source: 1988 Toxic Release Inventory System Reports

industry, toluene, formaldehyde, acetone, and xylene made up 28 percent, 18 percent, 17 percent, and 12 percent, of the total releases by this industry, respectively. For the instruments and related products industry, 50 percent of the total releases in 1988 consisted of acetone, 13 percent were toluene releases, 13 percent were methyl ethyl ketone releases, and 9 percent were methanol releases.

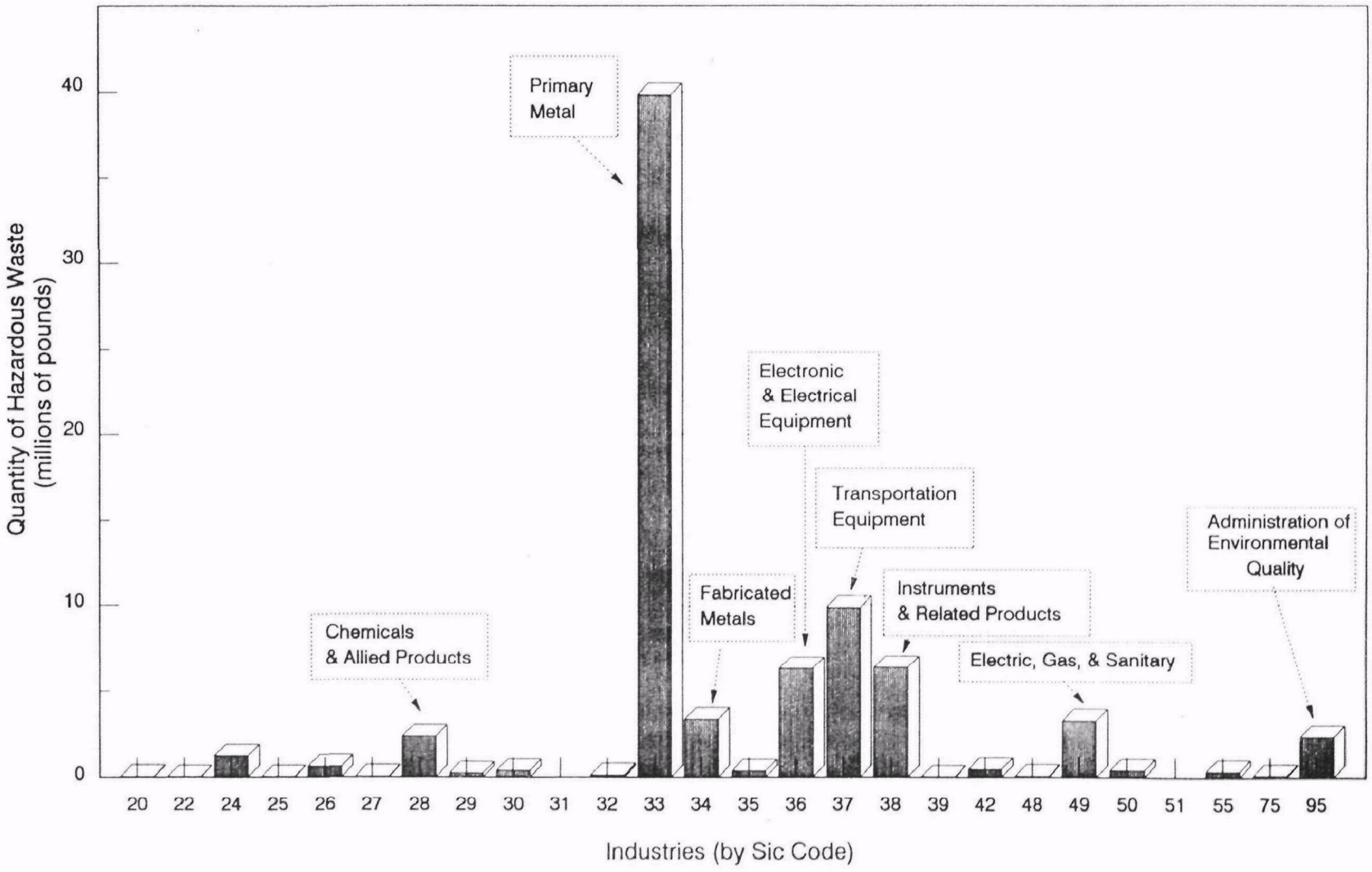
3.3 TYPES AND QUANTITIES OF RCRA HAZARDOUS WASTES GENERATED

As explained earlier, the TRIS data base provides information on the types of toxic substances used and quantities released into the environment by 207 large toxics users. Little information is available on small and large quantity hazardous waste generators that are not large toxics users but will be subject to the rule's requirements to develop toxics use and waste reduction plans and submit annual reports. When examining the data sources, the DEQ Quarterly Reports provided the most reliable information on quantities of hazardous waste generated and manifested (transported) offsite by 805 LQGs and SQGs. The data from the reports provide a picture of the types and quantities of RCRA and State-regulated hazardous wastes released by smaller facilities (i.e., facilities other than large toxics users). The important point to note with the DEQ Quarterly Report data is that facilities that treat, store, dispose or recycle hazardous wastes onsite are not captured. Additionally, releases to the air or discharges under a National Pretreatment Discharge and Elimination System (NPDES) permit or POTW (i.e., releases not regulated under RCRA) are not encompassed. Therefore, the quantities of RCRA wastes identified in the DEQ Quarterly Reports represent a subset of the total quantity of hazardous wastes generated by LQGs and SQGs.

An estimated 82-million pounds (41,000 tons) of hazardous waste were generated and transported offsite during 1988. Seven industry groups accounted for over 85 percent of the hazardous waste generated and transported. Exhibit 3-12 displays the quantities of RCRA hazardous wastes generated and transported offsite for a subset of industry groups, while Appendix A, Table 2 shows the quantities of hazardous waste generated and manifested by all industry groups. The primary metals industry (SIC 33) generated and transported nearly 40-million pounds of hazardous waste offsite. This accounts for nearly

Exhibit 3-12

Quantity of Hazardous Waste Generated and Transported Off-Site by SIC Code



Source: 1988 DEQ Quarterly Reports

half of the total quantity of hazardous waste manifested in Oregon in 1988. The other six industry groups generated and transported significantly smaller (but still substantial) quantities of waste. The breakdown of these quantities follows:

- The transportation equipment industry generated 9.8-million pounds of hazardous wastes (SIC 37).
- The instruments and related products industry generated 6.4-million pounds (SIC 38).
- The electronic and electrical equipment industry generated 6.3-million pounds (SIC 36).
- The electric, gas, and sanitary industry generated 3.2-million pounds (SIC 49).
- The chemical and allied products industry generated 2.4-million pounds (SIC 28).

In addition to the seven industry groups that accounted for over 85 percent of the hazardous waste that was generated and transported in 1988, a large quantity (2.3-million pounds) of hazardous waste was transported offsite by the administration of environmental quality (SIC 95) industry group. This quantity of hazardous waste is likely to be the result of emergency response cleanups and other waste management activities conducted by the State.

Six types of Federal- and State-regulated hazardous wastes are generated and transported offsite:

- D wastes, which exhibit at least one of the four hazardous waste characteristics and are listed under 40 CFR 261.21-261.24
- F wastes, which are from nonspecific sources and listed as hazardous under 40 CFR 261.31
- K wastes, which are hazardous wastes from specific sources and are listed under 40 CFR 261.32
- P wastes, which are specific discarded commercial chemical products, manufacturing chemical intermediates, or off-specification commercial chemical products identified as acutely hazardous wastes and listed under 40 CFR 261.33

- U wastes, which are specific discarded commercial chemical products, manufacturing chemical intermediates, or off-specification commercial chemical products identified as toxic wastes and listed under 40 CFR 261.33

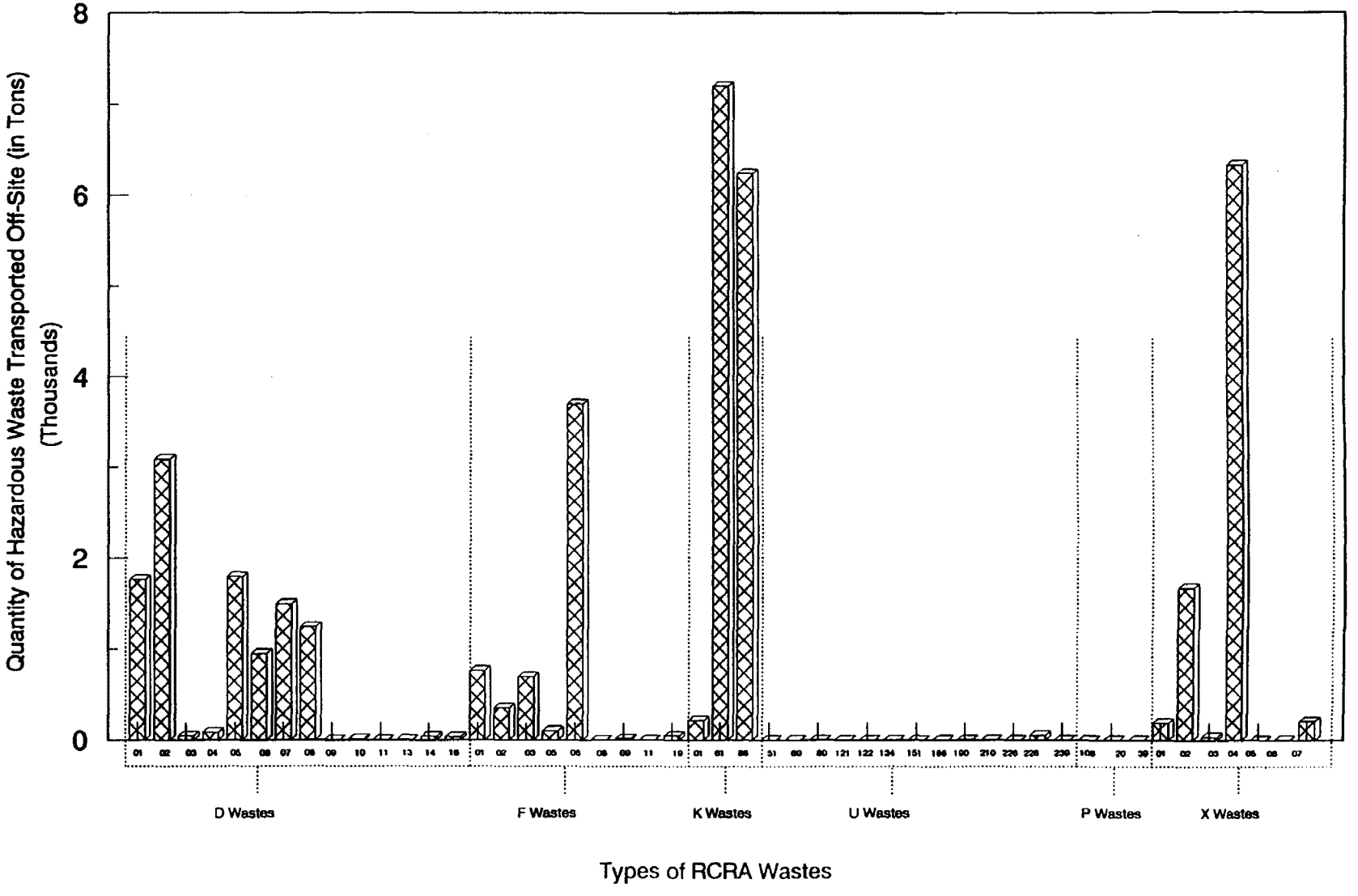
- X wastes, which are State-regulated solid wastes that include nonindustrial solid waste, polychlorinated biphenyls (PCBs), pesticide wastes, out-of-state regulated wastes, and lab packs.

Exhibit 3-13 shows that K wastes were the largest type of RCRA waste generated and shipped offsite (13,700 tons) in Oregon in 1988. (See Appendix A, Table 3 for the quantities of each RCRA waste generated.) Interestingly, K061 and K088, which are produced only by the primary metal industry (SIC 33), accounted for nearly all of the K wastes generated. The next largest group of wastes generated is the D wastes (10,500 tons), which are generated by a variety of industry groups. The largest quantity of D waste generated is D002 (a solid waste exhibiting the characteristic of corrosivity, but not listed as a hazardous waste), which is generated by the electronic and electrical equipment (SIC 36) and the instruments and related products industries (SIC 38). The next largest group of hazardous waste generated is State-regulated wastes. The primary State-regulated waste, i.e., nonhazardous industrial waste (X004), accounts for over 75 percent of the total State-regulated wastes generated and transported offsite. Very little U wastes and P wastes are produced and transported offsite.

Because the SARA 313 toxic substance release information is from larger toxics users and the hazardous waste generation information from the DEQ Quarterly Reports represents a range of business sizes, direct comparisons between the analyses presented in this section with the analyses in Section 3.2 cannot be made. However, a few observations can be made about industries that are major large toxics users and generators. With the exception of the paper and allied products industry, the industries that release major volumes of 313 toxic substances to the environment generally coincide with the industries that are the major generators of hazardous waste. The largest generator of hazardous waste in Oregon in 1988 was the primary metals industry (SIC 33), which released a total of 17,158,004 pounds of SARA 313 toxic substances to the environment, the second-largest release by industry. Similarly, the chemicals and allied products (SIC 28), electronic and electrical equipment (SIC 36), transportation equipment (SIC 37), and instruments and

Exhibit 3-13

Quantity of Hazardous Waste Generated and Transported Off-Site by RCRA Waste Code



Source: 1988 DEQ Quarterly Reports

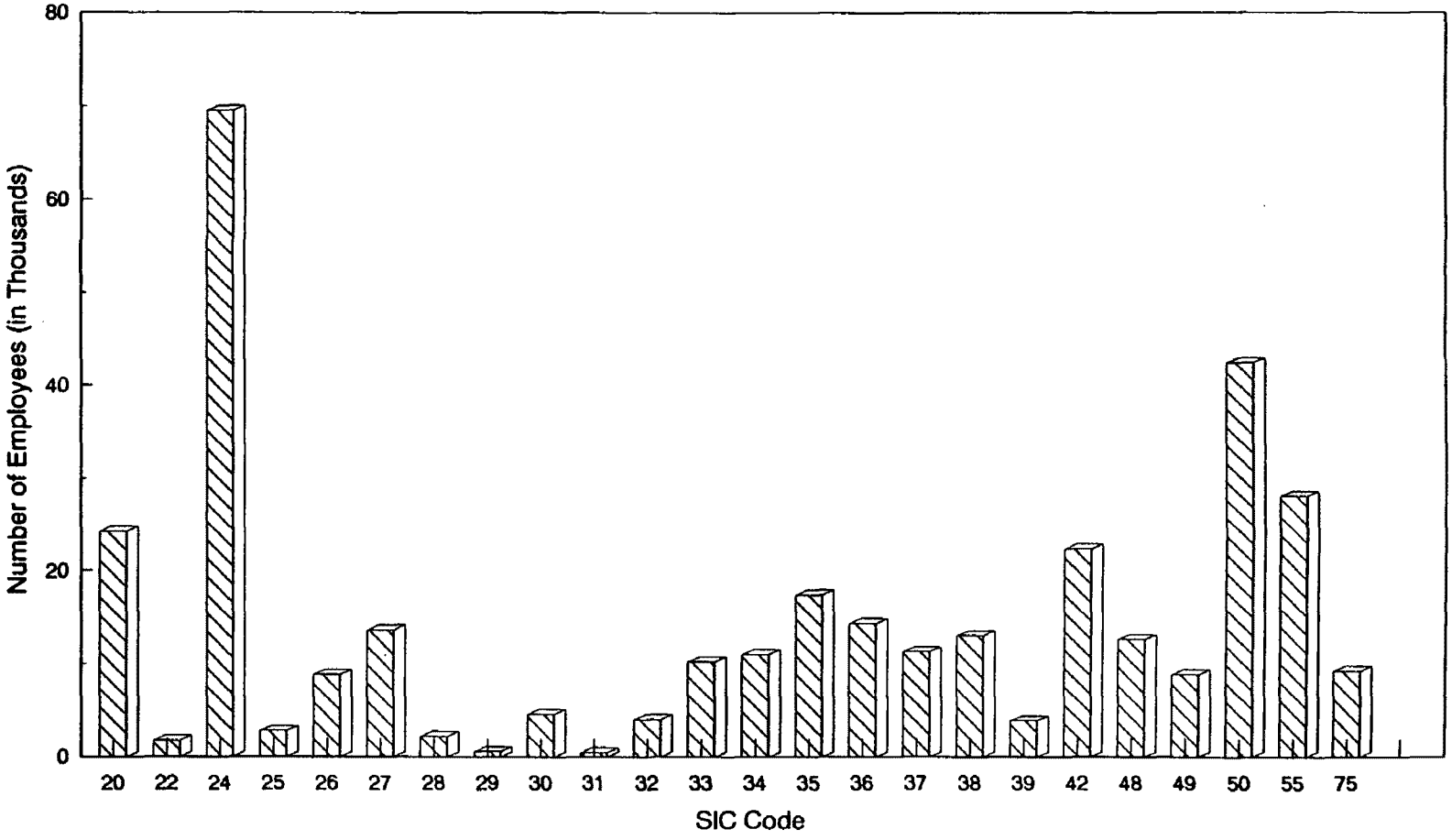
related products (SIC 38) industries all manifest relatively large quantities of waste as well as release major quantities of SARA 313 toxic substances to the environment. In contrast, the paper and allied products industry, which is the largest releaser of SARA 313 toxic substances to the environment, manifests relatively little hazardous waste. This likely is due to the fact that the pulp and paper industry predominantly releases wastes to the air and water and therefore is not RCRA regulated and generates relatively little manifested RCRA and State-regulated hazardous waste.

3.4 CHARACTERIZATION OF BUSINESS ACTIVITIES OF GENERATORS AND TOXICS USERS

Next, this report examines trends in economic activities, as measured by the number of employees, to identify projected growth in waste generating activities. Exhibit 3-14 shows the total average employment in Oregon in 1988 for each industry group of interest. Note that the employment figures in this and following exhibits include all businesses in that industry group, not only toxics users and hazardous waste generators. Five industry groups had individual total average employments of over 20,000 employees in 1988. The lumber and wood products industry (SIC 24) employed an average of 70,000 people in 1988 and was the largest employer of any industry group. The other four industries employing over 20,000 people in 1988, mostly in nonmanufacturing industries, include the durable goods industry (SIC 50), the auto dealers and service stations industry (SIC 55), food and kindred products manufacturing (SIC 20), and the trucking and warehousing industry (SIC 42).

Exhibits 3-15a and 3-15b illustrate Oregon employment trends in the manufacturing and nonmanufacturing industries, respectively, between 1987 and 1995. The data, gathered from the September 1990 *Oregon Economic and Revenue Forecast*, project that of the manufacturing industries, the machinery and electrical and electronic industries (SIC 35 and SIC 36) will undergo high growth through 1995, reaching an estimated 40,000 people employed in 1995. Conversely, the lumber and wood products industry (SIC 24) is expected to shrink significantly between now and 1995, decreasing its number of employees from 68,100 in 1987 to an estimated 58,000 in 1995.

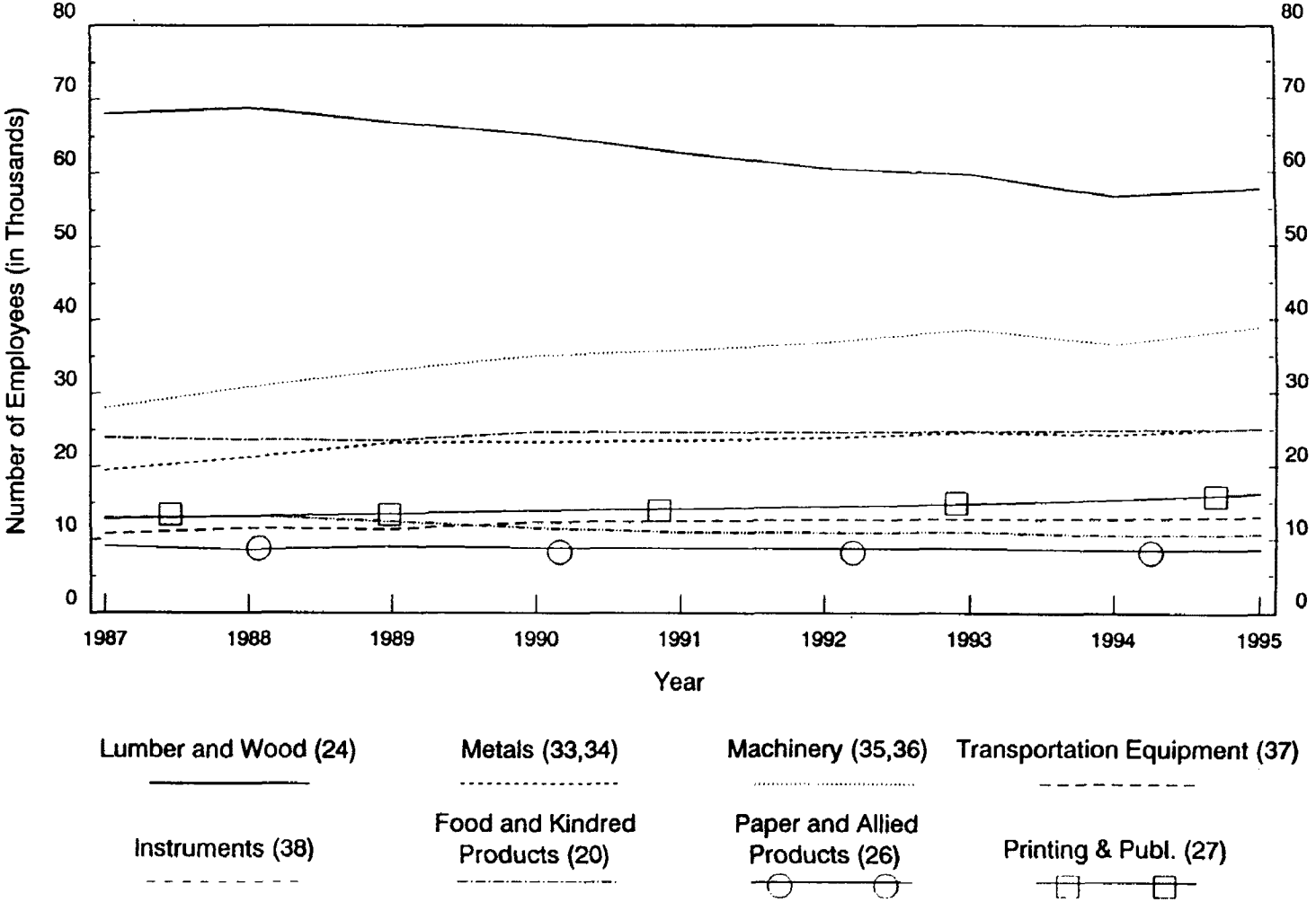
Exhibit 3-14
Oregon: Total Average Employment in 1988 by SIC Code



Source: Oregon Covered Employment and Payrolls, 1988

Exhibit 3-15a

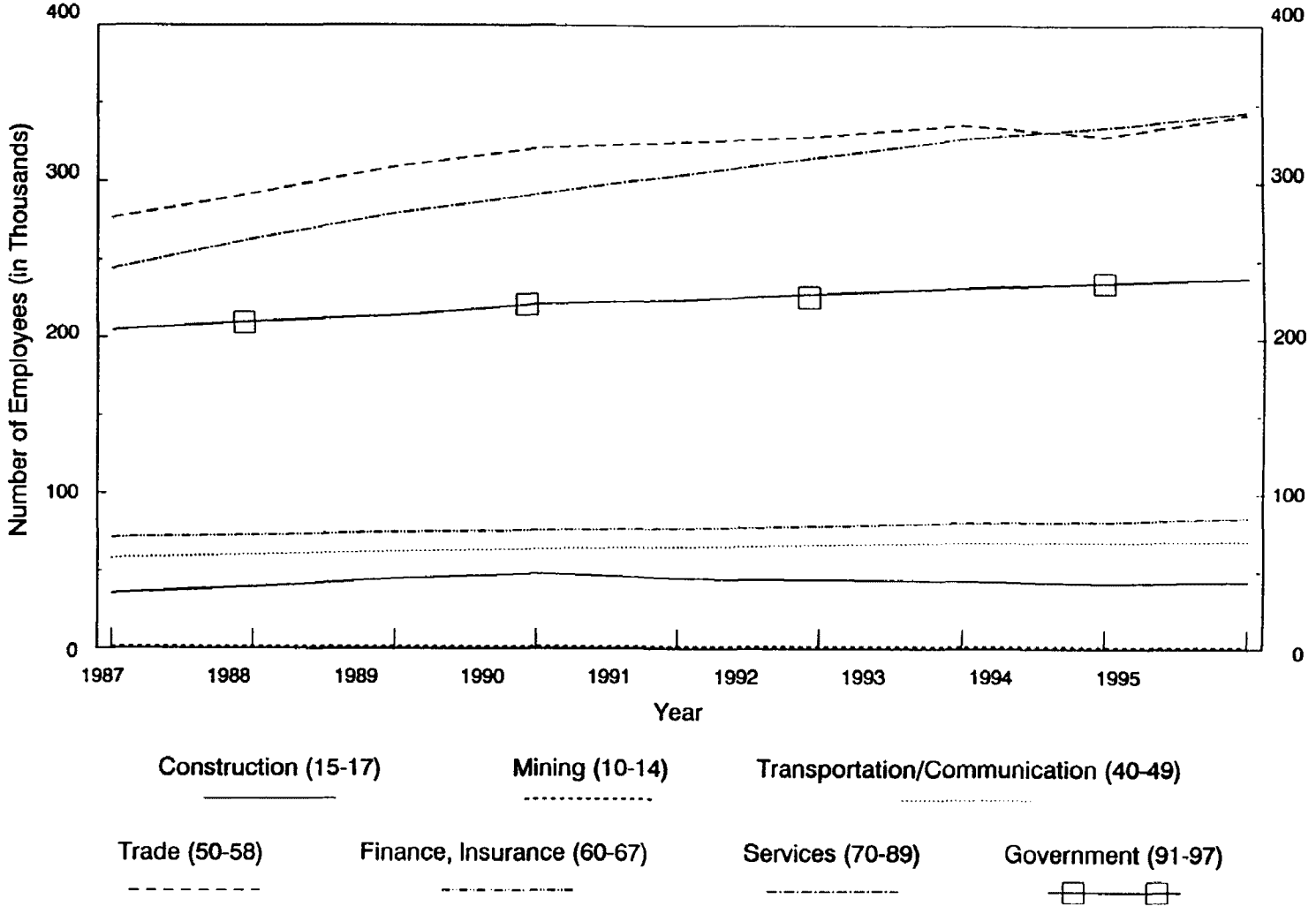
Oregon Manufacturing Employment
1987-1995 by SIC Code



Source: Oregon Covered Employment and Payrolls, 1988

Exhibit 3-15b

Oregon Nonmanufacturing Employment 1987-1995 by SIC Code



Source: Oregon Covered Employment and Payrolls, 1988

The data show more predominantly, however, that a number of manufacturing industries are projected to maintain or slightly increase the level of economic activity. Those industries relevant to toxics use and hazardous waste generation include the primary metal and fabricated metal products industries (SIC 33 and 34), the transportation equipment industry (SIC 37), the instruments and related products industry (SIC 38), the food and kindred products industry (SIC 20), the paper and allied products industry (SIC 26), and the printing and publishing industry (SIC 27). The implications of the trends in economic growth in manufacturing industries is that the electrical and electronics industry, a major generator of waste, and the machinery industry can be seen in the future as releasing an increasing percentage of toxic substances and hazardous wastes, if no reduction technologies are implemented.

Of the nonmanufacturing industries, the data suggest that several industries will experience significant growth as indicated by employment levels. These industries include the trade industry (SIC 50-58), the services industry (SIC 70-89), and the transportation and communication industries (SIC 40-49). Because some of the companies included in these industry groups are hazardous waste generators (see Exhibit 3-3), increased growth may contribute to a larger quantity of hazardous wastes being generated and transported. The number of employees in the services industry is expected to reach 344,500 by 1995. This projection represents a 40-percent increase from 1987 in the number of employees for this industry. The trade industry and the transportation and communication industries are expected to increase their number of employees by 24 percent and 18 percent, respectively. As a result of the increased growth in the nonmanufacturing industries, wastes generated from these industries may begin to account for a larger percentage of the total waste generated.

3.5 SUMMARY OF FINDINGS

An estimated 928 companies have been identified as toxics users, including LQGS and SQGs, that will be impacted by the Toxics Use Reduction and Hazardous Waste Reduction program. These 928 companies will be required to develop and implement

toxics use reduction and hazardous waste reduction plans and a subset of these facilities will be required to set performance goals for reducing toxics usage and waste generation.

Though the available information sources do not provide data to describe comprehensively all three groups (large toxics users, LQGs, and SQGs), enough data are available to begin characterizing toxics users as well as describing toxics use and waste generation patterns. The major findings based on the data can be summarized as follows:

- The majority of the toxics users and hazardous waste generators (90 percent) are located in the western half of Oregon, primarily concentrated around the Portland area.

- The industries that collectively account for a large number of toxics users and hazardous waste generators are lumber and wood products (SIC 24), chemicals and allied products (SIC 28), primary metals (SIC 33), fabricated metal products (SIC 34), electrical and electronic products (SIC 36), transportation and warehousing (SIC 42), and auto dealers and service stations (55).

- Industry groups vary with respect to the quantities of toxic substances released and hazardous wastes generated. While several industry groups contain a large number of toxics users (e.g. lumber and wood products, transportation and warehousing, and auto dealers and service stations), these same businesses release relatively small quantities of toxic substances or generate little waste. This has implications for technical assistance in that technical assistance targeted toward certain businesses must be appropriate for small operations.

- The industries that release major quantities of SARA 313 toxic substances to the environment can be, but are not necessarily, the industries that generate and transport large quantities of hazardous waste. For example, the paper and allied products industry (SIC 26) is the largest releaser of SARA 313 toxic substances but it generates and transports relatively little hazardous waste. In contrast, the primary metals industry (SIC 33) releases large volumes of SARA 313 toxic substances as well as large volumes of hazardous waste. Similarly, the chemicals and allied products (SIC 28), electronic and electrical equipment (SIC 36), transportation equipment (SIC 37), and the instruments and related products (SIC 38) industries release relatively large volumes of toxic substances and generate large quantities of hazardous waste.

- The three major SARA 313 toxic substances used by Oregon large toxics users in 1988 are sulfuric acid, acetone, and toluene.

- The largest quantities of toxic substances (34 percent) are released as stack or point-source air emissions, followed by 22 percent released to offsite locations, 16 percent released as nonpoint emissions, 15 percent to POTWs, and 13 percent to onsite land-management units.

- Of RCRA waste types generated and transported offsite, K wastes account for the largest volume, with nearly all of the waste type generated by the primary metals industry.

- Projections into 1995 show that the majority of manufacturing industries are expected to remain fairly stable. The only manufacturing industries expected to show any high growth are the machinery products (SIC 35), and electronic and electrical products (SIC 36) industries. These industries are shown to be releasers of toxic substances or generators of hazardous waste; therefore, increases are expected in the quantities of toxic substances released or wastes generated if no reduction technologies are implemented.

- High growth is projected for certain nonmanufacturing industry sectors containing industries that generate hazardous waste; therefore, an increasing percentage of waste generated can be expected to come from those industries.

4. IDENTIFICATION OF DATA GAPS AND SUGGESTIONS FOR COLLECTING BETTER DATA

4.1 SUMMARY OF EXISTING DATA GAPS

The data presented in this report are a first step toward providing the DEQ with the information needed to characterize the existing universe of toxics users. However, major data gaps exist, preventing the DEQ from fully characterizing the current universe of toxics users and hazardous waste generators and preventing an effective measurement of toxics use reduction and hazardous waste reduction. Specifically, the data gaps can be described as follows:

1. Incomplete representation of companies for developing an accurate count of the large toxics users and hazardous waste generators in Oregon.

To target technical assistance and recognition programs to large toxics users and hazardous wastes generators, the DEQ must have some knowledge about the universe of users and generators. According to the act passed by the Legislative Assembly, the technical assistance should extend beyond large toxics users, LQGs, and SQGs to cover CEGs. As pointed out, the universe described in section 3.1 is based on either incomplete data or information sources that are likely to provide underestimated counts of large toxics users and hazardous waste generators. Efforts need to be taken to update the current list of generators and to identify more accurately the overlap between the generator universe and the large toxics user universe.

2. Incomplete data on quantities of toxic substances used.

Thus far, the data sources used for this report have emphasized heavily the "output" side of the production process; i.e., chemical releases and waste generation. DEQ's mission, however, is to examine toxics use as well as hazardous waste generation. TRIS provides information on the frequencies of toxic substances used in manufacturing or

processing a product but does not provide data on the quantities of toxic substances used. The DEQ Quarterly Reports do not provide any information on the types or quantities of toxic substances used in manufacturing or processing that are associated with hazardous waste generation. The DEQ may want to re-examine the SARA 312 Reports or other data sources, such as the Comprehensive Assessment Information Rule (CAIR) Reports for information on quantities of chemicals used as inputs. Specifically, the State Fire Marshal's Office is designing a new information system to manage the data from the SARA 312 Reports. This new system may allow the DEQ to more easily query for quantitative use information on SARA 313 listed toxic substances.

The CAIR Reports, a reporting mechanism under the Toxic Substance Control Act (TSCA), require manufacturers, processors, and importers of 19 TSCA listed chemical substances to provide detailed information on the substance used, the processes that use or produce the substance, and the resulting waste streams. Ten of these TSCA listed substances are also SARA 313 toxic substances and they are as follows: acetamide, phenanthrene, toluene-2,6-diisocyanate, benzenamine, pyrene, hydrazinecarboxamide, toluene-2,4-diisocyanate, disulfide, chlorine, and toluene diisocyanate. Though CAIR covers a limited subset of SARA 313 substances, the data from this source may be used to supplement existing DEQ information. Furthermore, future iterations of CAIR reporting may cover additional SARA 313 substances; thereby increasing the usefulness of the data for characterizing Oregon toxics use patterns.

In addition to re-examining the SARA 312 data and the CAIR Reports, modifications to the TRIS Reporting Form also can serve as a mechanism for collecting quantitative use data. Modifications to the TRIS Reporting Form are discussed in section 4.2.

3. Incomplete data to describe toxic substance use and hazardous waste generation from smaller facilities (e.g., toxics users of less than 10,000 pounds per year and small and conditionally exempt generators).

The TRIS data provide a more complete picture of toxic substance use and releases for the large toxics users, which includes a subset of large generators. These large toxics users also are likely to be the most regulated facilities (e.g., generate RCRA regulated wastes, discharge under a NPDES permit, etc.) and may be subject to frequent reporting requirements. Toxic substance use and waste-release patterns for smaller facilities, on the other hand, are less complete. The DEQ Quarterly Reports, the source used to cover LQGs and SQGs, contain data for only those generators that manifest hazardous waste. The Quarterly Reports also do not provide any information on the types of chemicals used in the production or manufacturing processes that produce the hazardous wastes. Furthermore, little or no chemical use and release information is available for toxics users of less than 10,000 pounds per year (including CEGs). Although large toxics users are of concern due to the volume of chemicals used and released, more complete data are available on this group. The DEQ may, therefore, consider putting some efforts toward collecting data on the LQGs and SQGs that are not large toxics users and on CEGs and other small toxics users to develop a more comprehensive picture of usage and generation patterns. By having more knowledge of these smaller type facilities, the DEQ will be better able to target technical assistance.

No available source of information is ideal for collecting data on smaller-sized facilities; however, the DEQ may want to re-examine the following sources:

- The Hazardous Waste Biennial Reports - The DEQ may want to consider administering Biennial Reports in the future to SQGs as well as LQGs. By doing so, the DEQ will be able to (1) more accurately identify the universe of SQGs and (2) characterize hazardous waste generation patterns of smaller facilities. Secondly, the DEQ may want to consider administering the Biennial Report Form that collects identifying information (facility name and address and generator status) to CEGs. This would enable the DEQ to develop a more accurate count of CEGs.

- The SARA 312 Reports - As pointed out, a new information system is being developed for managing the SARA 312 Reports. If the new system provides more flexible searching routines, the DEQ may be able to identify small toxics users (i.e., less 10,000 pounds per year) of SARA 313 substances and to estimate quantities of toxic substances used by these smaller facilities.

4. Format of the data that do not permit an accurate estimate of the quantities of toxic substances released to the environment.

The TRIS report form allows respondents to enter releases with less than 1,000 pounds per month as point estimates or a range (e.g., 1-499, 500-999), while releases greater than 1,000 pounds are entered as point estimates. Prior to entry into the TRIS data base, all range estimates are converted to a specific point estimate using the midpoint of the range. It is not known to what degree the quantitative-release estimates presented in section 3.2 are over- or underestimated. Because all large quantities were entered as point estimates, the estimated totals of releases to the environment may not be affected greatly by using midpoints of ranges. When breaking down the totals and examining releases by toxic substances, however, small quantities of releases are more sensitive to using midpoints of ranges when representing point estimates. For the purpose of estimating releases to the environment, collection of point estimates rather than ranges would enable the DEQ to provide a more accurate picture of releases on a toxic substance basis.

5. Incomplete data for measuring progress made toward toxics use reduction and waste minimization.

The above four data gaps directly impact the DEQ's ability to accurately identify the number of toxics users and generators and to characterize toxic substance use and hazardous waste generation patterns. In order to go one step further and measure toxics use and hazardous waste reduction, additional data are required. The type of data required depends on the approach that the DEQ takes to measure toxics use and hazardous waste reduction. A common approach, as used in the Hazardous Waste Biennial Reports and the TRIS Reports, is for the facility to report the total quantity of a toxic

substance released or hazardous waste generated during the reporting year and the previous year. Using the facility's production ratio to account for any effects of the business cycle on waste generation or toxic substance releases, the quantity of the waste/toxic substance reduction during the reporting year would then be calculated. Exhibit 4-1 provides examples of estimating the quantity and percentage of a release that is reduced, using the above approach. These reporting mechanisms either provide the facilities with the option to report reduction information or requires only those facilities that have achieved toxics release or hazardous waste reductions to report. The result is that too few facilities have provided this type of toxics release or hazardous waste reduction information through these two reporting mechanisms and often times the data provided have been incomplete. The data currently available through these two reporting mechanisms, therefore, cannot support any reduction analyses.

If the DEQ were to conduct its own data collection and use the above method for estimating quantities of a toxic substance or hazardous waste reduced, it would need to request the following information from companies for each toxic substance or hazardous waste minimized:

- Quantity of the selected toxic substance used or hazardous waste generated during the reporting year
- Quantity of the selected toxic substance used or hazardous waste generated during the previous year
- The number or quantity of the product produced during the reporting year that is associated most closely with the toxic substance release or hazardous waste generation
- The number or quantity of the product produced during the previous year that is associated most closely with the toxic substance release or hazardous waste generation.

There are, however, measurement problems associated with this approach used by TRIS and the Biennial Reports in that reduction of a toxic substance or hazardous waste cannot be appropriately measured at the facility level. As reported by the National

Exhibit 4-1.
Examples of Estimating Quantities of Releases/Wastes Reduced

Quantity of lead released during 1988 = 700 pounds.
Quantity of lead released during 1987 = 500 pounds.

The number of lead acid batteries produced during 1988 = 300.
The number of lead acid batteries produced during = 150.

Calculation #1

a) Production ratio = $\frac{\text{\# of batteries produced in 1988}}{\text{\# of batteries produced in 1987}}$

$= \frac{300}{150} = 2$

b) Quantity of waste in 1988 if reduction did not occur = 1987 quantity x the production ratio

= 500 x 2 = 1000 pounds of lead

c) Quantity of waste reduced = 1988 quantity before reduction − 1988 quantity after reduction

= 1000 - 700 = 300 pounds of lead reduced

d) Percent of waste reduced = $\frac{\text{1988 quantity reduced}}{\text{1988 quantity before reduction}}$ x 100 percent

$= \frac{300}{1{,}000}$ x 100 percent = 30 percent

Calculation #2

a) Normalized waste amount for 1987 = $\frac{\text{Quantity of release during 1987}}{\text{Number of batteries produced during 1987}}$

$= \frac{500}{150} = 3.3$

b) Normalized waste amount for 1988 = $\frac{\text{Quantity of release during 1988}}{\text{Number of batteries produced during 1988}}$

$= \frac{700}{500} = 2.3$

c) Percent of waste minimized = $\frac{\text{1988 waste:product ratio - 1987 waste:product ratio}}{\text{1987 waste:. product ratio}}$ x 100

$= \frac{2.3 - 3.3}{3.3}$ x 100 percent = 30%

Academy of Sciences (NAS) in its 1990 report, *Tracking Toxic Substances at Industrial Facilities: Engineering Mass Balance Versus Materials Accounting*, waste reduction is measured best at the production unit level because some quantities of waste minimized may be masked when examined at the facility level. Conversely, a toxic substance release reported as minimized at the facility level actually may not be minimized at the production unit level. Furthermore, the current reporting systems do not suggest to facilities a standardized way of calculating the production ratio, which can lead to problems when comparing across facilities.

To measure toxic substance/hazardous waste reduction at the production unit level, the DEQ would need to collect the following types of information:

- Definition of a production unit
- Number and types of production units per facility
- Types and quantities of inputs for each of the production units at a facility
- Numbers and/or quantities of products produced from each production unit
- Types (individual toxic substances or wastes) and quantities of releases to all media from each production unit.

Exhibit 4-1 shows equations that can be applied to each production unit and used to calculate the decrease (or increase) in a chemical or group of chemical releases. Although this method may be more accurate, the effort needed by facilities to report waste reduction data on a production unit level is likely to be too time consuming and resource-intensive. Furthermore, the NAS report warns that summing this data to the facility level will mask results and the efficiency gained in measuring at the production unit level would be lost. Also, production units change over time; thereby making reduction analyses across time more difficult. Taking into consideration these constraints, the DEQ will need to examine the ability of Oregon toxics users to report at the production unit level and the resources needed to analyze these data.

4.2 SUGGESTIONS FOR IMPROVING EXISTING REPORTING MECHANISMS

Both Federal and State reporting mechanisms were examined for approaches to improve the types of data collected for characterizing toxics use and waste generation practices and for measuring toxics use and hazardous waste reduction in Oregon. Approaches for each level of reporting are given below.

4.2.1. Improvements to Federal Reporting Mechanisms

The TRIS Form R requests a variety of data, ranging from company identifying information to toxic substances used and released into the environment. In comparison to other Federal reporting mechanisms, TRIS remains the most comprehensive in providing data on chemical inputs into the production process as well as toxic substance releases. Form R was examined in light of the data gaps identified in the previous section, two modifications were identified to help the characterization of the toxics use and release patterns. These modifications are as follows:

- Request information on the total quantity of the toxic substance used in the production process during the reporting period. Currently the form only requests a range for the quantity of the toxic substance onsite at any time during the reporting year. The quantity of a toxic substance onsite does not provide the type of information needed for developing a baseline for measuring waste minimization. Instead, the quantity of a toxic substance used in manufacturing or processing a product can be used to gauge toxics use patterns and serve as a measure for examining the relationship between the chemical inputs and releases in a production process.

- Request point estimates only for quantities of releases. As mentioned earlier, Form R allows the respondent to specify a range for releases under 1,000 pounds per year. To describe more accurately releases, particularly for smaller volumes of chemicals, the form should be modified to allow only for point estimates.

Modifications in regard to collecting more accurate toxics use and release reduction data were not addressed because they would require extensive revisions to the TRIS report or to other Federal reporting mechanisms. This issue, instead, is addressed in the following section on modifications to State-reporting mechanisms.

4.2.2 Improvement to State Reporting Mechanisms

The primary reporting mechanism for the State is the annual progress reports that are to be submitted by large toxics users, LQGs, and SQGs starting in September 1992. The rules currently require this group of toxics users to report on progress made in regards to each performance goal established, any amendments to the reduction plan, name, CAS numbers and annual quantities of toxic substances used, waste codes and annual quantities of hazardous wastes generated, and a narrative summary explaining the quantities used and generated. Furthermore, toxics users will need to provide information on the location of the facility, SIC codes, EPA identification number, and a Toxic Release Inventory (TRI) identification number. Facilities are given the option to provide a production index for hazardous waste/toxic substance requiring a performance goal.

These data, collected through the Annual Progress Reports, are at the facility level and likely will be difficult to analyze across facilities due to variations in production processes that use toxic substances and generate hazardous wastes and variations in estimation methods. Furthermore, a comparison of an individual facility's data across time may also be difficult due to changes in products from year to year. Product changes will have an effect on the quantities of toxic substances used and hazardous wastes generated which cannot be identified through a facility production index. The DEQ should investigate the feasibility of collecting data on the quantities of toxic substances used and wastes generated by production unit through the Annual Progress Reports. Section 4.1 discusses how this would allow for a more accurate estimation method of quantities of toxic substances and hazardous wastes reduced. However, this method is extremely resource-intensive for facilities to implement. An alternative to requesting this information on the Annual Progress Reports is to select a sample of facilities submitting Annual Progress Reports and to conduct a case study using the more detailed approach.

APPENDIX A

Table 1

Number of Oregon Generators that Manifest (Transport) Hazardous Wastes Off-Site by Industry Group

SIC CODE	INDUSTRY GROUP	NUMBER OF COMPANIES
00	Unkown	119
13	Oil and Gas Extraction	1
14	Mining and Quarrying of Nonmetals	2
16	Heavy Construction	7
17	Construction - Special Trade	2
20	Food and Kindred Products	10
22	Textile Mill Products	1
24	Lumber and Wood Products	43
25	Furniture and Fixtures	2
26	Paper and Allied Products	11
27	Printing and Publishing	5
28	Chemical and Allied Products	18
29	Petroleum Refining and Related Industries	2
30	Rubber and Misc. Plastic Products	3
32	Stone, Clay, Glass, Concrete Products	4
33	Primary Metal Industry	15
34	Fabricated Metal Products	41
35	Industrial and Commercial Machinery	23

Source: 1988 DEQ Quarterly Reports

Table 1

Number of Oregon Generators that Manifest (Transport)
Hazardous Wastes Off-Site by Industry Group

36	Electronic and Electrical Equipment	41
37	Transportation Equipment	18
38	Instruments and Related Products	11
39	Miscellaneous Manufacturing Industries	3
40	Railroad Transportation	3
41	Local and Suburban Transit and Inter-urban Highway Passenger Transportation	7
42	Motor Freight Transportation and Warehousing (Trucking/Maintenance Services)	65
43	US Postal Service	1
44	Water Transportation	1
45	Air Transportation	3
47	Transportation Services	7
48	Communications	15
49	Electric, Gas, Sanitary Services	24
50	Wholesale Trade - Durable Goods	32
51	Wholesale Trade - Nondurable Goods	8
52	Building Materials, Hardware, Garden Supplies, Mobile Home Dealers	1
53	General Merchandise Stores	2
54	Food Stores	1
55	Automotive Dealers and Gasoline Service Stations	106

Source: 1988 DEQ Quarterly Reports

Table 1

Number of Oregon Generators that Manifest (Transport) Hazardous Wastes Off-Site by Industry Group

59	Miscellaneous Retail	2
67	Holding and Investment Offices	1
72	Personal Services	2
73	Business Services	4
75	Automotive Repair	38
76	Miscellaneous Repair Services	5
80	Health Services	9
82	Educational Services	15
86	Membership Organizations	8
87	Engineering, Accounting, Research Management Services	2
89	Services, NEC	2
91	Executive, Legislative, and General Government	13
92	Justice, Public Order and Safety	1
94	Administration of Human Resource Programs	1
95	Administration of Environmental Quality	12
96	Administration of Economic Programs	17
97	National Security	11
	Total	805

Source: 1988 DEQ Quarterly Reports

Table 2

Quantity of Hazardous Waste Generated by Industry Group

SIC Code	Industry Group	Quantity of Hazardous Waste Generated (in pounds)	Quantity of Hazardous Waste Generated (in tons)
00	Unknown	2,058,000	1,029.00
13	Oil and Gas Extraction	2,080	1.04
14	Mining and Quarrying of Nonmetals	6,040	3.02
16	Heavy Construction	13,780	6.89
17	Construction – Special Trade	5,880	2.94
20	Food and Kindred Products	24,580	12.29
22	Textile Mill Products	1,320	0.66
24	Lumber and Wood Products	1,218,000	609.00
25	Furniture and Fixtures	5,040	2.52
26	Paper and Allied Products	619,020	309.51
27	Printing and Publishing	24,140	12.07
28	Chemical and Allied Products	2,379,080	1,189.54
29	Petroleum Refining and Related Industries	246,940	123.47
30	Rubber and Misc. Plastic Products	396,640	198.32
32	Stone, Clay, Glass, and Concrete Products	118,580	59.29
33	Primary Metal Industry	39,853,760	19,926.88
34	Fabricated Metal Products	3,347,060	1673.53

Source: 1988 DEQ Quarterly Reports

Table 2

Quantity of Hazardous Waste Generated by Industry Group

SIC Code	Industry Group	Quantity of Hazardous Waste Generated (in pounds)	Quantity of Hazardous Waste Generated (in tons)
35	Industrial and Commercial Machinery	360,580	180.29
36	Electronic and Electrical Equipment	6,309,980	3,154.99
37	Transportation Equipment	9,883,580	4,941.79
38	Instruments and Related Products	6,372,320	3,186.16
39	Misc. Manufacturing Industries	4,780	2.39
40	Railroad Transportation	181,540	90.77
41	Local and Suburban Transit and Interurban Highway Passenger Transportation	34,620	17.31
42	Motor Freight Transportation and Warehousing	460,920	230.46
43	US Postal Service	3,740	1.87
44	Water Transportation	1,320	0.66
45	Air Transportation	10,540	5.27
47	Transportation Services	168,840	84.42
48	Communications	63,480	31.74
49	Electric, Gas, Sanitary Services	3,261,020	1,630.51
50	Wholesale Trade - Durables	388,640	194.32
51	Wholesale Trade - Nondurables	113,280	56.64

Source: 1988 DEQ Quarterly Reports

Table 2

Quantity of Hazardous Waste Generated by Industry Group

SIC Code	Industry Group	Quantity of Hazardous Waste Generated (in pounds)	Quantity of Hazardous Waste Generated (in tons)
52	Building Materials, Hardware, Garden Supplies, Mobile Home Dealers	19,720	9.86
53	General Merchandise Stores	6,620	3.31
54	Food Stores	140	0.07
55	Automotive Dealers and Gasoline Service Stations	321,340	160.67
59	Misc. Retail	5,320	2.66
67	Holding and Investment Offices	1,900	0.95
72	Personal Services	2,080	1.04
73	Business Services	286,120	143.06
75	Automotive Repair	81,520	40.76
76	Misc. Repair Services	29,580	14.79
80	Health Services	25,100	12.55
82	Educational Services	917,660	458.83
86	Membership Organizations	208,700	104.35
87	Engineering, Accounting, Research, Management Services	880	0.44
89	Services, NEC	10,420	5.21
91	Executive, Legislative, and General Government	50,220	25.11
92	Justice, Public Order, and Safety	17,780	8.89

Source: 1988 DEQ Quarterly Reports

Table 2

Quantity of Hazardous Waste Generated by Industry Group

SIC Code	Industry Group	Quantity of Hazardous Waste Generated (in pounds)	Quantity of Hazardous Waste Generated (in tons)
94	Administration of Human Resource Programs	460	0.23
95	Administration of Environmental Quality	2,329,920	1,164.96
96	Administration of Economic Programs	132,220	66.11
97	National Security	11,600	5.80
	Total	82,398,420	41,199.21

Source: 1988 DEQ Quarterly Reports

Table 3:
Quantity of Hazardous Waste Generated and Manifested
(Transported) Off-site by RCRA Waste Code

RCRA Waste Code	Transported (Tons)	Transported (Pounds)	Totals by RCRA Waste Code (Pounds)
D001	1,761.92	3,523,840	
D002	3,092.98	6,185,960	
D003	46.92	93,840	
D004	85.12	170,240	
D005	1,796.26	3,592,520	
D006	948.05	1,896,100	
D007	1,495.25	2,990,500	
D008	1,244.33	2,488,660	
D009	0.78	1,560	
D010	11.14	22,280	
D013	7.50	15,000	
D014	39.25	78,500	
D016	35.39	70,780	
		Total D Wastes:	21,129,780
F001	764.89	1,529,780	
F002	357.26	714,520	
F003	698.45	1,396,900	
F005	102.65	205,300	
F006	2,643.94	5,287,880	
F008	3.21	6,420	
F009	17.37	34,740	
F011	0.03	60	
F019	51.20	102,400	
		Total F Wastes:	9,278,000
K001	212.80	425,600	
K061	7,192.56	14,385,120	
K088	6,236.93	12,473,860	
		Total K Wastes:	27,284,580

Source: 1988 DEQ Quarterly Reports

Table 3:
Quantity of Hazardous Waste Generated and Manifested (Transported) Off-site by RCRA Waste Code

RCRA Waste Code	Transported (Tons)	Transported (Pounds)	Totals by RCRA Waste Code (Pounds)
U051	1.36	2,720	
U060	0.62	1,240	
U080	0.82	1,640	
U121	0.05	100	
U122	0.66	1,320	
U134	0.19	380	
U151	1.56	3,120	
U188	2.06	4,120	
U190	2.90	5,800	
U210	0.69	1,380	
U226	0.13	260	
U228	52.00	104,000	
U239	0.50	1,000	
		Total U Wastes:	127,080
P108	0.40	800	
P020	0.57	1,140	
P039	0.25	500	
		Total P Wastes:	2,440
X001	188.46	376,920	
X002	1,664.67	3,329,340	
X003	38.01	76,020	
X004	6,327.42	12,654,840	
X005	1.31	2,620	
X006	3.12	6,240	
X007	207.13	414,250	
		Total X Wastes:	16,860,230

Source: 1988 DEQ Quarterly Reports

Table 4

Quantity of Toxic Substances Released to Each Medium by Industry Group

SIC Code	Fugitive or Non-point Air Emissions	Stack or Point-Source Air Emissions	Discharges to Water Bodies	Underground Injection	Releases to Land	Discharges to POTWs	Releases to Other Off-Site Location
20	94,541	10,000	1,000	0	257,488	16,629	0
22	0	0	0	0	0	12,000	0
24	1,205,076	1,243,475	2,839	0	10,092	250	105,571
25	19,969	0	0	0	0	0	0
26	1,193,543	4,384,058	210,325	0	580,113	6,367,418	982,477
27	16,140	5,746	0	0	0	0	851
28	654,391	1,838,302	5,029	1	169	6,388	49,764
29	3,923	3,750	501	0	0	1,000	66
30	626,019	667,563	10,054	0	0	1	23,257
31	1,000	250	0	0	0	72,800	17,500
32	750	44,820	0	0	0	250	99,300
33	2,370,341	1,407,382	106,134	0	4,921,657	63,053	8,289,437
34	198,873	275,181	500	0	0	49,625	60,673
35	101,104	260,552	0	0	0	0	121,900
36	137,442	257,321	393	0	0	336,612	330,778
37	725,027	735,273	0	0	5,400	225	187,026
38	27,128	3,434,479	0	0	0	150,144	40,121
39	201,375	0	0	0	0	0	0
51	2,480	0	0	0	0	0	540

Source: 1988 Toxic Release Inventory System Reports

Table 5

Composition of Releases by Industry Code

SIC Code	Toxic Substance	Quantity Released
20	Ammonia	341,329
	Phosphoric Acid	16,629
	Isopropyl Alcohol	16,000
	Chlorine Dioxide	4,200
	Chlorine	1,500
22	Ammonia Sulfate	12,000
24	Toluene	727,975
	Formaldehyde	464,062
	Acetone	443,486
	Xylene	298,340
	Ammonia	150,341
	Methanol	145,557
	Methyl Ethyl Ketone	143,600
	Methyl Isobutyl Ketone	92,000
	1,1,1-Trichloroethane	30,300
	Phenol	27,100
	Naphthalene	13,030
	Dibenzofuran	9,990
	Pentachlorophenol	8,516
	Anthracene	6,117
	Copper	1,496
	Ammonium Nitrate	750
	Arsenic	671
	Zinc	659
	Copper Compounds	542
	Phosphoric Acid	502
	Hydrochloric Acid	500
	Chromium Compounds	500
	Methylenebis	500
	Chromium	250
	Sulfuric Acid	250
	Ammonium Sulfate	250
	Biphenyl	211
	Arsenic Compounds	55
	Zinc Compounds	3

Table 5 (continued)

SIC Code	Toxic Substances	Quantity Released
25	Methyl Ethyl Ketone	9,646
	Toluene	9,022
	Xylene	1,301
26	Methanol	8,872,930
	Chlorine	875,278
	Toluene	778,000
	Chloroform	750,721
	Chlorine Dioxide	640,255
	PCBs	590,482
	Ammonia	252,392
	Acetone	248,255
	Zinc	176,000
	Sulfuric Acid	156,860
	Catechol	118,881
	Formaldehyde	102,317
	Glycol Ethers	64,000
	Chromium	23,730
	1,1,1-Trichloroethane	22,300
	Ammonium Nitrate	12,000
	Copper	11,950
	Chromium Compounds	9,800
	Phenol	6,383
	Hydrochloric Acid	4,650
	Propylene	250
	Copper Compounds	250
	Barium Compounds	250
27	1,1,1-Trichloroethane	22,737
28	Methanol	1,033,815
	Ammonia	594,878
	Acetone	235,417
	Formaldehyde	159,419
	Styrene	110,945
	Xylene	98,793
	Toluene	85,624
	Methyl Ethyl Ketone	51,777
	Dichloromethane	42,767
	Phenol	36,216
	Chlorine	34,800
	Dimethyl Phthalate	15,610
	Ammonium Nitrate	15,600
	1,2,4 Trimethylbenzene	6,538
	Hydrochloric Acid	5,401
	Glycol Ethers	2,964
	Epichlorohydrin	2,564

Table 5 (continued)

SIC Code	Toxic Substance	Quantity Released
28 (cont.)	Ethylene Glycol	2,540
	1,1,1 Trichloroethane	2,310
	Vinyl Acetate	2,000
	Nitric Acid	1,800
	Maleic Anhydride	1,525
	NA	1,500
	Sulfuric Acid	1,438
	Methyl Isobutyl Ketone	1,402
	Barium Compounds	1,107
	Butyl Acrylate	1,000
	Methyl Methacrylate	1,000
	Phthalic Anhydride	750
	Chromium Compounds	534
	Dibutyl Phthalate	500
	Methyl Acrylate	500
	Copper Compounds	500
	Toluene-2,4-Diisocyanate	250
	Lead Compounds	250
	Methylenebis	9
	Butyl Benzyl Phthalate	1
29	Cyclohexane	2,423
	Benzene	1,750
	Toluene	1,250
	Xylene	750
	Ethylene Glycol	750
	Methanol	750
	Cumene	500
	Ethylbenzene	500
	1,2,4-Trimethylbenzene	500
	Asbestos	66
	Zinc Compounds	1
30	Trichloroethylene	484,692
	Dichloromethane	435,222
	Styrene	237,725
	Acetone	106,754
	Di(2-ethylhexyl)Phthalate	28,264
	1,1,1-Tricholorethane	11,451
	Sulfuric Acid	10,160
	Methylenebis	5,826
	Decabromodiphenyloxide	3,650
	Antimony Compounds	2,150
	Aluminum Oxide	500
	Toluene-2,6-Diisocyanate	250
	Toluene-2,4-Diisocyanate	250

Table 5 (*continued*)

SIC Code	Toxic Substance	Quantity Released
31	Ammonia	70,150
	Chromium	20,900
	Sulfuric Acid	500
32	Aluminum Oxide	97,020
	Dichloromethane	43,800
	Zinc Compounds	2,400
	Barium Compounds	1,900
33	Aluminum Oxide	11,583,923
	Zinc Compounds	1,807,750
	Zinc	494,450
	Lead Compounds	363,250
	Trichloroethylene	358,258
	Freon 113	347,171
	Chromium Compounds	261,882
	Methyl Isobutyl Ketone	205,950
	Glycol Ethers	197,326
	Cyanide Compounds	191,947
	Manganese	178,350
	Hydrogen Fluoride	158,858
	Chlorine	151,720
	1,1,1-Trichlorothane	135,450
	Ammonia	122,500
	Compound Beta	101,327
	Barium Compounds	95,250
	Nickel Compounds	63,958
	Cobalt Compounds	51,403
	Lead	43,750
	Hydrochloric Acid	36,590
	Aluminum	32,305
	Copper Compounds	30,895
	Acetone	26,918
	N-Butyl Alcohol	19,600

Table 5 (continued)

SIC Code	Toxic Substance	Quantity Released
33 (cont.)	Methyl Ethyl Ketone	17,000
	Chromium	15,650
	Phenol	11,850
	Manganese Compounds	11,511
	Dichloromethane	8,000
	Nitric Acid	6,931
	Butyl Benzyl Phthalate	6,872
	Nickel	6,700
	Tetrachloroethylene	6,177
	Copper	3,376
	Sulfuric Acid	1,493
	Methylenebis	913
	Titanium Tetrachloride	500
	Ethylene Glycol	250
34	Trichloroethylene	125,744
	Toluene	107,324
	Xylene	98,699
	Methyl Ethyl Ketone	62,479
	1,1,1-Trichlorethane	51,643
	Sulfuric Acid	49,975
	Tetrachloroethylene	34,900
	Copper Compounds	14,250
	Methyl Isobutyl Ketone	14,048
	N-Butyl Alcohol	11,976
	Hydrochloric Acid	4,011
	Nitric Acid	3,969
	Zinc Compounds	3,050
	Cyanide Compounds	750
	Chlorine	750
	Copper	500
	Manganese	250
	Methanol	250
	Zinc	250
	Phosphoric Acid	24
	Ammonia	10
35	Freon 113	117,802
	1,1,1-Trichloroethane	108,712
	Aluminum Oxide	73,500
	Dichloromethane	66,250
	Hydrochloric Acid	42,000
	Xylene	40,413
	Toluene	34,879

Table 5 (*continued*)

SIC Code	Toxic Substance	Quantity Released
36	Sulfuric Acid	353,133
	Acetone	206,840
	Freon 113	135,648
	Glycol Ethers	49,259
	Hydrochloric Acid	48,348
	Ammonia	44,326
	Nitric Acid	37,328
	Methanol	35,050
	1,1,1-Trichloroethane	30,585
	Xylene	22,774
	Lead Compounds	21,845
	Trichloroethylene	21,197
	Copper Compounds	15,500
	Hydrogen Fluoride	14,060
	Ethylene Glycol	13,413
	Formaldehyde	6,950
	Phosphoric Acid	3,691
	Copper	2,535
	Chromium	42
	Antimony	22
37	Styrene	500,157
	Acetone	358,141
	1,1,1-Trichloroethane	293,361
	Toluene	211,211
	Methyl Ethyl Ketone	168,690
	Xylene	39,364
	Chromium Compounds	22,584
	N-Butyl Alcohol	14,965
	Cyanide Compounds	11,233
	Methanol	11,032
	Ethylene Glycol	9,400
	Asbestos	5,400
	Glycol Ethers	2,116
	Methyl Methacrylate	1,980
	Manganese	1,772
	Chromium	750
	Nickel	750
	Hydrogen Fluoride	25
	Sulfuric Acid	20

Table 5 (continued)

SIC Code	Toxic Substance	Quantity Released
38	Acetone	1,824,213
	Toluene	470,532
	Methyl Ethyl Ketone	468,105
	Freon 113	197,252
	Glycol Ethers	154,864
	N-Butyl Alcohol	90,500
	1,1,1-Trichloroethane	53,799
	Trichloroethylene	26,858
	Copper Compounds	26,500
	Tetrachloroethylene	8,429
	Hydrochloric Acid	250
	Sulfuric Acid	250
	Nitric Acid	250
39	Styrene	201,375
51	Xylene	2,480
	2,4-D	540

The shaded area includes those chemicals comprising the "Other" category in Figure 3-11b

Source: 1988 Toxic Release Inventory System Reports