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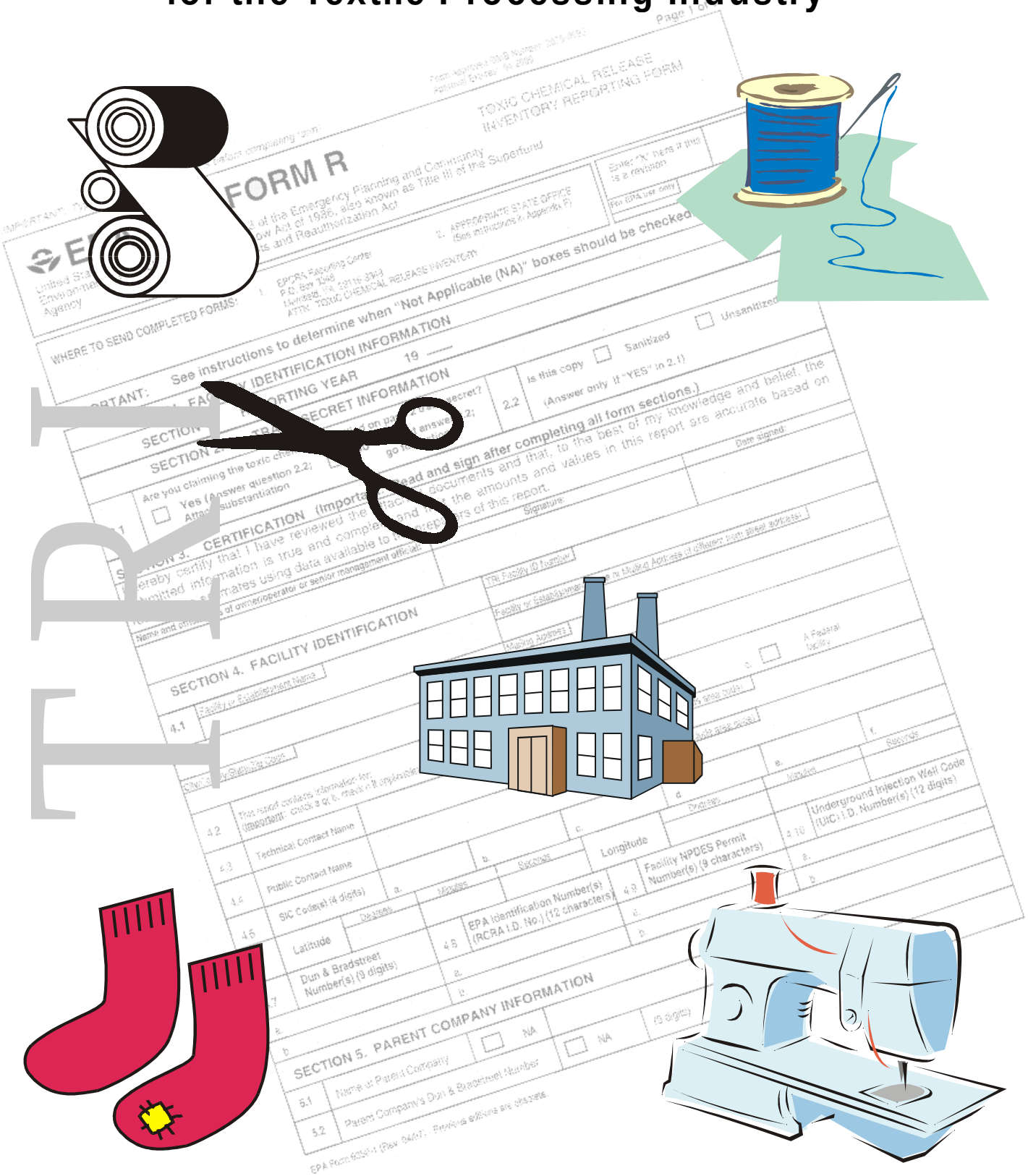
Emergency Planning and Community Right-To-Know Act Section 313 Reporting Guidance for the Textile Processing Industry



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ACKNOWLEDGMENT

The U.S. EPA wishes to acknowledge the valuable contributions made by the staff and members of the American Textile Manufacturers Institute (ATMI). Without the insight provided by those in the industry with actual experience in the fulfilling of the EPCRA Section 313 reporting requirements we would not have been able to produce a document that we believe will be of great assistance to those who must prepare future EPCRA Section 313 reports. Special thanks go to Ms. Stephanie Janczuk, Government Relations Associate, ATMI.

OVERVIEW

This document supersedes the booklet entitled *Title III Section 313 Release Reporting Guidance, Estimating Chemical Releases From Textile Dyeing*, dated February 1988. It is intended to assist establishments and facilities in the Textile Manufacturing Industry in complying with the Emergency Planning and Community Right-To-Know Act (EPCRA) Section 313 and Pollution Prevention Act (PPA) Section 6607 reporting requirements, the preparation of Form R or the alternate certification statement, Form A. The EPCRA Section 313 program is commonly referred to as the Toxic Chemical Release Inventory (TRI).

The principal differences in this new document include:

- More detailed examples;
- New EPCRA Section 313 regulations and guidance developed since 1988;
- PPA Section 6607 reporting requirements;
- U.S. Environmental Protection Agency's (EPA's) interpretive guidance on various issues specific to textile manufacturing; and
- EPCRA Section 313 issues regarding processes not discussed in the earlier document.

This document is designed to be a supplement to the annual issue of the *Toxic Chemical Release Inventory Reporting Forms and Instructions*, (*TRI Forms and Instructions)*. It is organized to provide a step-by-step guide to compliance with EPCRA Section 313, starting with how to determine if your facility must report and ending with guidance for estimating release and other waste management quantities.

The textile manufacturing process begins with spinning natural and man-made fibers into yarns and threads. These are then converted (by weaving and knitting) into fabrics. The fabrics, and in some cases the yarns and threads used to make them, are dyed and finished. Fabrics may then proceed through additional processing steps designed to fabricate textile products such as carpets, rugs, curtains, linens, apparel, and canvas.

Chapter 1 introduces EPCRA Section 313 and PPA Section 6607 reporting and provides a brief background on Section 313 of EPCRA and Section 6607 of PPA.

Chapter 2 discusses reporting requirements and begins with how to determine if your facility must report. This determination is based on your answers to a series of four questions:

- Is your facility's primary Standard Industry Classification (SIC) Code on the EPCRA Section 313 list?
- Does your facility employ ten or more full-time employees or the equivalent?
- Does your facility manufacture, process, or otherwise use any EPCRA Section 313 chemicals or chemical categories?
- Does your facility exceed any of the activity thresholds for an EPCRA Section 313 chemical or chemical category?

If the answer to ANY ONE of the first three questions is "No" you are not required to submit an EPCRA Section 313 report for any chemicals. If you answer "yes" to the first three questions and "no" to the fourth, you are not required to submit an EPCRA Section 313 report for that chemical or chemical category. If you answer "Yes" to ALL four questions, the next step is to determine what kind of report you must prepare, a Form R or the alternate certification statement, Form A. Chapter 2 provides detailed information on the requirements for each kind of report. Chapter 2 concludes with a discussion on how to address trade secrets and the records that you should keep to support your reporting.

Chapter 3 discusses how to calculate the activity thresholds (manufacture, process, and otherwise use) for the EPCRA Section 313 chemicals. Information is provided on how to determine which EPCRA Section 313 chemicals your facility manufactures, processes, or otherwise uses and how to calculate the quantities of each. Detailed information is also provided on the various exemptions:

- *De minimis* exemption;
- Article exemption;
- Facility-related exemption; and
- Activity-related exemptions.

Chapter 3 concludes with a discussion of how to determine which EPCRA Section 313 chemicals and chemical categories exceed a reporting threshold.

Chapter 4 discusses how to estimate the release and other waste management amounts for those EPCRA Section 313 chemicals and chemical categories for which you must prepare a report. The first part of this chapter provides a step-by-step approach designed to minimize the risk of overlooking an activity involving an EPCRA Section 313 chemical or chemical category and any potential sources or types of release and other waste management activities. This procedure consists of:

- Preparation of a detailed **process flow diagram**;
- Identification of EPCRA Section 313 chemicals and chemical categories and potential **sources** of chemical release and other waste management activities;
- Identification of the potential **types** of release and other waste management activities from each source; and
- Determination of the most appropriate methods for **estimating the quantities** of EPCRA Section 313 chemical and chemical category release and other waste management activities.

The second part of Chapter 4 is organized to follow the steps above as they pertain to textile manufacturing. The commonly used EPCRA Section 313 chemicals and chemical categories, process descriptions, release and other waste management estimates, example calculations, and common problems are presented.

This document includes examples and common errors applicable to textile manufacturing. These examples are based on information received from representatives of the American Textile Manufacturers Institute, questions received by the EPCRA Hotline, and questions identified during voluntary site surveys of facilities that have filed EPCRA Section 313 reports in the past.

CHAPTER 1 - INTRODUCTION

1.0 PURPOSE

The purpose of this guidance manual is two-fold. The primary purpose is to assist textile manufacturing facilities in complying with the reporting requirements of Section 313 of the Emergency Planning and Community Right-to-Know Act of 1986 (EPCRA) and of Section 6607 of the Pollution Prevention Act of 1990 (PPA). This manual explains the EPCRA Section 313 reporting requirements and discusses specific release and other waste management activities encountered at many textile manufacturing facilities. Since each plant is unique, the recommendations presented may have to be modified for your particular facility. The secondary purpose is to provide information to other interested parties (such as management, legal professionals, inspectors, consultants, teachers, students, and the general public) about the processes and some of the toxic chemicals used in this industry.

This manual is intended solely for guidance and does not alter any statutory or regulatory requirements. The document should be used in conjunction with the appropriate statutes and regulations but does not supersede them. Accordingly, the reader should consult other applicable documents (for example, the statute, the Code of Federal Regulations (CFR), relevant preamble language, and the current *Toxic Chemical Release Inventory Reporting Forms and Instructions* (*TRI Forms and Instructions*)).

This document supersedes the 1988 document entitled *Title III Section 313 Release Reporting Guidance, Estimating Chemical Releases From Textile Dyeing.* This new document includes:

- More detailed examples;
- New EPCRA Section 313 regulations and guidance developed since 1988;
- PPA Section 6607 reporting requirements;
- U.S. Environmental Protection Agency's (U.S. EPA's) interpretive guidance on various issues specific to textile manufacturing; and
- EPCRA Section 313 issues regarding processes not discussed in the earlier document.

It is intended to supplement the *TRI Forms and Instructions* document that is updated and published annually by U.S. EPA. It is essential that you use the current version of the *TRI Forms and Instructions* to determine if (and how) you should report. Changes or modifications to EPCRA Section 313 reporting requirements are reflected in the annual *TRI Forms and Instructions* and should be reviewed before compiling information for the report.

The objectives of this manual are to:

- Reduce the level of effort expended by those facilities that prepare an EPCRA Section 313 report; and
- Increase the accuracy and completeness of the data being reported.

U.S. EPA cannot anticipate every potential issue or question that may apply to your facility. Therefore, this manual attempts to address those issues most prevalent or common for textile manufacturing. Used in conjunction with the most current *TRI Forms and Instructions* and *Estimating Release and Waste Treatment Efficiencies for the Toxic Chemical Release Inventory Form (1999 version)*, facilities should be able to provide complete and accurate information for EPCRA Section 313 reporting. Additional discussions on specific issues can be found in U.S. EPA's current edition of *EPCRA Section 313, Questions and Answers* (the 1998 edition is EPA 745-B-98-004), which is available on the U.S. EPA's TRI website (**http://www.epa.gov/tri**) or by contacting the **EPCRA Hotline at 1-800-424-9346.**

In the Washington, DC metropolitan area, call 703-412-9810.

1.1 Background on EPCRA Section 313 and PPA Section 6607

The following overview of EPCRA Section 313 and Section 6607 of the PPA, will provide you with a basic understanding of the objectives and requirements of this program, and will help you in completing your forms.

One of the primary goals of EPCRA is to increase the public's knowledge of, and access to, information on both the presence of toxic chemicals in their communities and on releases into the environment and other waste management activities of those chemicals. EPCRA Section 313 requires certain designated businesses (see SIC Code discussion, Chapter 2, Section 2.2) to submit annual reports (commonly referred to as Form R reports and Form A reports) on over 600 EPCRA Section 313 chemicals and chemical categories. Covered facilities report the amounts released or otherwise managed as waste. However, if a facility meets the reporting criteria for listed toxic chemicals, the facility must report even if there are no releases or other waste management quantities associated with these chemicals. Throughout this document, whenever EPCRA Section 313 chemicals are discussed, the discussion includes chemical categories as appropriate. Chemicals or chemical categories may be added or deleted from the list. Therefore, before completing your annual report, be sure to check the most current list included with the *TRI Forms and Instructions* when evaluating the chemicals and chemical categories present at your facility. Copies of the reporting package can be requested from the EPCRA Hotline, 1-800-424-9346.

All facilities meeting the EPCRA Section 313 reporting criteria must report the annual release and other waste management activity quantities (routine and accidental) of EPCRA Section 313 chemicals and chemical categories to all environmental media. A separate report is required for each EPCRA Section 313 chemical or chemical category that is manufactured (including imported), processed, or otherwise used above the reporting threshold. The reports must be submitted to U.S. EPA and State or Tribal governments, on or before July 1, for activities in the previous calendar year. The owner/operator of the facility on July 1 is primarily responsible for the report, even if the owner/operator did not own the facility during the reporting year. However, property owners with no business interest in the operation of the facility, other than a lessor interest, are exempt from reporting requirements.

EPCRA also mandates U.S. EPA to establish and maintain a publicly available database system consisting of the information reported under Section 313 and under Section 6607 of the PPA. This database, known as the Toxic Chemical Release Inventory (TRI) database, can be accessed through the following sources:

- U.S. EPA Internet site, http://www.epa.gov/tri;
- Envirofacts Warehouse Internet site, http://www.epa.gov/enviro/; and
- Right-to-Know Network, http://www.rtk.net/trisearch.html.

However, information qualifying as a trade secret, in accordance with the regulatory requirements, is protected from public release. In addition to being a resource for the public, TRI data are also used in the research and development of regulations related to EPCRA Section 313 chemicals and chemical categories.

To reduce the reporting burden for small businesses, U.S. EPA established an alternate activity threshold of one million pounds manufactured, processed, or otherwise used for facilities with total annual reportable amounts of 500 pounds or less for each EPCRA Section 313 chemical or chemical category. Provided the facility does not exceed either the reportable amount or the alternate threshold, the facility may file a certification form (Form A) rather than a Form R. By filing the Form A, the facility certifies that they do not exceed the reportable amount of 500 pounds or exceed the alternate threshold of one million pounds for the respective chemical or chemical category.

Note that the annual reportable amount includes the quantity of EPCRA Section 313 chemical or chemical category in all production-related waste management activities, not just releases (see the discussion in Section 2.8 for more detail). Also note that either a Form A or a Form R, but not both, must be submitted for each EPCRA Section 313 chemical or chemical category above any reporting threshold, even if there are zero release and other waste management quantities.

Violation of EPCRA Section 313 reporting provisions may result in federal civil penalties of up to $27,500 per day for each violation (61 FR 69360). State enforcement provisions may also be applicable depending on the state's EPCRA Section 313 reporting regulations.

Members of the American Textile Manufacturers Institute provided input on common problems, specific to textile manufacturing, encountered by those completing the EPCRA Section 313 reports. U.S. EPA has combined this input with questions forwarded to the

EPCRA Hotline and those identified during voluntary site surveys of facilities that have filed EPCRA Section 313 reports in the past. Selected issues and guidance addressing these common problems are presented throughout this document as applicable.

The *TRI Forms and Instructions* and *The 1994 and 1995 Toxic Release Inventory Data Quality Report*, EPA 745-R-98-002 also contains discussions of common problems in completing the EPCRA Section 313 reports. You are encouraged to read both documents before filling out the Form R (or Form A) for your facility.

If, after reading this manual, you still have questions about EPCRA Section 313 reporting, please contact the EPCRA Hotline at 1-800-424-9346 or refer to the U.S. EPA's TRI website, http://www.epa.gov/tri. Assistance is also available from the designated EPCRA Section 313 Coordinator in the U.S. EPA regional office and the EPCRA contact in your state (see the *TRI Forms and Instructions* for a current list of these contacts). Additional guidance is also available in the resources listed in Appendix A.

CHAPTER 2 - REPORTING REQUIREMENTS

2.0 PURPOSE

The purpose of this chapter is to help you determine if you must prepare an EPCRA Section 313 report(s) and, if so, what kind of report(s) should be prepared (Form R or the alternate certification statement, the Form A). This chapter presents the EPCRA Section 313 reporting requirements to help you determine if these requirements apply to your facility. It also discusses the reporting of trade secrets and the records that must be kept.

To understand the following discussion you must first understand how EPCRA defines a facility. The term "facility" is defined as, "all buildings, equipment, structures, and other stationary items which are located on a single site or on contiguous or adjacent sites and which are owned or operated by the same person (or by any person who controls, who is controlled by, or who is under common control with such person)." A facility may contain more than one "establishment" (40 CFR 372.3). An "establishment" is defined as, "an economic unit, generally at a single physical location, where business is conducted, or where services or industrial operations are performed" (40 CFR 372.3).

U.S. EPA recognizes that for business reasons it may be easier and more appropriate for establishments at one facility to report separately. However, the combined quantities of EPCRA Section 313 chemicals and chemical categories manufactured, processed, or otherwise used in all establishments making up that facility must be considered for threshold determinations. Also, the combined release and other waste management activities reported singly for each establishment must total those for the facility as a whole.

Note that if a facility is comprised of more than one establishment, once an activity threshold is met by the facility, providing the facility meets the SIC Code and employee threshold criteria, release and other waste management activities from <u>all</u> establishments at the facility must be reported.

Example - Multiple Establishments

Your facility has several different establishments, all with SIC Codes covered by EPCRA Section 313. One establishment used 7,000 pounds of toluene, an EPCRA Section 313 chemical, during the year to clean equipment. Another establishment purchased and used 4,000 pounds of toluene during the year as a solvent to separate a component from a mixture with recovery of toluene for reuse. Both activities constitute otherwise use of the EPCRA Section 313 chemical (as presented in Section 2.5 and described in detail in Chapter 3) and the total for the facility exceeded the 10,000-pound otherwise use threshold for the year. Thus, if your facility meets the employee threshold, you must file one Form R for toluene from your facility, or two Form Rs, one from each establishment. **Please note that you may be eligible to file one Form A for the facility but you cannot file a separate Form A for each establishment.**

2.1 Must You Report?

How do you determine if your facility must prepare an EPCRA Section 313 report? Your answers to the following four questions will help you decide (illustrated by Figure 2-1):

1) Is the primary SIC Code for your facility included in the list covered by EPCRA Section 313 reporting (see Section 2.2)?

2) Does your facility have 10 or more full-time employees or the equivalent (see Section 2.3)?

3) Does your facility manufacture (which includes importation), process, or otherwise use EPCRA Section 313 chemicals or chemical categories (see Section 2.4)?

4) Does your facility exceed any applicable thresholds of EPCRA Section 313 chemicals or chemical categories (for non-PBT chemicals: 25,000 pounds per year for manufacturing; 25,000 pounds per year for processing; or 10,000 pounds per year for otherwise use - see Section 2.5; for PBT chemicals - see Section 2.6 for applicable thresholds)?

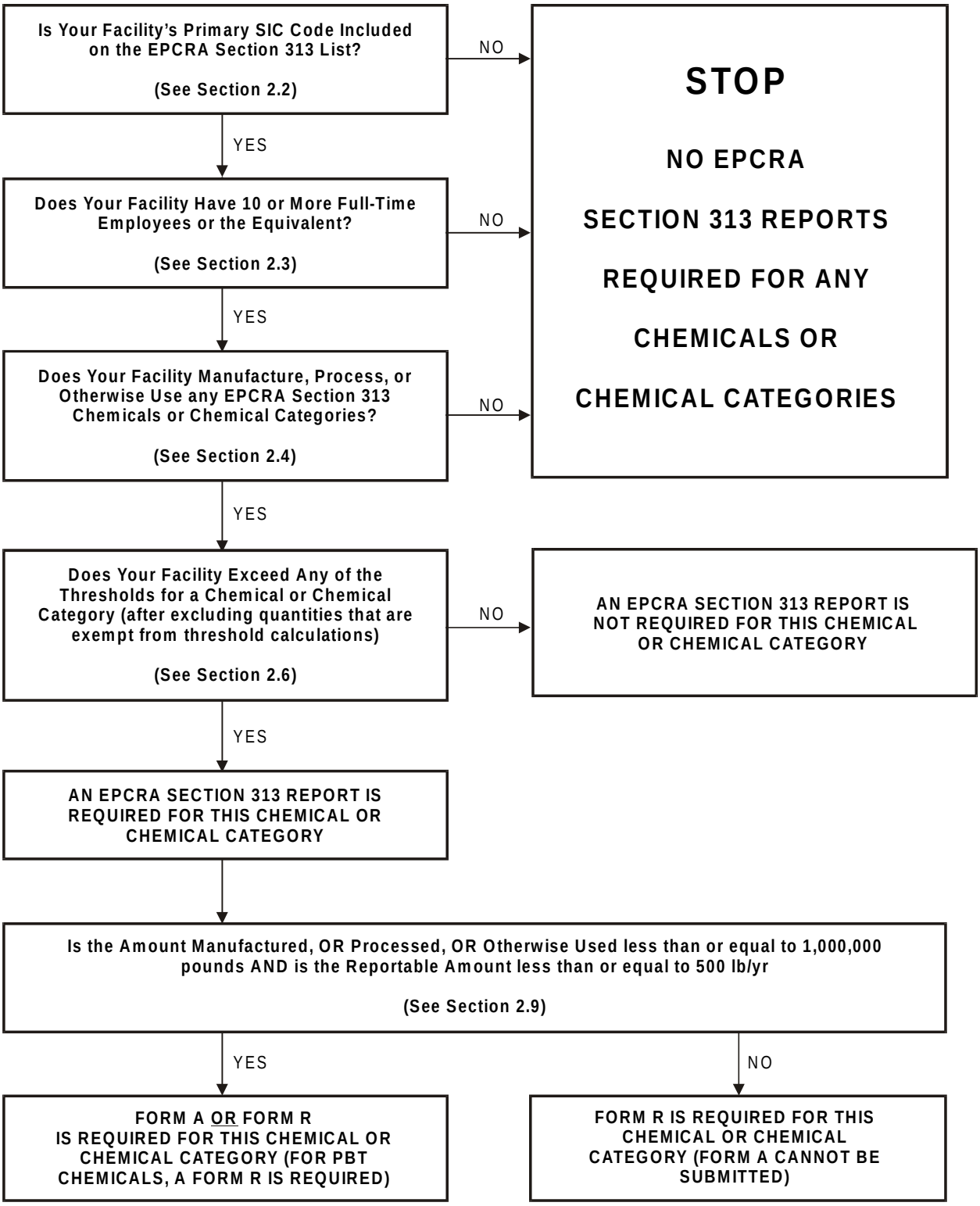

Figure 2-1. EPCRA Section 313 Reporting Decision Diagram

If you answered "No" to any of the first three questions, you are not required to prepare any EPCRA Section 313 reports. If you answered "Yes" to ALL of the first three questions, you must complete a threshold calculation for each EPCRA Section 313 chemical and chemical category at the facility, and submit an EPCRA Section 313 report for each chemical and chemical category exceeding the applicable threshold.

2.2 SIC Code Determination

Facilities with the SIC Codes presented in Table 2-1 are covered by the EPCRA Section 313 reporting requirements.

Table 2-1

SIC Codes Covered by EPCRA Section 313 Reporting

SIC Code Major Groups		
SIC Codes	**Industry**	**Qualifiers**
10	Metal Mining	Except SIC Codes 1011, 1081, and 1094
12	Coal Mining	Except SIC Code 1241
20 through 39	Manufacturing	None
4911, 4931, and 4939	Electric and Other Services and Combination Utilities	Limited to facilities that combust coal and/or oil for the purpose of generating electricity for distribution in commerce
4953	Refuse Systems	Limited to facilities regulated under RCRA Subtitle C
5169	Chemicals and Allied Products	None
5171	Petroleum Bulk Stations and Terminals	None
7389	Business Services	Limited to facilities primarily engaged in solvent recovery services on a contract or fee basis

Table 2-2 presents a listing of each four-digit SIC Code for textile manufacturing facilities, with brief descriptions. You should determine the SIC Code(s) for your facility, based on the activities on site. For assistance in determining which SIC Code best suits your facility refer to *Standard Industrial Classification Manual, 1987* published by the Office of Management and Budget.

Table 2-2

SIC Codes for Textile Manufacturing Facilities

SIC Code	Description
2211	Broadwoven Fabric Mills, Cotton
2221	Broadwoven Fabric Mills, Man-Made Fiber and Silk
2231	Broadwoven Fabric Mills, Wool (including Dyeing and Finishing)
2241	Narrow Fabric and Other Smallwares Mills: Cotton, Wool, Silk, and Man-Made Fiber
2251	Women's Full-Length and Knee-Length Hosiery, Except Socks
2252	Hosiery, Not Elsewhere Classified
2253	Knit Outerwear Mills
2254	Knit Underwear and Nightwear Mills
2257	Weft Knit Fabric Mills
2258	Lace and Warp Knit Fabric Mills
2259	Knitting Mills, Not Elsewhere Classified
2261	Finishers of Broadwoven Fabrics, Cotton
2262	Finishers of Broadwoven Fabrics, Man-Made Fiber and Silk
2269	Finishers of Textiles, Not Elsewhere Classified
2273	Carpet and Rug Mills
2281	Yarn Spinning Mills
2282	Yarn Texturizing, Throwing, Twisting, and Winding Mills
2284	Thread Mills
2295	Coated Fabrics, not Rubberized
2296	Tire Cord and Tire Fabric Mills
2297	Nonwoven Fabric Mills
2298	Rope, Cordage, and Twine Mills
2299	Textile Goods, Not Elsewhere Classified

Note that auxiliary facilities can assume the SIC Code of another covered establishment if the primary function is to support the covered establishment's operations. For the purpose of EPCRA Section 313, auxiliary facilities are defined as those that are primarily engaged in performing support services for another covered establishment, or multiple establishments of a covered facility, and are in a different physical location from the primary facility. In addition, auxiliary facilities perform an integral role in the primary facility's activities. In general, the auxiliary facility's basic administrative services (e.g., paperwork,

payroll, employment) are performed by the primary facility. If an auxiliary facility's primary function is to support/service a facility with a covered SIC Code, the auxiliary facility assumes the covered SIC Code as its primary SIC Code and must consider the other reporting requirements (40 CFR Section 372.22) to determine if it must comply with the EPCRA Section 313 reporting requirements. However, if the SIC Code for the primary facility is not covered by EPCRA Section 313, then neither the primary nor the auxiliary facility is required to submit a report.

If your facility has more than one SIC Code (i.e., several establishments with different SIC Codes are owned or operated by the same entity and are located at your facility), you are subject to reporting requirements if:

- All the establishments have SIC Codes covered by EPCRA Section 313; OR
- The total value of the products shipped or services provided at establishments with covered SIC Codes is greater than 50% of the value of the entire facility's products and services; OR
- Any one of the establishments with a covered SIC Code ships and/or produces products or provides services whose value exceeds the value of services provided, products produced, and/or shipped by every other establishment within the facility.

Example - Primary SIC Code

A facility has two establishments. The first establishment performs dyeing and printing operations on textile fabrics and is in SIC Code 2269, which is a covered SIC Code. The second establishment performs textile folding and packaging services and is in SIC Code 7389. SIC Code 7389 is not an EPCRA Section 313 covered SIC Code. The textile product is worth $20/unit as received by the establishment in the covered SIC Code. The facility determines the dyed or printed fabric is worth $70/unit as received by the establishment in the non-covered SIC Code. The finished product value is estimated to be $80/unit. The value added by the establishment in the covered SIC Code ($50/unit) is more than 50% of the product value; therefore, the primary SIC Code is 2269, a covered SIC Code. Thus, the establishment is covered by EPCRA Section 313 reporting and the entire facility is subject to reporting.

A pilot plant within a covered SIC Code is considered a covered facility and is subject to reporting, provided it meets the employee and activity criteria (note that pilot plants are not eligible for the laboratory exemption, which is discussed in Chapter 3). Warehouses on the

same site as facilities in a covered SIC Code, and warehouses that qualify as auxiliary facilities of covered facilities, are also subject to reporting, provided all applicable reporting requirements are met.

While you are currently required to determine your facility's reporting eligibility based on the SIC code system described above, it is important to be aware that the SIC code system will be replaced by a new system in the future. On April 9, 1997 (62 FR 17287), the Office of Management and Budget promulgated the North American Industrial Classification System (NAICS). NAICS is a new economic classification system that replaces the SIC code system as a means of classifying economic activities for economic forecasting and statistical purposes. The transition to the new NAICS may require regulatory actions. As a result, the SIC code system is still required to be used as the mechanism to determine your facility's reporting eligibility. EPA will issue notice in the *Federal Register* to inform you and other EPCRA Section 313 facilities of its plans to adopt the NAICS and how facilities should make their NAICS code determination.

2.3 Number of Employees

If your facility meets SIC Code and activity threshold criteria, you are required to prepare an EPCRA Section 313 report if your facility has 10 or more full-time employees or the equivalent. A full-time employee equivalent is defined as a work year of 2,000 hours. If your facility's employees hours total 20,000 or more hours in a calendar year, you meet the 10 or more employee threshold criterion.

The following information should be included in your employee calculations:

- Owners;
- Operations/manufacturing staff;
- Clerical staff;
- Temporary employees;
- Sales personnel;
- Truck drivers (employed by the facility);
- Other non-manufacturing or off-site facility employees directly supporting the facility;

- Paid vacation and sick leave; and
- Contractor employees (maintenance, construction, etc. but excluding contracted truck drivers and minor intermittent service vendors (e.g., trash handlers)).

In general, if an individual is employed or hired to work at the facility, all the hours worked by that individual for the facility (including paid leave and overtime) should be counted in determining if the 20,000-hour criterion has been met.

Example - Employee Equivalent Calculation

Your facility has six full-time employees working 2,000 hours/year. You also employ two full-time sales people and a delivery truck driver (employed by the facility) who are assigned to the plant, each working 2,000 hours/year but predominantly on the road or from their homes. The wastewater treatment system (on site and owned by the facility) is operated by a contractor who spends an average of two hours per day and five days per week at the plant. Finally, you built an addition to the plant warehouse during the year, using four contractor personnel who were on site full time for six months (working on average of 1,000 hours each). You would calculate the number of full-time employee equivalents as follows:

- Hours for your nine full-time employees (six plant personnel, two salespeople, and one delivery truck driver) are:
  (9 employees) × (2,000 hours/year) = 18,000 hours/year;

- Hours for the wastewater treatment system operator are:
  (2 hours/day) × (5 days/week) × (52 weeks/year) = 520 hours/year; and

- Hours for the construction crew are:
  (4 contractors) × (1,000 hours) = 4,000 hours/year.

Your facility has a total of 22,520 hours for the year, which is above the 20,000 hours/year threshold; therefore, you meet the employee criterion.

2.4 Manufacturing, Processing, and Otherwise Use of EPCRA Section 313 Chemicals or Chemical Categories

If you are in a covered SIC Code and have 10 or more full-time employee equivalents, you must determine which EPCRA Section 313 chemicals and chemical categories are manufactured, processed, or otherwise used at your facility. You should prepare a list which includes all chemicals and chemical categories found in mixtures and trade name products at all establishments at the facility. This list should then be compared to the CURRENT list of EPCRA Section 313 chemicals and chemical categories found in the *TRI Forms and Instructions* document for that reporting year (also available from the EPCRA Hotline, 1-800-424-9346).

Once you identify the EPCRA Section 313 chemicals and chemical categories at your facility, you must evaluate the activities involving each chemical and chemical category and determine if any activity thresholds have been met.

The original list of chemicals and chemical categories subject to EPCRA Section 313 reporting was a combination of chemical lists from New Jersey and Maryland. Refinements to the list have been made and changes are anticipated to continue. The list can be modified by U.S. EPA initiatives or industry or the public can petition U.S. EPA to modify the list. When evaluating a chemical or chemical category for addition or deletion from the list, U.S. EPA must consider the chemical's potential acute human health effects and chronic human health effects, or its adverse environmental effects. U.S. EPA reviews these petitions and initiates a rulemaking to add or delete the chemical or chemical category from the list, or publishes an explanation why it denied the petition.

Note that chemicals and chemical categories are periodically added, delisted, or modified. Therefore, it is imperative that you refer to the appropriate reporting year's list. You can refer to the U.S. EPA's TRI website, http://www.epa.gov/tri, for updated guidance. Also, note that a list of synonyms for EPCRA Section 313 chemicals and chemical categories can be found in the U.S. EPA publication *Common Synonyms for Chemicals Listed Under Section 313 of the Emergency Planning and Community Right-To-Know Act*, (EPA 745-R-95-008). Table 2-3 lists the EPCRA Section 313 chemicals and chemical categories most frequently reported for textile manufacturing. This list is not intended to be all inclusive and should only be used as a guide.

Table 2-3

EPCRA Section 313 Chemicals and Chemical Categories Commonly Encountered in Textile Manufacturing (SIC Major Group 22)

Process	Chemicals and Chemical Categories
Dyeing/Printing	Ethylene glycol, certain glycol ethers, methanol, copper compounds, chromium compounds
Desizing	Certain glycol ethers
Sizing	Methanol
Scouring	Biphenyl, xylene, certain glycol ethers
Chemical Finishing	Certain glycol ethers, methyl ethyl ketone, formaldehyde
Coating Operations	Dichloromethane, methanol, methyl ethyl ketone, toluene
Article/Formulation Components	Chromium compounds, copper compounds, methanol, antimony compounds
Manufacturing/Processing Aids	Ethylene glycol, methanol, phenol, toluene, xylene, biphenyl
Reactants	Diisocyanates, formaldehyde, methanol, phenol

2.5 Activity Categories

EPCRA Section 313 defines three activity categories for the listed chemicals and chemical categories: manufacturing (which includes importing), processing, and otherwise use. The activity thresholds are 25,000 pounds per year for manufacturing, 25,000 pounds per year for processing, and 10,000 pounds per year for otherwise use[1]. These thresholds apply to each chemical or chemical category individually. The quantity of chemicals or chemical categories stored on site or purchased is not relevant for threshold determinations. Rather, the determination is based solely on the annual quantity actually manufactured (including imported), processed, or otherwise used. Therefore, EPCRA Section 313 chemicals and chemical categories that are brought on site and stored, but are not prepared in the reporting year for distribution in that year or subsequent years or are not otherwise used on site during the reporting year, are not considered towards any activity threshold.

[1]These activity thresholds are for non-PBT chemicals. See Section 2.6 for the activity thresholds applicable to PBT chemicals.

Expanded definitions with examples of each of the three activities are found in Chapter 3, Tables 3-2, 3-3, and 3-4. The terms are briefly defined in Table 2-4.

Table 2-4

Activity Categories

Activity Category	Definition	Threshold[1] (lb/yr)
Manufacture	To produce, prepare, import, or compound an EPCRA Section 313 chemical or chemical category. Manufacture also applies to an EPCRA Section 313 chemical or chemical category that is produced coincidentally during the manufacture, processing, otherwise use, or disposal of another chemical or mixture of chemicals as a byproduct, and an EPCRA Section 313 chemical or chemical category that remains in that other chemical or mixture of chemicals as an impurity during the manufacturing, processing, or otherwise use or disposal of any other chemical substance or mixture.	25,000
Process	To prepare an EPCRA Section 313 chemical or chemical category, or a mixture or trade name product containing an EPCRA Section 313 chemical or chemical category, for distribution in commerce. For example, the addition of an EPCRA Section 313 chemical as a flame retardant for fabric should be reported if you exceeded the reporting threshold. Processing includes the preparation for sale to your customers (and transferring between facilities within your company) of a chemical or formulation that you manufacture. For example, if you manufacture an EPCRA Section 313 chemical or chemical category or product, package it, and then distribute it into commerce, this chemical has been manufactured AND processed by your facility.	25,000

[1]These activity thresholds are for non-PBT chemicals. See Section 2.6 for the activity thresholds applicable to PBT chemicals.

Table 2-4 (Continued)

Activity Category	Definition	Threshold[1] (lb/yr)
Otherwise Use	Generally, use of an EPCRA Section 313 chemical or chemical category that does not fall under the manufacture or process definitions is classified as otherwise use. An EPCRA Section 313 chemical or chemical category that is otherwise used does not function by being incorporated into a product that is distributed in commerce, but may be used instead as a manufacturing or processing aid (e.g., catalyst), in waste processing, or as a fuel (including waste fuel). On May 1, 1997 U.S. EPA revised the interpretation of otherwise use. The following new otherwise use definition became effective with the 1998 reporting year (62 FR 23834, May 1, 1997): Otherwise use means "any use of a toxic chemical contained in a mixture or other trade name product or waste, that is not covered by the terms manufacture or process. Otherwise use of a toxic chemical does not include disposal, stabilization (without subsequent distribution in commerce), or treatment for destruction unless: 1) The toxic chemical that was disposed, stabilized, or treated for destruction was received from off site for the purposes of further waste management; OR 2) The toxic chemical that was disposed, stabilized, or treated for destruction was manufactured as a result of waste management activities on materials received from off site for the purposes of further waste management activities."	10,000

[1]These activity thresholds are for non-PBT chemicals. See Section 2.6 for the activity thresholds applicable to PBT chemicals.

COMMON ERROR - Coincidental Manufacture

The coincidental manufacture of an EPCRA Section 313 chemical or chemical category, outside the primary product process line but in direct support of the process, is frequently overlooked. For example, the coincidental manufacture of nitrate compounds from on-site wastewater treatment of nitric acid is commonly overlooked. In many processes, nitric acid is typically discharged, collected, and sent to an on-site treatment plant, where it is neutralized and discharged to a POTW. Nitrate compounds are coincidentally manufactured during the neutralization of nitric acid and are subject to the 25,000 pounds per year reporting threshold. If the threshold is exceeded, corresponding releases should be reported as a "Discharge to POTW" in Section 6.1 and included in Section 8.7 ("Quantity Treated Off Site") of the Form R, and not reported under Section 6.2 "Transfers to Other Off-Site Locations." The quantity of nitrate compounds coincidentally manufactured can be estimated as discussed in detail in EPA's guidance document, *Toxics Release Inventory, List of Chemicals Within the Water Dissociable Nitrate Compounds Category and Guidance for Reporting* (Revised May 1996, EPA 745-E-96-004).

Another coincidental manufacture example would be the production of metal oxides (metal compounds) during fuel combustion (e.g., burning of coal and/or oil to generate power).

Relabeling or redistribution of an EPCRA Section 313 chemical or chemical category where no repackaging occurs does not constitute manufacturing, processing, or otherwise use of that chemical. This type of activity should not be included in threshold determinations.

Also, note that the threshold determinations for the three activity categories (manufacturing, processing, and otherwise use) are mutually exclusive. That is, you must conduct a separate threshold determination for each activity category and if you exceed any threshold, all release and other waste management activities of that EPCRA Section 313 chemical or chemical category at the facility must be considered for reporting.

2.6 Persistent, Bioaccumulative, and Toxic (PBT) Chemicals

U.S. EPA promulgated the final rule for Persistent, Bioaccumulative, and Toxic (PBT) chemicals in the October 29, 1999 Federal Register (64 FR 209). This rule applies for the reporting year beginning January 1, 2000 (for EPCRA Section 313 reports that must be filed by July 1, 2001).

In this rule, U.S. EPA has added seven chemicals and lowered the reporting thresholds for 18 chemicals and chemical categories that meet the EPCRA Section 313 criteria for persistence and bioaccumulation. The PBT chemicals and their thresholds are listed in Table 2-5.

Table 2-5

Reporting Thresholds for EPCRA Section 313 Listed PBT Chemicals

Chemical Name or Chemical Category	CASRN	Section 313 Reporting Threshold (in pounds unless noted other-wise)
Aldrin	309-00-2	100
Benzo(g,h,i)perylene	191-24-2	10
Chlordane	57-74-9	10
Dioxin and dioxin-like compounds category (manufacturing; and the processing or otherwise use of dioxin and dioxin-like compounds if the dioxin and dioxin-like compounds are present as contaminants in a chemical and if they were created during the manufacturing of that chemical)	NA	0.1 grams
Heptachlor	76-44-8	10
Hexachlorobenzene	118-74-1	10
Isodrin	465-73-6	10
Methoxychlor	72-43-5	100
Octachlorostyrene	29082-74-4	10
Pendimethalin	40487-42-1	100
Pentachlorobenzene	608-93-5	10
Polycyclic aromatic compounds category	NA	100
Polychlorinated biphenyl (PCBs)	1336-36-3	10
Tetrabromobisphenol A	79-94-7	100
Toxaphene	8001-35-2	10
Trifluralin	1582-09-8	100
Mercury	7439-97-6	10
Mercury compounds	NA	10

U.S. EPA also added two chemicals to the polycyclic aromatic compounds (PACs) category that is listed above:

- Benzo(j,k)fluorene (fluoranthene)
- 3-methylchloanthrene

These two chemicals are not to be reported individually; rather, they should be included within the PACs compound category.

U.S. EPA finalized two thresholds based on the chemicals' potential to persist and bioaccumulate in the environment. The two levels include setting Section 313 manufacture, process, and otherwise use thresholds to 100 pounds for PBT chemicals and to 10 pounds for that subset of PBT chemicals that are highly persistent and highly bioaccumulative. One exception is the dioxin and dioxin-like compounds category. EPA set the threshold for the dioxin and dioxin-like compound category at 0.1 gram.

U.S. EPA eliminated the *de minimis* exemption for the PBT chemicals. However, this action does not affect the applicability of the *de minimis* exemption to the supplier notification requirements (40 CFR 372.45(d)(1)). U.S. EPA also excluded all PBT chemicals from eligibility for the alternate threshold of 1 million pounds (see Section 2.9) and eliminated range reporting of PBT chemicals and chemical categories for on-site releases and transfers off-site for further waste management.

Concurrent with the additions and lowered thresholds discussed above, U.S. EPA added "vanadium, except when contained in an alloy" and "vanadium compounds" to the list of toxic chemicals subject to reporting under EPCRA Section 313. The corresponding thresholds for vanadium and vanadium compounds remain 10,000 pounds if otherwise used, 25,000 pounds if processed, and 25,000 pounds if manufactured. Please refer to the discussion on "Qualifiers" in Section 3.1 if vanadium is a concern at your facility.

Note that U.S. EPA is currently developing five guidance documents for chemicals modified by the PBT rule:

- Dioxins and dioxin-like compounds;
- Mercury and mercury compounds;
- Vanadium and vanadium compounds;
- Polycyclic aromatic compounds (PACs) category; and
- Other PBT chemicals.

Please refer to this guidance if applicable to your facility.

2.7 How Do You Report?

You must submit an EPCRA Section 313 report for each EPCRA Section 313 chemical or chemical category that exceeds a threshold for manufacturing, OR processing, OR otherwise use (providing you meet the employee and SIC Code criteria). Provided you do not exceed certain alternate activity thresholds and total annual reportable amounts, you may prepare a Form A (See Section 2.8) rather than a Form R. The *TRI Forms and Instructions* contain detailed directions for the preparation and submittal of EPCRA Section 313 reports for each listed chemical for the reporting year. The *TRI Forms and Instructions* are sent to all facilities that submitted EPCRA Section 313 reports the preceding year. However, if you do not receive a courtesy copy, you may request copies of the *TRI Forms and Instructions* from the EPCRA Hotline (1-800-424-9346).

2.8 Form R

Form R is the report in which the information required by EPCRA Section 313 is reported. If you are submitting a Form R, it is essential that you use the *TRI Forms and Instructions* for the appropriate reporting year. U.S. EPA encourages the electronic submittal of the Form R, via the Automated Toxic Chemical Release Inventory Reporting Software (ATRS). Use of the ATRS will save preparation time in data entry and photocopying and reduce errors via on-line validation routines and use of pick lists. The ATRS can be found on the Internet at:

- **http://www.epa.gov/atrs**

The ATRS is available in both DOS and Windows versions. More information can be found in the *TRI Forms and Instructions* and by calling the ATRS User Support Hotline at (703) 816-4434.

The Form R consists of two parts:

Part I, Facility Identification Information. This part may be photocopied and re-used for each Form R you submit, except for the signature, which must be original for each submission.

Part II, Chemical Specific Information. You must complete this part separately for each EPCRA Section 313 chemical or chemical category; it cannot be reused year to year even if reporting has not changed.

Submission of incomplete EPCRA Section 313 reports may result in issuance of a Notice of Technical Error (NOTE), Notice of Significant Error (NOSE), or Notice of Non-compliance (NON). See the current *TRI Forms and Instructions* for more detailed information on completing the Form R and submitting the EPCRA Section 313 report.

2.9 Alternate Threshold and Form A

U.S. EPA developed the Form A, also referred to as the "Certification Statement" to reduce the annual reporting burden for facilities with minimal amounts of EPCRA Section 313 chemicals and chemical categories released and otherwise managed as waste (59 FR 61488, November 1994; applicable beginning reporting year 1994 and beyond). On Form A you certify that you are not required to report the release and other waste management information required by EPCRA Section 313 and PPA Section 6607. A facility must meet the following two criteria to use a Form A:

- First, the total annual reportable amount of the EPCRA Section 313 chemical or chemical category cannot exceed 500 pounds per year. The "reportable amount" is defined as the sum of the on-site amounts released (including disposal), treated, recycled, and combusted for energy recovery, combined with the sum of the amounts transferred off site for recycling, energy recovery, treatment, and/or release (including disposal). This total corresponds to the total of data elements 8.1 through 8.7 on the 1999 version of the Form R.

- Second, the amount of the EPCRA Section 313 chemical or chemical category manufactured, processed, OR otherwise used cannot exceed one million pounds. It is important to note that the quantities for each activity are mutually exclusive and must be evaluated independently. If the quantity for any one of the activities exceeds 1,000,000 pounds a Form A cannot be used.

Example - Form A Threshold

If the combined annual reportable amounts from all activities do not exceed 500 pounds, a facility that manufactures 900,000 pounds of an EPCRA Section 313 chemical and processes 150,000 pounds of the same chemical is eligible to use the Form A because the facility did not exceed the one million pounds threshold for either activity, even though the total activity usage exceeds one million pounds.

The Form A Certification Statement must be submitted for each eligible EPCRA Section 313 chemical and chemical category. The information on the Form A will be included in the publicly accessible TRI database; however, these data are marked to indicate that they represent certification statements rather than Form Rs. Note that separate establishments at a facility cannot submit separate Form As for the same chemical or chemical category; rather, only one Form A per EPCRA Section 313 chemical or chemical category can be submitted per facility.

While Form A requests facility identification and chemical identification information, no release and other waste management quantity estimations to any media are required. You must simply certify that the total annual reportable amount did not exceed 500 pounds, and the amounts manufactured, processed, or otherwise used did not exceed one million pounds. Once the facility has completed estimates to justify the submission of a Form A, there is a considerable time savings in using the Form A, especially in subsequent years, providing activities involving the chemical or chemical category did not change significantly. It is strongly recommended that you document your initial rationale and refer to it every year to verify that you have not modified a part of the process that would invalidate the initial rationale supporting use of the Form A.

Common Error - Form A Reporting

Many facilities in this industry may be eligible to submit the Alternate Certification Statement (Form A). Listed below are some key points to remember when deciding if you should submit a Form A or Form R for an EPCRA Section 313 chemical or chemical category:

1. The 500 lb/yr annual reportable amount criteria refers to a single EPCRA Section 313 chemical (or chemical category) and is the sum of the on-site amounts released (including disposal), treated, recycled and combusted for energy recovery combined with amounts transferred off-site for further waste management activities. This total is the sum of the data elements 8.1 through 8.7 of the 1999 Form R for a single chemical (or chemical category).
2. The 1,000,000 lb/yr alternate threshold refers to the amount of a single EPCRA Section 313 chemical (or chemical category) manufactured, OR the amount of a single EPCRA Section 313 chemical (or chemical category) processed, OR the amount of a single EPCRA Section 313 chemical (or chemical category) otherwise used. The quantities are mutually exclusive and must be evaluated independently. If the quantity for any one of these activities exceeds 1,000,000 pounds, a Form A cannot be used.

> Example: Your site otherwise uses a total of 750,000 lb/yr of chromium compounds, and processes an additional 300,000 lb/yr of chromium compounds. Chromium compound disposal (based on the parent metal chromium) totals 250 lb/yr to an off-site landfill, and 100 lb/yr discharged to a POTW. No recycling or treatment of chromium compounds occur. Your site did not exceed the 1,000,000-pound alternate threshold for processing, nor did your site exceed the alternate threshold for otherwise use. The total annual reportable amount of 350 lb/yr falls below 500 lb/yr. Therefore, you may complete a Form A for chromium compounds, rather than a Form R.

When determining if you are eligible to complete a Form A, rather than a Form R, remember that each EPCRA Section 313 chemical or chemical category should be reviewed individually. For example, you may need to complete a Form R for Chemicals A, B, and C, however a Form A may be completed for Chemical D (assuming the eligibility requirements are met).

> Example: Your site otherwise uses 300,000 lb/yr of methanol and 200,000 lb/yr copper compounds. The total annual reportable amount for methanol is 10,000 lb/yr, and the total annual reportable amount for copper compounds is 200 lb/yr. You must complete a Form R for methanol, however you are eligible to complete a Form A for copper compounds.

If your facility consists of multiple establishments, only a single Form A can be submitted for the entire facility (separate establishments at a facility cannot submit separate Form As for the same chemical or chemical category; one Form A can be submitted for multiple chemicals or chemical categories).

> Example: Your site has three establishments and all otherwise use methanol. The first establishment otherwise uses 500,000 lb/yr of methanol. The second and third establishments each otherwise use 300,000 lb/yr of methanol. The total amount of methanol otherwise used at the facility equals 1,100,000 lb/yr (500,000 + 300,000 + 300,000). You may not submit a Form A for methanol. You may either submit one Form R for the entire facility, or you may submit three Form Rs (one for each establishment) for methanol.

2.10 Trade Secrets

If you submit trade secret information, you must prepare two versions of the substantiation form as prescribed in 40 CFR Part 350 (see 53 FR 28801, July 29, 1988) as well as

two versions of the EPCRA Section 313 report. One set of reports should be "sanitized" (i.e., it should provide a generic name for the EPCRA Section 313 chemical or chemical category identity). This version will be made available to the public. The second version, the "unsanitized" version, should provide the actual identity of the EPCRA Section 313 chemical and have the trade secret claim clearly marked in Part I, Section 2.1 of the Form R or Form A. The trade secrets provision only applies to the EPCRA Section 313 chemical or chemical category identity. All other parts of the Form R or Form A must be filled out accordingly.

Individual states may have additional criteria for confidential business information and the submittal of both sanitized and unsanitized reports for EPCRA Section 313 chemicals and chemical categories. Facilities may jeopardize the trade secret status of an EPCRA Section 313 chemical or chemical category by submitting an unsanitized version to a state agency or tribal government that does not require an unsanitized version.

More information on trade secret claims, including contacts for individual state's submission requirements, can be found in the *TRI Forms and Instructions*.

2.11 Recordkeeping

Complete and accurate records are absolutely essential to meaningful compliance with EPCRA Section 313 reporting requirements. Compiling and maintaining good records will help you to reduce the effort and cost in preparing future reports, and to document how you arrived at the reported data in the event of U.S. EPA compliance audits. U.S. EPA requires you to maintain records substantiating each EPCRA Section 313 report submission for a minimum of three years. Each facility must keep copies of every EPCRA Section 313 report along with all supporting documents, calculations, work sheets, and other forms that you used to prepare the EPCRA Section 313 report. U.S. EPA may request this supporting documentation during a regulatory audit.

Specifically, U.S. EPA requires the following records be maintained for a period of three years from the date of the submission of a report (summarized from 40 CFR 372.10):

1) A copy of each EPCRA Section 313 report that is submitted.

2) All supporting materials and documentation used to make the compliance determination that the facility or establishment is a covered facility.

3) Documentation supporting the report submitted, including:

- Claimed allowable exemptions,
- Threshold determinations,
- Calculations for each quantity reported as being released, either on or off site, or otherwise managed as waste,
- Activity determinations, including dates of manufacturing, processing, or use,
- The basis of all estimates,
- Receipts or manifests associated with transfers of each EPCRA Section 313 chemical or chemical category in waste to off-site locations, and
- Waste treatment methods, treatment efficiencies, ranges of influent concentrations to treatment, sequential nature of treatment steps, and operating data to support efficiency claims.

4) For facilities submitting a Form A, all supporting materials used to make the compliance determination that the facility or establishment is eligible to submit a Form A, including:

- Data supporting the determination the alternate threshold applies,
- Calculations of the annual reportable amounts,
- Receipts or manifests associated with the transfer of each EPCRA Section 313 chemical or chemical category in waste to off-site locations, and
- Waste treatment methods, treatment efficiencies, ranges of influent concentrations to treatment, sequential nature of treatment steps, and operating data to support efficiency claims.

Because EPCRA Section 313 reporting does not require additional testing or monitoring you must determine the best readily available source of information for all estimates. Some facilities may have detailed monitoring data and off-site transfer records that can be used for estimates while others may only have purchase and inventory records. Examples of records that you should keep, if applicable, might include:

- Each EPCRA Section 313 report submitted;

- EPCRA Section 313 Reporting Threshold Worksheets (sample worksheets can be found in Chapter 3 of this document as well as in the *TRI Forms and Instructions)*;
- EPCRA Section 313 Reporting Release and Other Waste Management Quantity Estimation Worksheets (sample worksheets can be found in Chapter 4 of this document);
- Engineering calculations and other notes;
- Formulation sheets;
- Purchase records from suppliers;
- Inventory data;
- Material Safety Data Sheets (MSDSs);
- New Source Performance Standards (NSPS);
- National Pollutant Discharge Elimination System (NPDES)/State Pollutant Discharge Elimination System (SPDES) permits and monitoring reports;
- EPCRA Section 312, Tier II reports;
- Monitoring records;
- Air permits;
- Flow measurement data;
- Resource Conservation Recovery Act (RCRA) hazardous waste generator's reports;
- Pretreatment reports filed with local governments;
- Invoices from waste management firms;
- Manufacturer's estimates of treatment efficiencies;
- Comprehensive Environmental Response, Conservation, and Liability Act of 1980 (CERCLA) Reportable Quantity (RQ) reports;
- RCRA manifests; and
- Process flow diagrams (including emissions, releases, and other waste management activities).

CHAPTER 3 - EPCRA SECTION 313 CHEMICAL OR CHEMICAL CATEGORY ACTIVITY THRESHOLD DETERMINATIONS

3.0 PURPOSE

This chapter provides a step-by-step procedure for determining if any EPCRA Section 313 chemicals or chemical categories exceed a reporting threshold. Threshold determinations are essentially a three step process:

Step 1) Identify any EPCRA Section 313 chemicals or chemical categories you manufacture/import, process, or otherwise use.

Step 2) Identify the activity category and any exempt activities for each EPCRA Section 313 chemical and chemical category.

Step 3) Calculate the quantity of each EPCRA Section 313 chemical and chemical category and determine which ones exceed an activity threshold.

3.1 Step 1 - Identify Which EPCRA Section 313 Chemicals or Chemical Categories are Manufactured (Including Imported), Processed, or Otherwise Used

Compile lists of all chemicals and mixtures at your facility. For facilities with many different chemicals and mixtures it is often helpful to prepare two lists: one with the pure (single ingredient) chemicals (including chemical compounds) and one with the mixtures and trade name products. On the second list, under the name of each mixture/trade name product, write the names of all chemicals in that product. Next, compare the chemicals and chemical categories on both lists to the current EPCRA Section 313 chemicals and chemical categories list found in the *TRI Forms and Instructions* (remember that chemicals and chemical categories may be periodically added and deleted and you should use the current reporting year's instructions). Highlight the EPCRA Section 313 chemicals and chemical categories that are on your lists.

Review the lists to be sure each chemical and chemical category is shown by its correct EPCRA Section 313 name. For example, a common EPCRA Section 313 chemical found in textile manufacturing operations is methanol. Methanol (Chemical Abstracts Service

(CAS) Registry No. 67-56-1) has several synonyms including carbinol, methyl alcohol, methyl hydroxide, and wood alcohol. It must be reported on Form R (or Form A), Item 1.2, by its EPCRA Section 313 chemical name, methanol. Synonyms can be found in the U.S. EPA document *Common Synonyms for Chemicals Listed Under Section 313 of the Emergency Planning and Community Right-to-Know Act* (EPA 745-R-95-008).

While you must consider every chemical on the EPCRA Section 313 chemical and chemical category list, you should be aware of the chemicals and chemical categories typically used in textile manufacturing. As a guide, the most frequently reported EPCRA Section 313 chemicals and chemical categories for reporting year 1995 by textile manufacturing facilities, SIC Major Group 22, and the processes they are typically used in, are listed in Table 2-3.

A computerized spreadsheet may be helpful in developing your facility's chemical and chemical category list and performing threshold calculations. The spreadsheet could show the chemical, chemical category, or chemical mixture with corresponding component concentrations; the yearly quantity manufactured, processed, or otherwise used; and the CAS Registry number. The spreadsheet could also be designed to identify the total quantity by activity category (amounts manufactured, processed, and otherwise used) for each EPCRA Section 313 chemical or chemical category in every mixture, compound, and trade name product.

An initial investment of time will be required to develop this spreadsheet; however, the time and effort saved in threshold calculations in subsequent years will be significant. Such a system will also reduce the potential of inadvertently overlooking EPCRA Section 313 chemicals or chemical categories present in mixtures purchased from off-site sources.

To develop the chemical and chemical category list and the associated activity categories you may want to consult the following:

- Material Safety Data Sheets (MSDSs);
- Facility purchasing records;

- New Source Performance Standards (NSPS);
- Inventory records;
- Air and water discharge permits;
- Individual manufacturing/operating functions; and
- Receipts or manifests associated with the transfer of each EPCRA Section 313 chemical and chemical categories in waste to off-site locations.

The following is suggested useful information needed to prepare your EPCRA Section 313 reports and should be included for each chemical and chemical category on your spreadsheet:

- The mixture name and associated EPCRA Section 313 chemical and chemical category names;
- The associated Chemical Abstract Service (CAS) Registry numbers;
- The trade name for mixtures and compounds;
- The throughput quantities; and
- Whether the chemical or chemical category is manufactured, processed, or otherwise used at the facility (be sure to include quantities that are coincidentally manufactured and imported, as appropriate).

MSDSs provide important information for the type and composition of chemicals and chemical categories in mixtures, and for determining whether you have purchased raw materials that contain EPCRA Section 313 chemicals and chemical categories. As of 1989, chemical suppliers to facilities in SIC Major Group Codes 20 through 39 are required to notify manufacturing customers of any EPCRA Section 313 chemicals and chemical categories present above the applicable *de minimis* concentration in mixtures or trade name products distributed to facilities. The notice must be provided to the receiving facility and may be attached or incorporated into that product's MSDS. If no MSDS is required, the notification must be in a letter that accompanies the first shipment of the product to your facility each year. This letter must contain the chemical name, CAS Registry number, and the weight or volume percent (or a range) of the EPCRA Section 313 chemical or chemical category in mixtures or trade name products.

Carefully review the entire MSDS. Although new MSDSs must list whether EPCRA Section 313 chemicals and chemical categories are present, the language and location of this notification is not currently standardized. Depending on the supplier, this information could

be found in different sections of the MSDS. The most likely sections of an MSDS to provide information on EPCRA Section 313 chemicals and chemical categories are:

- Physical properties/chemical composition section;
- Regulatory section;
- Hazardous components section;
- Labeling section; and
- Additional information section.

Also, many EPCRA Section 313 chemicals and chemical categories are present as impurities in mixtures. These quantities must also be considered in threshold determinations unless the concentration is below the *de minimis* value (see Section 3.2.2.1).

COMMON ERROR - Mixture Components

Facilities often overlook EPCRA Section 313 chemicals and chemical categories that are present in small quantities of bulk solutions. For example, xylene is often purchased in large quantities for use as a solvent, among other things. Most facilities correctly report for xylene; however, ethylbenzene is typically present at up to 15% in commercially available solutions of xylene. Many facilities have historically overlooked the ethylbenzene in their bulk xylene purchases.

Several chemicals on the EPCRA Section 313 chemical list include qualifiers related to use or form. Some chemicals are reportable ONLY if manufactured by a specified process or classified in a specified activity category. For example, isopropyl alcohol is only reportable if it is manufactured using the strong acid process and saccharin is reportable only if it is manufactured. Some other chemicals are only reportable if present in certain forms. For example, only yellow or white phosphorus is reportable, while black or red phosphorus is not reportable.

The qualifiers and associated chemicals and chemical categories are presented below. A detailed discussion of the qualifier criteria can be found in the *TRI Forms and Instructions*. Please make special note of the discussion pertaining to vanadium and vanadium compounds.

- **Aluminum oxide (fibrous)** - Aluminum oxide is only subject to threshold determination and release and other waste management calculations when

it is handled in fibrous forms. U.S. EPA has characterized fibrous aluminum oxide for purposes of EPCRA Section 313 reporting as a man-made fiber commonly used in high-temperature insulation applications such as furnace linings, filtration, gaskets, joints, and seals.

- **Ammonia** - (includes anhydrous ammonia and aqueous ammonia from water dissociable ammonium salts and other sources) On June 26, 1995, U.S. EPA qualified the listing for ammonia (CAS Registry No. 7664-41-7) and deleted ammonium sulfate (solution) (CAS Registry No. 7783-20-2) from the EPCRA Section 313 chemical list. Both the qualification and the deletion were effective as of reporting year 1994. The qualifier for ammonia means that anhydrous forms of ammonia are 100% reportable while only 10% of the total aqueous ammonia is reportable. Any evaporation of ammonia from aqueous ammonia solutions is considered anhydrous ammonia. This qualifier applies to both activity threshold determinations and release and other waste management calculations. Note that while ammonium sulfate is no longer an EPCRA Section 313 chemical, 10% of the aqueous ammonia formed from the dissociation of ammonium sulfate (and all other ammonium salts) is reportable, and must be included in both activity threshold determinations and release and other waste management calculations. Additionally, any ammonium nitrate must also be included in the threshold determination and the nitrate portion included in the release and other waste management calculations, for the nitrate compounds category. U.S. EPA has published guidance on reporting for ammonia and ammonium salts in *Emergency Planning and Community Right-to-Know, EPCRA Section 313, Guidance for Reporting Aqueous Ammonia,* EPA 745-R-95-012 (included as Appendix C).

- **Asbestos (friable)** - Asbestos only needs to be considered when it is handled in the friable form. Friable refers to the physical characteristics of being able to crumble, pulverize, or reduce to a powder with hand pressure.

- **Fume or dust** - Two metals (aluminum and zinc) are qualified with “fume or dust.” This definition excludes “wet” forms such as solutions or slurries, but includes powder, particulate, or gaseous forms of these metals. There is no particle size limitation for particulates. For example, use of zinc metal as part of a final textile product is not subject to reporting unless the zinc is in the form of a fume or dust. However, even though elemental zinc is reportable only in the fume or dust form, all forms of zinc compounds are reportable. Note that the entire weight of all zinc compounds should be included in the threshold determination for zinc compounds, while only the metal portion of metal compounds is reported in the release and other waste management amounts. Prior to reporting year 2000, vanadium was also qualified with “fume or dust.” As of reporting year 2000 this qualifier has been removed for vanadium such that all physical forms are now reportable unless the vanadium is

contained in an alloy. Please see the discussion on vanadium and vanadium compounds below, if applicable.

- **Hydrochloric acid (acid aerosols)** - On July 25, 1996, U.S. EPA promulgated a final rule delisting non-aerosol forms of hydrochloric acid (CAS Registry No. 7647-01-0) from the EPCRA Section 313 chemical list (effective for the 1995 reporting year). Therefore, threshold determinations and release and other waste management estimates now apply only to the aerosol forms. Under EPCRA Section 313, the term aerosol covers any generation of airborne acid (including mists, vapors, gas, or fog) without any particle size limitation. Therefore, any process that sprays hydrochloric acid "manufactures" hydrochloric acid aerosol and you should include this quantity in the manufacturing threshold determination.

- **Manufacturing qualifiers** - Two chemicals, saccharin and isopropyl alcohol, contain qualifiers relating to manufacture. The qualifier for saccharin means that only manufacturers of the chemical are subject to the reporting requirement. The qualifier for isopropyl alcohol means that only facilities that manufacture the chemical by the strong acid process are required to report. Facilities that only process or otherwise use these chemicals are not required to report. Thus, a facility that uses isopropyl alcohol as a solvent should not report for isopropyl alcohol.

- **Nitrate Compounds (water dissociable; reportable only in aqueous solution)** - A nitrate compound is covered by this listing only when in water and if water dissociable. Although the complete weight of the nitrate compound must be used for threshold determinations for the nitrate compounds category, only the nitrate portion of the compound must be considered for release and other waste management calculations. One issue recently raised by industry is how to report nitrate compounds in wastewater and sludge that is applied to farms as a nitrogen source (either on site or off site). Although during such use nitrate compounds may be taken up by plants and cycled back into the ecosystem, U.S. EPA considers that the nitrate compounds in wastewaters/sludges to be managed as waste. In this scenario, nitrate compounds should be reported as being disposed to land (either on site or off site as appropriate). U.S. EPA has published guidance for these chemicals in *List of Toxic Chemicals Within the Water Dissociable Nitrate Compounds Category and Guidance for Reporting* (EPA 745-R-96-004).

- **Phosphorus (yellow or white)** - Only manufacturing, processing, or otherwise use of phosphorus in the yellow or white chemical forms require reporting. Black and red phosphorus are not subject to EPCRA Section 313 reporting.

- **Sulfuric acid (acid aerosols)** - On June 26, 1995, U.S. EPA promulgated a final rule delisting non-aerosol forms of sulfuric acid (CAS Registry No. 7664-93-9) from the EPCRA Section 313 chemical list (effective for the 1994 reporting year). Therefore, threshold determinations and release and other waste management estimates now apply only to the aerosol forms. Under EPCRA Section 313, the term aerosol covers any generation of airborne acid (including mists, vapors, gas, or fog) without any particle size limitation. Therefore, any process that sprays sulfuric acid "manufactures" sulfuric acid aerosol and you should include this quantity in the manufacturing threshold determination. U.S. EPA has published guidance for acid aerosols in *Guidance for Reporting Sulfuric Acid*, EPA 745-R-97-007.

- **Vanadium and vanadium compounds** - Note that prior to reporting year 2000 (effective December 31, 1999 for EPCRA Section 313 reports that must be filed by July 1, 2001), the fume or dust qualifier also applied to vanadium. As of December 31, 1999, U.S. EPA removed this qualifier for vanadium for reporting year 2000 and beyond. Concurrently, U.S. EPA exempted all physical forms of metallic vanadium that are present in alloys. Therefore, vanadium that is present in any physical form of alloys should not be considered for EPCRA Section 313 reporting. However, if vanadium is separated from the alloy, all physical forms of the vanadium are considered to be manufactured and the quantity manufactured should be applied to the 25,000-pound manufacturing threshold. If the vanadium is subsequently processed or otherwise used, the applicable quantity should also be applied to the processing or otherwise use threshold(s). If a threshold is exceeded, all quantities released or otherwise managed as waste must be reported as appropriate.

  Concurrent with this rulemaking, U.S. EPA also added vanadium compounds to the list of toxic chemicals subject to reporting under EPCRA Section 313. U.S. EPA specifically excluded vanadium compounds from the fume or dust qualifier and from the alloy exemption. Therefore, all physical forms of vanadium compounds must be included in threshold determinations and release and other waste management activities estimates.

COMMON ERROR - Sulfuric and Hydrochloric Acid (Acid Aerosols)

The textile manufacturing industry uses aqueous sulfuric acid and hydrochloric acid for pH adjustment and textile dyeing operations. Only aerosol forms of sulfuric acid and hydrochloric acid, including mists, vapors, gas, fog, and other airborne forms of any particle size, are reportable under EPCRA Section 313. Therefore, facilities do not need to include non-aerosol forms of either chemical toward threshold determinations and subsequent release and other waste management calculations.

3.2 Step 2. Identify the Activity Category and Any Exempt Activities for Each EPCRA Section 313 Chemical

The next step is to identify the activity category (or categories) and any exempt activities for each EPCRA Section 313 chemical and chemical category on your list. Table 3-1 lists the reporting thresholds for each of the activity categories (Tables 3-2 through 3-4 provide detailed definitions of subcategories for each activity category). Each threshold must be individually calculated; they are mutually exclusive and are not additive.

Table 3-1

Reporting Thresholds

Activity Category	Threshold[1]
Manufacture (including import)	25,000 pounds per year
Process	25,000 pounds per year
Otherwise Use	10,000 pounds per year

[1]These reporting thresholds are for non-PBT chemicals. See Section 2.6 for the reporting thresholds applicable to PBT chemicals.

Example -Threshold Determination

If your facility manufactures 22,000 pounds of an EPCRA Section 313 chemical or chemical category and you also otherwise use 8,000 pounds of the same chemical or chemical category, you have not exceeded either threshold and an EPCRA Section 313 report for that chemical or chemical category is not required. However, if your facility manufactures 28,000 pounds per year of an EPCRA Section 313 chemical or chemical category and otherwise uses 8,000 pounds of the same chemical or chemical category, you have exceeded the manufacturing threshold and ALL release and other waste management quantities (except those specifically exempted) of that chemical or chemical category must be reported on the Form R, including those from the otherwise use activity.

Example - Xylene Isomers

Textile manufacturing operations use the EPCRA Section 313 chemical xylene with the mixed isomers, CAS Registry No. 1330-20-7, being the most frequently reported type. Ortho-, meta-, and para-xylene are each listed on the EPCRA Section 313 chemicals list in addition to xylene (mixed isomers). The mixed isomers classification should be used when a mixture contains any combination of two or three of the isomers. The threshold determination for xylene should be calculated for each isomeric form individually unless the xylenes are manufactured, processed, or otherwise used as a mixture of xylene isomers. For example, a covered facility annually uses 8,000 pounds of para-xylene, 6,000 pounds of ortho-xylene, and 8,000 pounds of mixed isomers as carrier solvents in three separate processing lines. All three activities of xylene are classified as otherwise used as the carrier is intended to evaporate and not remain with the product. There are no other uses of any form of xylene in the facility. The otherwise used activity threshold of 10,000 pounds/year has not been reached for any of the xylenes and an EPCRA Section 313 report need not be prepared for xylene. However, should any two of the streams mix, the facility will exceed the otherwise use threshold for mixed isomers and an EPCRA Section 313 report must be prepared for the mixed isomer form of xylene.

Each of the activity categories is divided into subcategories.

COMMON ERROR - Threshold Determination for Recirculation

Facilities often incorrectly base threshold calculations on the amount of EPCRA Section 313 chemicals or chemical categories in a recirculation system rather than the amount actually used in the reporting year. The amount of the EPCRA Section 313 chemical or chemical category that is actually manufactured (including the quantity imported), processed, or otherwise used, not the amount in storage or in the system, should be the amount applied to the threshold determination. For example, a solvent containing an EPCRA Section 313 chemical or chemical category is used, recirculated on site, and reused as a solvent. The amount of EPCRA Section 313 chemical or chemical category recirculated in the on-site recycling process is not considered in the threshold determination because it is considered a "direct reuse" and is not reportable. Only the amount of new chemical added to the system should be included in the otherwise used threshold calculation. However, if you send a solvent containing an EPCRA Section 313 chemical or chemical category off site for distillation and subsequent recycling, it should be reported as a transfer to an off-site location for recycling (Part II, Sections 6.2 and 8.5 of the 1999 Form R) because the distillation is considered a waste management activity. The amount of solvent returned to you and subsequently used in the same reporting year must be included in the threshold determination. If the reporting threshold is exceeded, the total quantity recycled should be reported in Section 8.4, i.e., the amount recycled on site must be reported in Section 8.4 each time it is recycled.

As discussed in the *TRI Forms and Instructions*, you are required to designate EACH category and subcategory that applies to your facility. Detailed definitions, including descriptions of subcategories for each activity and selected examples, are presented in Tables 3-2, 3-3, and 3-4.

Table 3-2

Definitions and Examples of Manufacturing Subcategories

Manufacturing Activity Subcategory	Definition	Examples in the Textile Industry
Produced or imported for on-site use/processing	A chemical or chemical category that is produced or imported and then further processed or otherwise used at the same facility.	
Produced or imported for sale/distribution	A chemical or chemical category that is produced or imported specifically for sale or distribution outside the manufacturing facility.	
Produced as a byproduct	A chemical or chemical category that is produced coincidentally during the production, processing, or otherwise use of another chemical substance or mixture and is separated from that substance or mixture. Toxic chemicals produced and released as a result of waste treatment or disposal are also considered byproducts.	Ammonia, phenol, and methanol.
Produced as an impurity	A chemical or chemical category that is produced coincidentally as a result of the manufacture, processing, or otherwise use of another chemical and remains primarily in the mixture or product with that other chemical.	

Table 3-3

Definitions and Examples of Processing Subcategories

Processing Activity Subcategory	Definition	Examples in the Textile Industry
Reactant	A natural or synthetic chemical or chemical category used in chemical reactions for the manufacture of another chemical substance or product. Examples include feedstocks, raw materials, intermediates, and initiators.	Formaldehyde, methanol, and phenol.
Formulation component	A chemical or chemical category that is added to a product or product mixture prior to further distribution of the product and acts as a performance enhancer during use of the product. Examples include additives, dyes, reaction diluents, initiators, solvents, inhibitors, emulsifiers, surfactants, lubricants, flame retardants, and rheological modifiers.	Antimony compounds, copper compounds, chromium compounds, and methanol
Article component	A chemical or chemical category that becomes an integral component of an article distributed for industrial, trade, or consumer use.	
Repackaging only	A chemical or chemical category that is processed or prepared for distribution in commerce in a different form, state, or quantity. May include, but is not limited to, the transfer of material from a bulk container, such as a tank truck, to smaller containers such as cans or bottles.	

Table 3-4

Definitions and Examples of Otherwise Use Subcategories

Otherwise Use Activity Subcategory	Definition	Examples in the Textile Industry
Chemical processing aid	A chemical or chemical category that is added to a reaction mixture to aid in the manufacture or synthesis of another chemical substance but is not intended to remain in or become part of the product or product mixture. Examples include process solvents, catalysts, inhibitors, initiators, reaction terminators, and solution buffers.	Biphenyl, methanol, dichloromethane, ethylene glycol, phenol, toluene, and xylene.
Manufacturing aid	A chemical or chemical category that aids the manufacturing process but does not become part of the resulting product and is not added to the reaction mixture during the manufacture or synthesis of another chemical substance. Examples include process lubricants, metalworking fluids, coolants, refrigerants, and hydraulic fluids.	Equipment cleaning agents such as ethylene glycol and methanol.
Ancillary or other use	A chemical or chemical category that is used for purposes other than aiding chemical processing or manufacturing. Examples include cleaners, degreasers, lubricants, fuels (including waste fuels), and chemicals used for treating wastes.	

3.2.1 Concentration Ranges for Threshold Determination

You should use the best readily available information, or where such data are not available, reasonable estimates, for all calculations in EPCRA Section 313 reporting; however, the exact concentration of an EPCRA Section 313 chemical or chemical category in a mixture or trade name product may not be known. The supplier or MSDS may only list ranges, or upper or lower bound concentrations. U.S. EPA has developed guidance on how to use information in these situations for threshold determinations.

- If the concentration is provided as a lower and upper bound or as a range, you should use the mid-point in your calculations for the threshold determination. For example, the MSDS for the trade name product states methanol is present in a concentration of not less than 20% and not more than 40%, or it may be stated as present at a concentration between 20 to

40%. You should use the midpoint value of 30% methanol in your threshold calculations.

- If only the lower bound concentration of the EPCRA Section 313 chemical or chemical category is specified and the concentration of other components are given, subtract the other component values from 100%. The remainder should be considered the upper bound for the EPCRA Section 313 chemical or chemical category and you should use the given lower bound to calculate the mid-point as discussed above. For example, the MSDS states that a solvent contains at least 50% methyl ethyl ketone (MEK) and 20% non-hazardous surfactants. Subtracting the non-hazardous contents from 100% leaves 80% as the upper bound for MEK. The mid-point between upper (80%) and lower (50%) bounds is 65%, the value you should use in your threshold calculation.

- If only the lower bound is specified and no information on other components is given, you should assume the upper bound is 100% and calculate the mid-point as above.

- If only the upper bound concentration is provided, you should use this value in your threshold calculation.

Special guidance for concentration ranges that straddle the *de minimis* value is presented in Section 3.2.2.1.

3.2.2 Evaluation of Exemptions

When determining thresholds, you can exclude quantities of any EPCRA Section 313 chemicals and chemical categories that are manufactured, processed, or otherwise used in <u>exempt</u> activities. Exemptions are divided into four classes:

1. *De minimis* exemption;
2. Article exemption;
3. Facility-related exemption; and
4. Activity-related exemptions.

<u>COMMON ERROR - Exempt Activities</u>

Quantities of an EPCRA Section 313 chemical or chemical category used for exempt activities do not need to be included in your threshold determinations or release and other waste management calculations, even if the chemical or chemical category is used in a reportable activity elsewhere in the facility.

3.2.2.1 *De Minimis* Exemption

If the amount of EPCRA Section 313 chemical(s) or chemical categories present in a mixture or trade name product processed or otherwise used is below its *de minimis* concentration level, that amount is considered to be exempt from threshold determinations and release and other waste management calculations. Note that this exemption does not apply to manufacturing, except for importation or as an impurity as discussed below. Also note that the *de minimis* exemption does not apply to the manufacturing, processing, or otherwise use of the PBT chemicals (refer to Section 2.6). The *de minimis* concentration for EPCRA Section 313 chemicals and chemical categories is 1%, except for Occupational Safety and Health Administration (OSHA)-defined carcinogens, which have a 0.1% *de minimis* concentration. Note that if a mixture contains more than one member of an EPCRA Section 313 chemical category, the weight percent of all members must be summed. If the total meets or exceeds the category's *de minimis* level, the *de minimis* exemption does not apply. U.S. EPA has published several detailed questions and answers and a directive in the current edition of *EPCRA Section 313, Questions and Answers* (1998 edition is EPA 745-B-98-004; see Appendix A, Directive #2) that may be helpful if you have additional concerns about the *de minimis* exemption. The *TRI Forms and Instructions* list each EPCRA Section 313 chemical and chemical category with the associated *de minimis* value.

Once the *de minimis* level has been equaled or exceeded, the exemption no longer applies to that process stream, even if the EPCRA Section 313 chemical or chemical category later falls below the *de minimis* concentration. All release and other waste management activities that occur after the *de minimis* concentration has been equaled or exceeded are subject to reporting. The facility does not have to report release and other waste management activities that took place before the *de minimis* concentration was equaled or exceeded.

Example - *De Minimis*

Your facility processes a mixture containing 1.1% nitric acid and 0.6% manganese. The *de minimis* exemption would apply to manganese because the concentration is below 1%, which is the *de minimis* level for manganese; however, it would not apply to nitric acid. All of the nitric acid must be included in threshold determinations and release and other waste management calculations.

The *de minimis* exemption also applies to EPCRA Section 313 chemicals and chemical categories that are coincidentally manufactured below the *de minimis* level only if that chemical is manufactured as an impurity in a mixture that is subsequently distributed in commerce. In addition, the exemption applies to EPCRA Section 313 chemicals and chemical categories below the *de minimis* concentration in an imported mixture or trade name product.

For some mixtures the concentration of EPCRA Section 313 chemicals and chemical categories may be available only as a range. U.S. EPA has developed guidance on how to determine quantities applicable to threshold determinations and release and other waste management calculations when this range straddles the *de minimis* value. In general, only the quantity of the processed or otherwise used EPCRA Section 313 chemical or chemical category whose concentration exceeds the *de minimis* must be considered. Therefore, U.S. EPA allows facilities to estimate the quantity below the *de minimis* and exclude it from further consideration. The following examples illustrate this point.

Examples - *De Minimis* Concentration Ranges

Example 1:

A facility processes 8,000,000 pounds of a mixture containing 0.25 to 1.25% manganese. Manganese is subject to a 1% *de minimis* concentration exemption. The amount of mixture subject to reporting is the quantity containing manganese above the *de minimis* concentration:

$$(8{,}000{,}000) \times (0.0125 - 0.0099) \div (0.0125 - 0.0025)$$

The average concentration of manganese that is not exempt (above the *de minimis)* is:

$$(0.0125 + 0.0100) \div (2)$$

Therefore, the amount of manganese that is subject to threshold determination and release and other waste management estimates is:

$$\left[\frac{(8{,}000{,}000) \times (0.0125 - 0.0099)}{(0.0125 - 0.0025)}\right] \times \left[\frac{(0.0125 + 0.0100)}{(2)}\right] = 23{,}400 \text{ pounds}$$

= 23,400 pounds manganese (which is below the processing threshold)

In this example, because the facility's information pertaining to manganese was available to two decimal places, 0.99 was used to determine the amount below the *de minimis* concentrations. If the information was available to one decimal place, 0.9 should be used, as in Example 2 below.

Example 2:

As in Example 1, manganese is present in a mixture, of which 8,000,000 pounds is processed. The MSDS states the mixture contains 0.2% to 1.2% manganese. The amount of mixture subject to reporting (above *de minimis*) is:

$$(8{,}000{,}000) \times (0.012 - 0.009) \div (0.012 - 0.002)$$

The average concentration of manganese that is not exempt (above *de minimis*) is:

$$(0.012 + 0.010) \div (2)$$

Therefore, the amount of manganese that is subject to threshold determinations and release and other waste management estimates is:

$$\left[\frac{(8{,}000{,}000) \times (0.012 - 0.009)}{(0.012 - 0.002)}\right] \times \left[\frac{(0.012 + 0.010)}{(2)}\right] = 26{,}400 \text{ pounds}$$

= 26,400 pounds manganese (which is above the processing threshold)

The exemption does not apply to EPCRA Section 313 chemicals and chemical categories coincidentally manufactured as byproducts and separated from the product, nor does it apply to EPCRA Section 313 chemicals and chemical categories coincidentally manufactured as a result of waste management activities, from either on site or off site. (Under EPCRA Section 313, U.S. EPA does not consider waste to be a mixture.) For example, facilities may generate nitrate compounds as byproducts. The nitrate compounds would be considered to be coincidentally manufactured and the *de minimis* exemption would not apply. Thus, the amount of nitrate compounds (water dissociable and in water) created should be counted toward the 25,000-pound manufacturing threshold.

3.2.2.2 Articles Exemption

An article is defined as a manufactured item that:

- Is formed to a specific shape or design during manufacture;
- Has end-use functions dependent in whole or in part upon its shape or design; and
- Does not release an EPCRA Section 313 chemical or chemical category under normal conditions of processing or otherwise use of the item at the facility.

If you receive a manufactured article from another facility or you produce the article in your facility and process or otherwise use it without changing the shape or design, and your processing or otherwise use does not result in the release into the environment of more than 0.5 pound of the EPCRA Section 313 chemical or chemical category in a reporting year for all like articles, then the EPCRA Section 313 chemical or chemical category in that article is exempt from threshold determinations and release and other waste management calculations (U.S. EPA allows a release of 0.5 pound or less to be rounded to zero; the 0.5 pound limit does not apply to each individual article, but applies to the sum of all releases from processing or use of all like articles). Section 313 chemicals or chemical categories used to produce an article, however, do not qualify for the article exemption.

The shape and design can be changed somewhat during processing and otherwise use as long as part of the item retains the original dimensions. That is, as a result of processing or otherwise use, if an item retains its initial thickness or diameter, in whole or in part, then it still meets the article definition. If the item's original dimensional characteristics are totally altered during processing or otherwise use, the item would not meet the definition. As an example, items that do not meet the definition would be items that are cold extruded, such as lead ingots formed into wire or rods. However, cutting a manufactured item into pieces that are recognizable as the article would not change the exemption status as long as the diameter and the thickness of the item remain unchanged. For instance, metal wire may be bent and sheet metal may be cut, punched, stamped, or pressed without losing the article status as long as no change is made in the diameter of the wire or tubing or the thickness of the sheet and no releases above 0.5 pound per year occur for all like articles.

Example - Articles Exemption

A textile facility may receive fabric for further processing, such as cutting the fabric to a certain design specification. The fabric may be trimmed by the facility without losing the article status. However, if the releases of an EPCRA Section 313 chemical from all like fabrics exceed 0.5 pounds per year, the article exemption is negated.

Any processing or otherwise use of an article that results in a release above 0.5 pound per year for each EPCRA Section 313 and chemical category chemical for all like articles

also negates the exemption. Cutting, grinding, melting, or other processing of a manufactured item could result in a release of an EPCRA Section 313 chemical or chemical category during normal conditions of use and, therefore, could negate the article exemption if the total annual releases from all like articles exceeds 0.5 pound in a year. However, if all of the resulting waste is recycled or reused either on site or off site, so that the release of the EPCRA Section 313 chemical or chemical category does not exceed 0.5 pound for the calendar year, then the article's exemption status is maintained. If the processing or otherwise use of similar manufactured items results in a total release of less than or equal to 0.5 pound of any individual EPCRA Section 313 chemical or chemical category to any environmental media in a calendar year, U.S. EPA will allow this quantity to be rounded to zero and the manufactured items maintain their article status. The 0.5-pound limit does not apply to each individual article, but applies to the sum of all releases from processing or otherwise use of like articles for each EPCRA Section 313 chemical or chemical category. The current edition of *EPCRA Section 313 Questions and Answers* (1998 edition is EPA 745-B-98-004) presents several specific question and answer discussions pertaining to the articles exemption.

Example - Articles Exemption

If a textile article is subjected to a fabric printing process that removes a portion of an EPCRA Section 313 chemical from the surface that is not recycled or reused, this process would constitute a release and could negate the article exemption if the total releases from all like articles is greater than 0.5 lb for the reporting year.

3.2.2.3 Facility-Related Exemption

Laboratory Activity Exemption

EPCRA Section 313 chemicals and chemical categories that are manufactured, processed, or otherwise used in laboratories under the supervision of a technically qualified individual are exempted from the threshold determination (and subsequent release and other waste management calculations). This exemption may be applicable in circumstances such as laboratory sampling and analysis, research and development, and quality assurance and quality control activities. It does not include pilot plant scale or specialty chemical production. It also

does not include laboratory support activities. For example, chemicals used to maintain laboratory equipment are not eligible for the laboratory exemption.

Example - Laboratory Activity Exemption

A textile manufacturer applies various formulations of fabric coatings containing EPCRA Section 313 chemicals to product samples for testing flame resistance. The testing occurs in the facility's laboratory under the supervision of a "technically qualified individual." The EPCRA Section 313 chemicals used in this activity would be exempt from EPCRA Section 313 reporting and should not be included in any threshold determinations or release and other waste management calculations.

3.2.2.4 Activity-Related Exemptions (Otherwise Use Exemptions)

Some exemptions apply to the otherwise use of an EPCRA Section 313 chemical or chemical category. The specific quantities of EPCRA Section 313 chemicals and chemical categories used in these activities do not need to be included in facility threshold determinations (nor the associated release and other waste management calculations). The following otherwise use activities are considered exempt:

- **EPCRA Section 313 chemicals and chemical categories used in routine janitorial or facility grounds maintenance**. Examples are bathroom cleaners, fertilizers, and garden pesticides similar in type or concentration to consumer products. Materials used to clean process equipment do not meet this exemption.

- **Personal use of items**. Examples are foods, drugs, cosmetics, and other personal items including those items within a facility-operated cafeteria, store, or infirmary. Office supplies such as correction fluid are also exempt.

- **Structural components of the facility**. Exemptions apply to EPCRA Section 313 chemicals and chemical categories present in materials used to construct, repair, or maintain structural components of a facility. An example common to all facilities would be the solvents and pigments used to paint the buildings. Materials used to construct, repair, or maintain process equipment are not exempt.

- **EPCRA Section 313 chemicals and chemical categories used with facility motor vehicles**. This exemption includes the use of EPCRA Section 313 chemicals and chemical categories for the purpose of maintaining motor vehicles operated by the facility. Common examples include gasoline, radiator coolant, windshield wiper fluid, brake and transmission fluid, oils and lubricants, cleaning solutions, and solvents in paint used to touch up the vehicle. Motor vehicles include, but may not be limited to, cars, trucks, forklifts, locomotives, and aircraft. Note that this exemption applies to the OTHERWISE USE of EPCRA Section 313 chemicals and chemical categories. The coincidental manufacture of EPCRA Section 313 chemicals and chemical categories resulting from combustion of gasoline is not exempt and should be considered toward the manufacturing threshold.

Example - Motor Vehicle Exemption

Methanol is purchased for use as a processing aid and as a windshield washer anti-freeze in company vehicles. Only the amount used as a processing aid would be used in facility threshold calculations. Even if the facility still exceeds the otherwise use threshold, the amount in the anti-freeze is exempt from release and other waste management calculations.

This exemption does NOT apply to stationary equipment. The use of lubricants and fuels for stationary process equipment (e.g., pumps and compressors) and stationary energy sources (e.g., furnaces, boilers, heaters), are NOT exempt.

Example - Process Equipment Chemical Use

Lubricants containing listed EPCRA Section 313 chemicals and chemical categories used on facility vehicles, or on-site structural maintenance activities that are not integral to the process, are exempt activities. However, lubricants used to maintain pumps and compressors that aid facility process operations are not exempt and the amount of the EPCRA Section 313 chemical or chemical category in the lubricant should be applied to the otherwise use threshold.

- **EPCRA Section 313 chemicals and chemical categories in certain air or water drawn from the environment or municipal sources**. Included are an exemption for EPCRA Section 313 chemicals and chemical categories present in process water and non-contact cooling water drawn from the environment or a municipal source, or chemicals and chemical categories present in air used either as compressed air or as an oxygen source for combustion.

Example - Chemicals in Process Water

A facility uses river water for one of its processes. This water contains approximately 100 pounds of an EPCRA Section 313 chemical or chemical category. The facility ultimately returns the water that contains the entire 100 pounds of the EPCRA Section 313 chemical or chemical category to the river. The EPCRA Section 313 chemical or chemical category in the water can be considered exempt because the EPCRA Section 313 chemical or chemical category was present as it was drawn from the environment. The facility does not need to consider the EPCRA Section 313 chemical or chemical category drawn with river water for threshold determinations or release and other waste management calculations.

3.2.3 Additional Guidance on Threshold Calculations for Certain Activities

This section covers three specific situations in which the threshold determination may vary from normal facility operations: reuse, remediation, and recycling activities of EPCRA Section 313 chemicals and chemical categories.

3.2.3.1 Reuse Activities

Threshold determinations of EPCRA Section 313 chemicals and chemical categories that are reused at the facility are based only on the amount of the EPCRA Section 313 chemical or chemical category that is added to the system during the year, not the total volume in the system. For example, a facility operates a refrigeration unit that contains 15,000 pounds of anhydrous ammonia at the beginning of the year. The system is charged with 2,000 pounds of anhydrous ammonia during the year. The facility has therefore otherwise used only 2,000 pounds of the EPCRA Section 313 chemical or chemical category and is not required to report (unless the facility has additional otherwise use activities of ammonia that, when taken together, exceed the reporting threshold). If, however, the whole refrigeration unit was recharged with 15,000 pounds of new or fresh anhydrous ammonia during the year, the facility would exceed the otherwise use threshold, and be required to report.

Example - Threshold Determination, Recirculation

Facilities often incorrectly base threshold calculations on the amount of EPCRA Section 313 chemicals in a recirculation system rather than the amount actually used in the reporting year. The amount of the EPCRA Section 313 chemical that is actually manufactured (including the quantity imported), processed, or otherwise used, not the amount in storage or in the system, should be the amount applied to the threshold determination.

For example, a solvent containing an EPCRA Section 313 chemical is used, recirculated on site, and reused as a solvent. The amount of EPCRA Section 313 chemical recirculated in the on-site recycling process is not considered in the threshold determination because it is considered a "direct reuse" and is not reportable. Only the amount of new chemical added to the system should be included in the otherwise used threshold calculation.

However, if you send a solvent containing an EPCRA Section 313 chemical off site for distillation and subsequent recycling, it should be reported as a transfer to an off-site location for recycling (Form R, Part II, Section 6.2 and 8.5) because the distillation is considered a waste management activity. The amount of solvent returned to you and subsequently used in the same reporting year must be included in the threshold determination. If the reporting threshold is exceeded, the total quantity recycled should be reported in Section 8.4; i.e., the amount recycled must be reported in Section 8.4 each time it is recycled.

3.2.3.2 Remediation Activities

EPCRA Section 313 chemicals and chemical categories undergoing remediation (e.g., Superfund remediation) are not being manufactured, processed, or otherwise used. Therefore, they are not included in the activity threshold determinations.

However, if you are conducting remediation of an EPCRA Section 313 chemical or chemical category that is also being manufactured, processed, or otherwise used by the facility above an activity threshold level, you must consider this activity for release and other waste management calculations. You must report any release or other waste management quantities of an EPCRA Section 313 chemical or chemical category due to remediation in Part II, Sections 5 through 8, accordingly, of the 1999 Form R. Those quantities would also be considered as part of the amount for determining Form A eligibility. EPCRA Section 313 chemicals and chemical categories used for remediation should be considered toward threshold determinations.

Excavation of material already landfilled does not constitute a release or other waste management activity for EPCRA Section 313 reporting purposes. If an EPCRA Section 313 chemical or chemical category exceeds one of the reporting thresholds elsewhere at the facility, all release and other waste management quantities of that chemical must be reported, including release and other waste management quantities resulting from remediation. However,

routine activities (e.g., dredging a lagoon), even if not performed every year, are not considered to be remedial actions and are always subject to reporting.

3.2.3.3 Recycling Activities

For on-site recycling and reuse systems where the same EPCRA Section 313 chemical or chemical category is recycled and reused multiple times, the quantity should be counted only once (at the time it is introduced into the system) for threshold calculations. (Please note that for reporting on-site waste management activities, the quantity of the EPCRA Section 313 chemical or chemical category should be counted every time it exits the recycling unit in Section 8 of Form R.) EPCRA Section 313 chemicals and chemical categories recycled off site and returned to the facility should be treated as newly purchased materials for purposes of EPCRA Section 313 threshold determinations.

3.3 Step 3. Calculate the Quantity of Each EPCRA Section 313 Chemical and Chemical Category and Determine Which Ones Exceed an Activity Threshold

The final step is to determine the quantity and which EPCRA Section 313 chemicals and chemical categories exceed an activity threshold. At this point you should have:

1. Identified each EPCRA Section 313 chemical and chemical category at your facility.

2. Determined the activity category for each EPCRA Section 313 chemical and chemical category (manufactured, processed, or otherwise used).

Now, you must sum the amount for each EPCRA Section 313 chemical and chemical category by activity category, subtract all exempt quantities, and compare the totals to the applicable thresholds. Each EPCRA Section 313 chemical and chemical category exceeding **any one** of the activity thresholds requires the submission of an EPCRA Section 313 report. Provided you meet certain criteria you may prepare a Form A rather than a Form R (see Section 2.8).

COMMON ERROR - Assuming a Threshold is Exceeded

U.S. EPA recently published a report, *The 1994 and 1995 Toxic Release Inventory Data Quality Report*, EPA 745-R-98-002, with the site survey results of over 100 facilities to evaluate EPCRA Section 313 reporting quality. One of the findings of this survey was that facilities that simply assumed that chemical activity thresholds were exceeded were often in error. This resulted in many of these facilities filing EPCRA Section 313 reports when thresholds were actually not exceeded. Unless the facility has strong grounds to support such an assumption, the time spent in explicitly calculating the activity threshold is well spent.

COMMON ERROR - Zero Release and Other Waste Management Quantities

If you meet all reporting criteria and exceed any activity threshold for an EPCRA Section 313 chemical, you must prepare a Form R **OR** Form A for that chemical activity, even if you have zero release and other waste management activities. Exceeding the chemical activity threshold, not the quantity released and otherwise managed as waste determines whether you must report. Note that if the release and other waste managed quantity is 500 pounds or less you may be eligible to use the alternate certification statement, Form A, rather than a Form R (see Section 2.9) for each chemical or chemical category.

COMMON ERROR - Certain Glycol Ethers

Many facilities in the textile industry otherwise use glycol ethers in various processes. Certain glycol ethers are reportable as a chemical category for EPCRA Section 313. The definition of which glycol ethers are reportable was modified starting with reporting year 1993 to exclude high molecular weight glycol ethers. The current definition and listing of specific chemicals reportable under EPCRA Section 313 is presented in U.S. EPA's *Toxic Release Inventory: List of Toxic Chemicals Within the Glycol Ethers Category*, May 1995 (EPA 745-R-95-006) and has been included in this document as Appendix D.

When performing threshold calculations, you must determine which glycol ethers your facility uses and whether they are reportable under EPCRA Section 313.

COMMON ERROR - Threshold Determinations for Metal Compounds

Facilities are often confused regarding threshold calculations for metal compounds. The threshold determination for metal compounds should be calculated using the total amount of the compound, not just the weight of the parent metal. If a threshold is exceeded, the reportable quantities should be based on the amount of parent metal only. To determine if the de minimis concentration is exceeded, the weight of the entire compound must be applied.

For those metal compounds listed separately on the EPCRA Section 313 chemical list, do not include the amounts of those compounds manufactured, processed, or otherwise used in threshold determinations for the metal compound category. If a compound is listed separately, thresholds and release and other waste management quantities should both be based on the entire compound amount. An EPCRA Section 313 report, if required, should be submitted for this chemical individually.

To determine if an EPCRA Section 313 chemical or chemical category exceeds a reporting threshold, you must calculate the annual activity amount of that chemical. Start with

the amount of chemical at the facility as of January 1, add any amount brought on site during the year and the amount manufactured (including imported), and subtract the amount left in the inventory on December 31. If necessary, adjust the total to account for exempt activities (see Section 3.2.2 for a discussion of exemptions). You should then compare the result to the appropriate threshold to determine if you are required to submit an EPCRA Section 313 report for that chemical or chemical category. Keep in mind that the threshold calculations are independent for each activity category: manufactured, processed, and otherwise used. If more than one activity category applies, the amount associated with each category is determined separately.

Table 3-5 presents a work sheet that may be helpful when conducting your threshold determinations. Table 3-6 illustrates an example of how the work sheet can be used for the following example:

Example - Threshold Worksheet

Assume your facility purchases two mixtures that contain methyl ethyl ketone in the applicable reporting year. You purchased 25,000 pounds of Mixture A (which is 50% methyl ethyl ketone, by weight, according to the MSDS) and 110,000 pounds of Mixture B (which contains 20% methyl ethyl ketone, by weight). Further, you determine that you process the entire quantity of Mixture A, while you process only half of Mixture B and otherwise use the other half. You do not qualify for any exempt activities.

In this example, you would have processed a total of 23,500 pounds of methyl ethyl ketone (12,500 pounds from activities associated with Mixture A and 11,000 pounds from activities associated with Mixture B). You would also have otherwise used a total of 11,000 pounds (all from Mixture B). Therefore, you would not have exceeded the 25,000 pound threshold for processing; however, you would have exceeded the 10,000 pound threshold for otherwise use and would be required to submit an EPCRA Section 313 report that includes releases and other waste management quantities from all activities (including processing).

Table 3-5. EPCRA Section 313 Reporting Threshold Worksheet

Facility Name: _____ **Date Worksheet Prepared:** _____
EPCRA Section 313 Chemical or Chemical Category: _____ **Prepared By:** _____
CAS Registry Number: _____
Reporting Year: _____

Amounts of the chemical manufactured, processed, or otherwise used.

Mixture Name or Other Identifier	Information Source	Total Weight (lb)	Percent TRI Chemical by Weight	TRI Chemical Weight (lb)	Amount of the EPCRA Section 313 Chemical by Activity (lb):		
					Manufactured	Processed	Otherwise Used
1.							
2.							
3.							
4.							
Subtotal:					(A)_____lb.	(B)_____lb.	(C)_____lb.

Exempt quantity of the chemical that should be excluded.

Mixture Name as Listed Above	Applicable Exemption (de minimis, article, facility, activity)	Fraction or Percent Exempt (if Applicable)	Amount of the EPCRA Section 313 Chemical Exempt from Above (lb):		
			Manufactured	Processed	Otherwise Used
1.					
2.					
3.					
4.					
Subtotal:			(A_1)_____lb.	(B_1)_____lb.	(C_1)_____lb.
		Amount subject to threshold:	($A-A_1$)_____ lb.	($B-B_1$)_____ lb.	($C-C_1$)_____ lb.
Compare to threshold for EPCRA Section 313 reporting.		Activity threshold quantities[2]:	25,000 lb.	25,000 lb.	10,000 lb.

If any one of these thresholds is exceeded, reporting is required for all activities. [Do not submit this worksheet with your EPCRA Section 313 report; retain it for your records.]

[2]These activity thresholds apply to non-PBT chemicals. See Section 2.6 for activity thresholds applicable to PBT chemicals.

Table 3-6. Sample EPCRA Section 313 Reporting Threshold Worksheet

Facility Name: ABC Textile Finishing, Inc.
EPCRA Section 313 Chemical or Chemical Category: Methyl ethyl ketone
CAS Registry Number: 78-93-3
Reporting Year: 1999

Date Worksheet Prepared: May 1, 2000
Prepared By: A.B. Calloway

Amounts of the chemical manufactured, processed, or otherwise used.

Mixture Name or Other Identifier	Information Source	Total Weight (lb)	Percent TRI Chemical by Weight	TRI Chemical Weight (lb)	Amount of the EPCRA Section 313 Chemical by Activity (lb):		
					Manufactured	Processed	Otherwise Used
1. Mixture A	Purchasing records, MSDS	25,000	50%	12,500	---	12,500	---
2. Mixture B	Purchasing records, MSDS	110,000	20%	22,000	---	11,000	11,000
3.							
4.							
Subtotal:					(A) 0 lb.	(B) 23,500 lb.	(C) 11,000 lb.

Exempt quantity of the chemical that should be excluded.

Mixture Name as Listed Above	Applicable Exemption (de minimis, article, facility, activity)	Fraction or Percent Exempt (if Applicable)	Amount of the EPCRA Section 313 Chemical Exempt from Above (lb):		
			Manufactured	Processed	Otherwise Used
1. None					
2.					
3.					
4.					
Subtotal:			(A_1) 0 lb.	(B_1) 0 lb.	(C_1) 0 lb.
		Amount subject to threshold:	($A-A_1$) 0 lb.	($B-B_1$) 23,500 lb.	($C-C_1$) 11,000 lb.
Compare to threshold for EPCRA Section 313 reporting.		Activity threshold quantities[2]:	25,000 lb.	25,000 lb.	10,000 lb.

If any one of these thresholds is exceeded, reporting is required for all activities. [Do not submit this worksheet with your EPCRA Section 313 report; retain it for your records.]

[2]These activity thresholds apply to non-PBT chemicals. See Section 2.6 for activity thresholds applicable to PBT chemicals.

CHAPTER 4 - ESTIMATING RELEASE AND OTHER WASTE MANAGEMENT QUANTITIES

4.0 PURPOSE

This chapter is intended to guide the user in developing a systematic approach for estimating release and other waste management quantities of EPCRA Section 313 chemicals and chemical categories from textile manufacturing processes. Figure 4-1 diagrams a recommended approach for estimating quantities of reportable EPCRA Section 313 chemicals or chemical categories.

This chapter also includes common EPCRA Section 313 reporting and compliance issues as they apply to textile manufacturers. The general discussion (Section 4.1) is followed by a presentation of specific examples and issues (Section 4.2) as they pertain to textile manufacturers.

4.1 General Steps for Determining Release and Other Waste Management Activity Quantities

Release and other waste management activity quantities can be determined by completing the following four steps described in detail in the following sections.

Step 1) Prepare a **process flow diagram**.

Step 2) Identify EPCRA Section 313 chemicals and chemical categories and potential **sources** of chemical release and other waste management activities.

Step 3) Identify release and other waste management activity **types**.

Step 4) Determine the most appropriate method(s) and **calculate the estimates** for release and other waste management activity quantities.

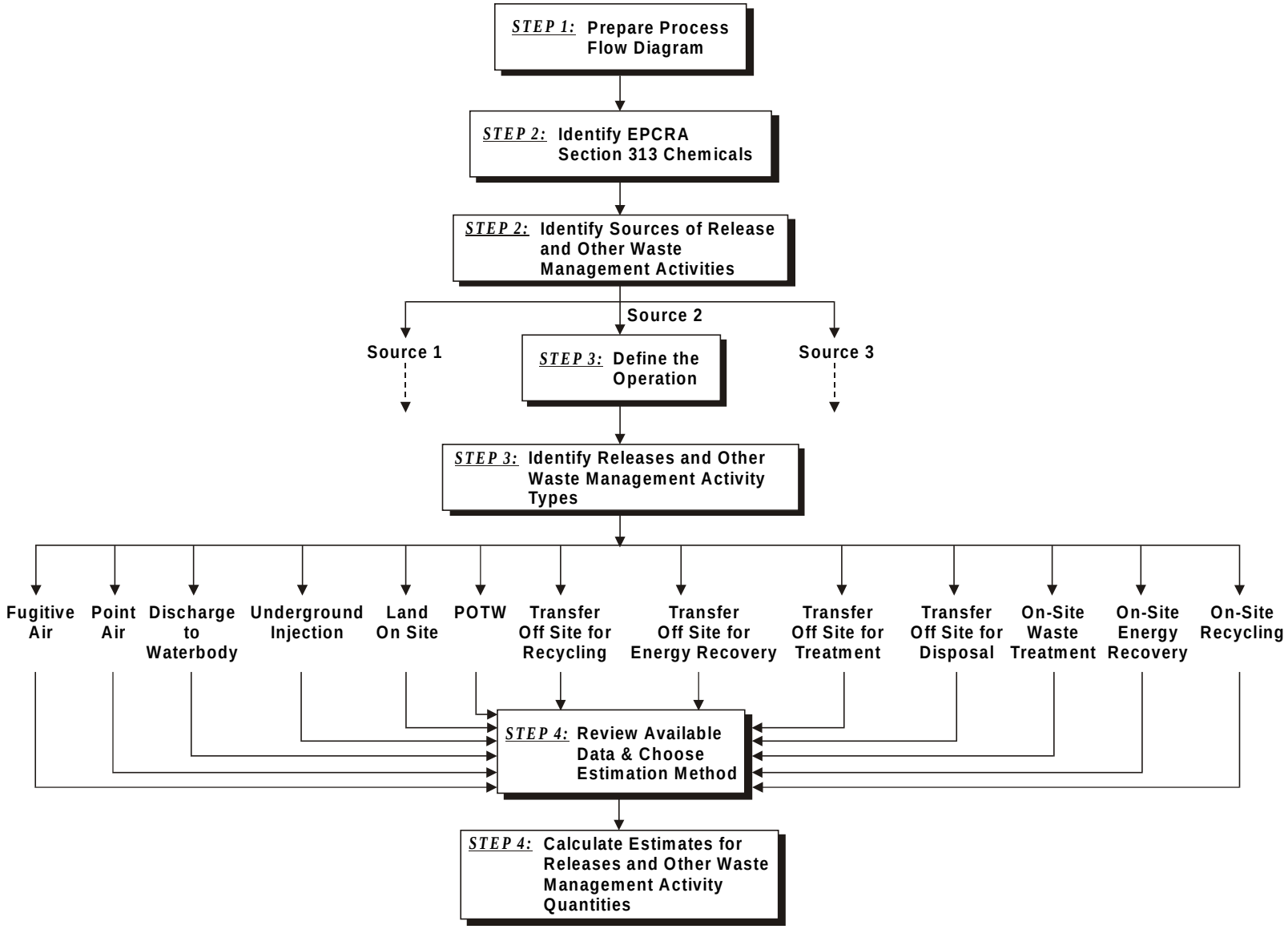

Figure 4-1. Release and Other Waste Management Calculation Approach

For EPCRA Section 313 purposes, “sources” means the streams or units that generate the release and other waste management activity (such as process vents, container residue, or spills) and “types” means the environmental media corresponding to elements in Sections 5 through 8 of the 1999 Form R (for example, releases to fugitive air, releases to stack air, discharges to receiving streams or POTWs, or releases to land).

4.1.1 Step 1: Prepare a Process Flow Diagram

Preparing a process flow diagram will help you to identify potential sources and types of EPCRA Section 313 chemicals and chemical categories released and otherwise managed as waste at your facility. Depending on the complexity of your facility, you may want to diagram individual processes or operations rather than the entire facility. The diagram should show how materials flow through the processes and identify material input, generation, and output points. Looking at each operation separately, you can determine where EPCRA Section 313 chemicals and chemical categories are used and the medium to which they may be released or otherwise managed as waste.

4.1.2 Step 2: Identify EPCRA Section 313 Chemicals and Chemical Categories and Potential Sources of Chemical Release and Other Waste Management Activities

Once a process flow diagram has been developed, you must determine the potential sources and the EPCRA Section 313 chemicals and chemical categories that may be released and otherwise managed as waste from each unit operation and process. Remember to include upsets and routine maintenance activities. Potential sources include:

- Accidental spills and releases;
- Air pollution control devices (e.g., baghouses, electrostatic precipitators, and scrubbers)
- Clean up and housekeeping practices;
- Combustion byproducts.
- Container residues;
- Fittings;
- Flanges;
- Process discharge streams;
- Process vents;
- Pumps;
- Recycling and energy recovery byproducts;
- Relief valves;
- Stock pile losses;
- Storage tanks;

- Storm water runoff;
- Tower stacks;
- Transfer operations;
- Treatment sludge;
- Volatilization from process or treatment; and
- Waste treatment discharges.

Next, you must identify the EPCRA Section 313 chemicals and chemical categories that may be released or otherwise managed as waste from each source. A thorough knowledge of the facility operations and processes is required for this determination. You should also consider whether any of the EPCRA Section 313 chemicals or chemical categories are coincidentally manufactured at your facility. Table 2-3 identifies EPCRA Section 313 chemicals and chemical categories typically used in textile manufacturing. This table can be used as an aid in identifying which chemicals and chemical categories are found in your process. The list may not include all the EPCRA Section 313 chemicals and chemical categories your facility uses, and it may include many chemicals that you do not use.

4.1.3 Step 3: Identify Release and Other Waste Management Activity Types

For each identified source of an EPCRA Section 313 chemical or chemical category, you should examine all possible release and other waste management activity types. Figure 4-2 schematically represents the possible release and other waste management activity types as they correspond to individual data elements of the Form R. Remember to include both routine operations and accidents when identifying types. This diagram along with the following descriptions can be used as a checklist to make sure all possible types of release and other waste management activities have been considered.

a. Fugitive or Non-Point Air Emissions (Part II, Section 5.1 of Form R) - Includes all emissions to the air that are not released through stacks, vents, ducts, pipes, or any confined air stream. Examples include:

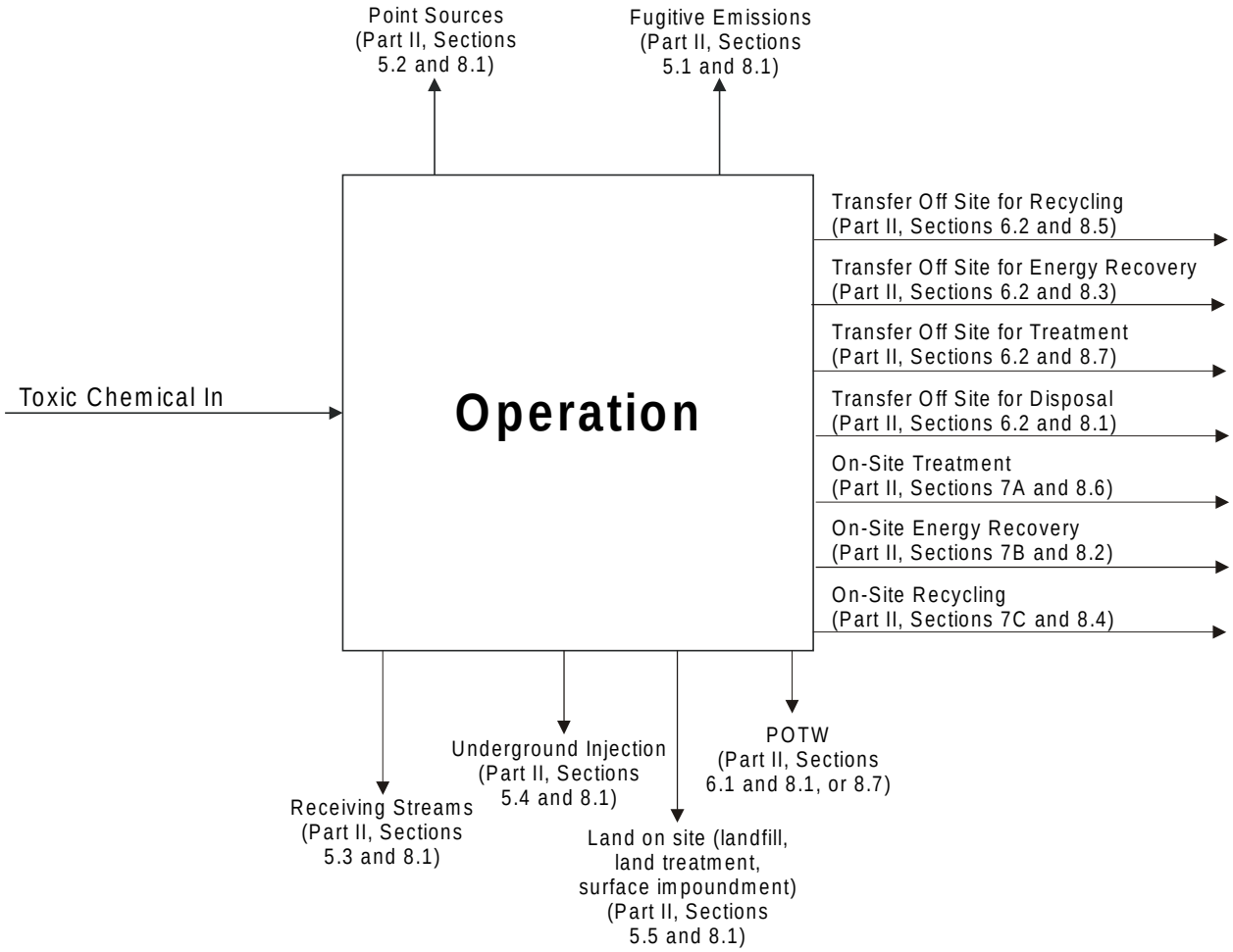

Figure 4-2. Possible Release and Other Waste Management Types[1] for EPCRA Section 313 Chemicals and Chemical Categories

[1]Sections refer to 1999 Form R. Quantities released to the environment as a result of remedial actions, catastrophic events, or one-time events should be reported in Part II, Section 8 as Subsection 8.8.

- Equipment leaks from valves, pump seals, flanges, compressors, sampling connections, open-ended lines, etc.;
- Releases from building ventilation systems, such as a roof fan in an open room;
- Evaporative losses from solvent cleaning tanks, surface impoundments, and spills; and
- Emissions from any other fugitive or non-point source.

COMMON ERROR - Reporting Fugitive Emissions

A common reporting error is failure to account for fugitive air releases during the transfer of volatile chemicals such as toluene, chlorine, or ammonia from storage tanks to unit operations. Sources of fugitive air releases from transfer operations include valves and pipe flanges. To calculate breathing and working losses, SOCMI emission factors, AP-42 emission factors and equations, and EPA's TANKS computer program can be used (see Section 4.1.4.3).

Note that releases from storage tanks are classified as stack air emissions.

b. Stack or Point Air Emissions (Part II, Section 5.2 of Form R) - Includes all emissions to the air that occur through stacks, vents, ducts, pipes, or any confined air stream, including the emissions from storage tanks and air pollution control equipment. Note that emissions released from general room air through a ventilation system are not considered stack or point releases for the purpose of EPCRA Section 313 reporting unless they are channeled through an air pollution control device. Instead, they are considered fugitive releases. However, you should note that for certain state reporting requirements not associated with EPCRA Section 313 reporting, some state air quality agencies consider ventilation systems to be a stack or point source.

c. Discharges to Receiving Streams or Water Bodies (Part II, Section 5.3 of Form R) - Includes direct wastewater discharges to a receiving stream or surface water body. Discharges usually occur under a NPDES or SPDES permit.

d. Underground Injection On-Site to Class I Wells (Part II, Section 5.4.1 of Form R) and to Class II through V Wells (Part II, Section 5.4.2 of Form R) - Includes releases into an underground well at the facility. These wells may be monitored under an Underground Injection Control (UIC) Program permit. RCRA Hazardous Waste Generator Reports may be a good source of information for wastes injected into a Class I well. Injection rate meters may provide information for all the well classes.

e. Disposal to Land On-Site (Part II, Section 5.5 of Form R) - Includes all releases to land on site, both planned (i.e., disposal) and unplanned (i.e., accidental release or spill). The four predefined subcategories for

reporting quantities released to land within the boundaries of the facility are:

(1) **Landfill** - The landfill may be either a RCRA permitted (Part II, Section 5.51A) or a non-hazardous waste landfill (Part II, Section 5.51B). Both types are included if they are located on site. Leaks from landfills in the years subsequent to the disposal of the EPCRA Section 313 chemicals or chemical categories in the landfill do not need to be reported as a release.

(2) **Land treatment/application farming** - Land treatment is a disposal method in which a waste containing an EPCRA Section 313 chemical or chemical category is applied to or incorporated into soil. Volatilization of an EPCRA Section 313 chemical or chemical category because of the disposal operation must be included in the total fugitive air releases and should be excluded from land treatment/application farming to avoid double counting.

Sludge and/or aqueous solutions that contain biomass and other organic materials are often collected and applied to farm land. This procedure supplies a nitrogen source for plants and supplies metabolites for microorganisms. U.S. EPA considers this operation to be land treatment/farming if it occurs on site. If a facility sends this material off site for the same purpose, it is considered to be a "transfer to an off-site location, disposal" and should be reported under Sections 6.2 and 8.1 of the Form R.

The ultimate disposition of the chemical or chemical category after application to the land does not change the required reporting. For example, even if the chemical or chemical category is eventually biodegraded by microorganisms or plants, it is not considered recycled, reused, or treated.

(3) **Surface impoundment** - A surface impoundment is a natural topographic depression, man-made excavation, or diked area formed primarily of earthen materials that is designed to hold an accumulation of wastes containing free liquids. Examples include: holding, settling, storage, and elevation pits; ponds; and lagoons. Quantities of the toxic chemical released to surface impoundments that are used merely as part of a wastewater treatment process generally must not be reported in this section. However, if the sludge from the surface impoundment contains the EPCRA Section 313 chemical or chemical category, then the EPCRA Section 313 chemicals or chemical categories in the sludge must be estimated in this section unless the sludge is removed and subjected to another waste management activity.

(4) **Other disposal** - Releases to land that do not fit the categories of landfills, land treatment, or surface impoundment are classified as other disposal. This disposal may include any spills or leaks of the EPCRA Section 313 chemical or chemical category to land.

f. Discharges to Publicly Owned Treatment Works (POTW) (Part II, Section 6.1 of Form R) - Includes the amount of EPCRA Section 313 chemical or chemical category in water transferred to an off-site POTW. Note that metals and metal compounds transferred to a POTW must also be reported in Section 8.1.

g. Transfers to Other Off-Site Locations (Part II, Section 6.2 of Form R) - Includes all off-site transfers containing the EPCRA Section 313 chemical or chemical category for the purposes of disposal, treatment, energy recovery, or recycling. Off-site transfer for disposal includes underground injection, landfill/surface impoundment, other land disposal and transfer to a waste broker for disposal. The amount transferred off site for disposal must also be reported in Section 8.1.

Be sure to consider metals and metal compounds that are present in pigments used in spray coating applications. Waste containing these pigments may be present in spent filters or other waste generated from spray booths.

Also reported in Section 6.2 would be any residual EPCRA Section 313 chemicals or chemical categories in “empty” containers transferred off site. U.S. EPA expects that all containers (bags, totes, drums, tank trucks, etc.) will have a small amount of residual solids and/or liquid. On-site cleaning of containers must be considered for EPCRA Section 313 reporting. If the cleaning occurs with a solvent (organic or aqueous), you must report the disposition of the waste solvent as appropriate. If the containers are sent off site for disposal or reclamation, you should report the EPCRA Section 313 chemical or chemical category in this section.

COMMON ERROR - Shipping Container Residue

Do not overlook residual chemicals or chemical categories in containers. U.S. EPA recently published *The 1994 and 1995 Toxic Release Inventory Data Quality Report*, EPA 745-R-98-002, presenting the site survey results of over 100 facilities to evaluate EPCRA Section 313 reporting quality. This survey found the largest source of overlooked release and other waste management activities was from container residue. So-called "empty" drums may contain an inch or more of liquid after draining and similarly "empty" bags may contain residues of dust and powder. Even though each individual drum or bag may only contain a small amount of an EPCRA Section 313 chemical or chemical category, for facilities that receive hundreds or thousands of drums or bags each year the annual cumulative amount of an EPCRA Section 313 chemical or chemical category can be substantial. The quantities should typically be reported in Section 6.2. Please note that unlike RCRA, EPCRA Section 313 does not define what constitutes an "empty" container. EPCRA Section 313 is merely trying to account for all the quantities of toxic chemicals released and otherwise managed as waste.

Actual data and a knowledge of the unloading methods at your facility can be used to estimate the quantity of residual EPCRA Section 313 chemicals or chemical categories in containers. However, U.S. EPA has developed guidance to assist facilities if no site-specific information is available. Table 4-1 provides results from experimentation on residue quantities left in drums and tanks when emptied. These results are presented as the mass percent of the vessel capacity, and are categorized based on unloading method, vessel material, and bulk fluid material properties such as viscosity and surface tension. No testing was conducted for residual solids in this study. If data or site-specific knowledge is available to estimate the quantity of solid residual in containers, it should be considered. If no data are available, U.S. EPA believes an estimate of 1% residual solid material is reasonable.

Example - Container Residue

You have determined that a Form R for an EPCRA Section 313 chemical must be submitted. The facility purchases and uses one thousand 55-gallon steel drums that contain a 10% aqueous solution of the chemical. Further, it is assumed that the physical properties of the solution are similar to water. The solution is pumped from the drums directly into a mixing vessel and the "empty" drums are triple-rinsed with water. The rinse water is indirectly discharged to a POTW and the cleaned drums are sent to a drum reclaimer.

Table 4-1 lists the residue quantity of water in a steel drum, unloaded by pumping, as approximately 2.29% of drum capacity. In this example, it can be assumed that all of the residual solution in the drums was transferred to the rinse water. Therefore, the quantity sent off site to the drum reclaimer should be reported as "zero."

The annual quantity of residual solution that is transferred to the rinse water can be estimated by multiplying the mean weight percent of residual solution remaining in a pumped steel drum by the total annual weight of solution in the drums. If the density is not known, it may be appropriate to use the density of water (8.34 pounds per gallon):

$$(0.0229) \times (55 \text{ gal/drum}) \times (1{,}000 \text{ drums}) \times (8.34 \text{ lb/gal}) = 10{,}504 \text{ pounds solution.}$$

The concentration of the EPCRA Section 313 chemical in the solution is 10%.

$$(10{,}504 \text{ lb solution}) \times (0.10) = 1{,}050 \text{ pounds EPCRA Section 313 chemical.}$$

Therefore, 1,050 pounds of the EPCRA Section 313 chemical are sent off site to the POTW, and should be reported in Part II, Sections 6.1 and 8.7 of the 1999 Form R. Because they cannot be destroyed, metals cannot be reported as being treated, and metals and metal portions of metal compounds should be reported in Part II, Sections 6.1 and 8.1 of the 1999 Form R.

h. On-Site Waste Treatment (Part II, Section 7A of Form R) - Includes all on-site waste treatment of reported EPCRA Section 313 chemicals and chemical categories. The information reported in Section 7A focuses on the treatment of the entire *waste stream*, not the specific EPCRA Section 313 chemical or chemical category. The information includes: type of waste stream (gaseous, aqueous or non-aqueous liquid, or solid); treatment methods or sequence; influent concentrations of the EPCRA Section 313 chemical or chemical category; treatment efficiency of each method or sequence; and whether efficiency data are based on actual operating data. Metals and metal portions of metal compounds subjected to a combustion process are not destroyed but should still be reported as going through the treatment process, with a treatment efficiency of zero. Note that only the metal portion of metal compounds should be reported in the Form R. The following example illustrates how Section 7A should be completed for on-site treatment of a wastewater stream containing three EPCRA Section 313 chemicals.

Table 4-1

Summary of Residue Quantities From Pilot-Scale Experimental Study[a,b] (weight percent of drum capacity)

Unloading Method	Vessel Type	Value	Material			
			Kerosene[c]	Water[d]	Motor Oil[e]	Surfactant Solution[f]
Pumping	Steel drum	Range Mean	1.93 - 3.08 2.48	1.84 - 2.61 2.29	1.97 - 2.23 2.06	3.06 3.06
Pumping	Plastic drum	Range Mean	1.69 - 4.08 2.61	2.54 - 4.67 3.28	1.70 - 3.48 2.30	Not Available
Pouring	Bung-top steel drum	Range Mean	0.244 - 0.472 0.404	0.266 - 0.458 0.403	0.677 - 0.787 0.737	0.485 0.485
Pouring	Open-top steel drum	Range Mean	0.032 - 0.080 0.054	0.026 - 0.039 0.034	0.328 - 0.368 0.350	0.089 0.089
Gravity Drain	Slope-bottom steel tank	Range Mean	0.020 - 0.039 0.033	0.016 - 0.024 0.019	0.100 - 0.121 0.111	0.048 0.048
Gravity Drain	Dish-bottom steel tank	Range Mean	0.031 - 0.042 0.038	0.033 - 0.034 0.034	0.133 - 0.191 0.161	0.058 0.058
Gravity Drain	Dish-bottom glass-lined tank	Range Mean	0.024 - 0.049 0.040	0.020 - 0.040 0.033	0.112 - 0.134 0.127	0.040 0.040

[a]From "Releases During Cleaning of Equipment." Prepared by PEI Associates, Inc., for the U.S. Environmental Protection Agency, Office of Pesticides and Toxic Substances, Washington DC, Contract No. 68-02-4248. June 30, 1986.

[b]The values listed in this table should only be applied to similar vessel types, unloading methods, and bulk fluid materials. At viscosities greater than 200 centipoise, the residue quantities can rise dramatically and the information on this table is not applicable.

[c]For kerosene, viscosity = 5 centipoise, surface tension = 29.3 dynes/cm^2

[d]For water, viscosity = 4 centipoise, surface tension = 77.3 dynes/cm^2

[e]For motor oil, viscosity = 97 centipoise, surface tension = 34.5 dynes/cm^2

[f]For surfactant solution viscosity = 3 centipoise, surface tension = 31.4 dynes/cm^2

Example - On-Site Waste Treatment

A process at the facility generates a wastewater stream containing an EPCRA Section 313 chemical (chemical A). A second process generates a wastewater stream containing two EPCRA Section 313 chemicals, a metal (chemical B) and a mineral acid (chemical C). Thresholds for all three chemicals have been exceeded and you are in the process of completing separate Form Rs for each chemical.

The two wastewater streams are combined and sent to an on-site wastewater treatment system before being released to a POTW. This system consists of an oil/water separator that removes 99% of chemical A; a neutralization tank in which the pH is adjusted to 7.5, thereby destroying 100% of the mineral acid (chemical C); and a settling tank where 95% of the metal (chemical B) is removed from the water (and eventually land filled off site).

Section 7A should be completed slightly differently when you file the Form R for each of the chemicals. The table accompanying this example shows how Section 7A should be completed for each chemical. First, on each Form R you should identify the type of waste stream in Section 7A.1a as wastewater (aqueous waste, code W). Next, on each Form R you should list the code for each of the treatment steps that is applied to the entire waste stream, regardless of whether the operation affects the chemical for which you are completing the Form R (for instance, the first four blocks of Section 7A.1b of all three Form Rs should show: P19 (liquid phase separation), C11 (neutralization), P11 (settling/clarification), and N/A (to signify the end of the treatment system). Note that Section 7A.1b is the only section of the Form R that is not chemical specific. It applies to the entire waste stream being treated. Section 7A.1c of each Form R should show the concentration of the specific chemical in the influent to the first step of the process (oil/water separation). For this example, assume chemicals A, B, and C are all present at concentrations greater than 1%. Therefore, code "1" should be entered. Section 7A.1d is also chemical specific. It applies to the efficiency of the entire system in destroying and/or removing the chemical for which you are preparing the Form R. You should enter 99% when filing for chemical A, 95% for chemical B, and 100% for chemical C. Finally, you should report whether the influent concentration and efficiency estimates are based on operating data for each chemical, as appropriate.

Chemical A						
7A.1a	7A.1b	1. P19	2. C11	7A.1c	7A.1d	7A.1e
W	3. P11	4. N/A	5. _____	1	99 %	Yes X / No ____
	6. _____	7. _____	8. _____			

Chemical B						
7A.1a	7A.1b	1. P19	2. C11	7A.1c	7A.1d	7A.1e
W	3. P11	4. N/A	5. _____	1	95 %	Yes X / No ____
	6. _____	7. _____	8. _____			

Chemical C						
7A.1a	7A.1b	1. P19	2. C11	7A.1c	7A.1d	7A.1e
W	3. P11	4. N/A	5. _____	1	100 %	Yes X / No ____
	6. _____	7. _____	8. _____			

Note that the quantity removed and/or destroyed is not reported in Section 7 and that the efficiency reported in Section 7A.1d refers to the amount of EPCRA Section 313 chemical destroyed and/or removed from the applicable waste stream. The amount actually destroyed should be reported in Section 8.6 (quantity treated on site). For example, when completing the Form R for chemical B you should report "0" pounds in Section 8.6 because the metal has been removed from the wastewater stream, but not actually destroyed. The quantity of chemical B that is ultimately land filled off site should be reported in Sections 6.2 and 8.1. However, when completing the Form R for chemical C you should report the entire quantity in Section 8.6 because raising the pH to 7.5 will completely destroy the mineral acid.

i. **On-Site Energy Recovery (Part II, Section 7B of Form R)** - Includes all on-site energy recovery of reported EPCRA Section 313 chemicals and chemical categories. U.S. EPA's view is that EPCRA Section 313 chemicals or chemical categories that do not contribute significant heat energy during combustion processes should not be considered for energy recovery. Therefore, only EPCRA Section 313 chemicals or chemical categories with a significant heating value that are combusted in an energy recovery unit such as an industrial furnace, kiln, or boiler can be reported for energy recovery. If an EPCRA Section 313 chemical or chemical category is incinerated on site but does not significantly contribute energy to the process, (e.g., chlorofluorocarbons (CFCs)) it must be considered on-site waste treatment (see 4.1.3, h. above). Metals and metal portions of metal compounds will never be combusted for energy recovery. Note that only the metal portion of metal compounds should be reported in the Form R.

j. **On-Site Recycling (Part II, Section 7C of Form R)** - Includes all on-site recycling methods used on EPCRA Section 313 chemicals or chemical categories.

k. **Source Reduction and Recycling Activities (Part II, Section 8 of Form R)*** - Provide information about source reduction and recycling activities related to the EPCRA Section 313 chemical or chemical category for which release and other waste management activities are being reported. Section 8 uses some data collected to complete Part II, Sections 5 through 7. For this reason, Section 8 should be completed last. The relationship between Sections 5, 6, and 8.8 to Sections 8.1, 8.3, 8.5, and 8.7 are provided in equation forms below.

(1) **Quantity Released (Part II, Section 8.1 of Form R)** - The quantity reported in Section 8.1 is the quantity reported in all of Section 5 plus the quantity of metals and metal compounds reported as discharged off site to POTWs in Section 6.1 plus the quantity reported as sent off site for disposal in Section 6.2 minus the quantity reported in Section 8.8 that was released on site or sent off site for disposal:

§8.1 = §5 + §6.1 (metals and metal compounds) + §6.2 (disposal) - §8.8 (on-site release or off-site disposal only)

(2) **Quantity Used for Energy Recovery On-Site (Part II, Section 8.2 of Form R)** - Estimate the quantity of the EPCRA Section 313 chemical or chemical category in wastes combusted for energy recovery on site. This estimate should be the quantity of

*The Subsection 8.1 through 8.8 designations are for the 1999 Form R. Please refer to the current reporting year *TRI Forms and Instructions* for any changes.

the chemical or chemical category combusted in the process for which codes were reported in Section 7B. Test data from trial burns or other monitoring data may be used to estimate the quantity of the EPCRA Section 313 chemical or chemical category combusted for energy recovery purposes. If monitoring data are not available, vendor specifications regarding combustion efficiency may be used as they relate to the EPCRA Section 313 chemical or chemical category. A quantity must be reported in Section 8.2 when a method of on-site energy recovery is reported in Section 7B and vice versa.

Two conditions need to be met to report the combustion of an EPCRA Section 313 chemical or chemical category in waste as energy recovery: the chemical or chemical category (1) must have a significant heating value and (2) must be combusted in an energy recovery unit, such as a waste heat boiler, an industrial furnace, or a kiln. If an EPCRA Section 313 chemical or chemical category that does not have a significant heating value (except metals and metal compounds) is combusted for energy recovery on site, it must be considered on-site waste treatment (see 4.1.3.h). However, this does not apply to metals and metal compounds. Metals and metal compounds in a waste that are combusted on site will never be combusted for energy recovery or treated for destruction and are therefore normally disposed. Note that "NA" should be reported for EPCRA Section 313 chemicals and chemical categories that do not have a significant heating value. This includes metals, metal portions of metal compounds, halogens, hydrochlorofluorocarbons (HCFCs), and CFCs.

(3) **Quantity Used for Energy Recovery Off-Site (Part II, Section 8.3 of Form R)** - The quantity reported in Section 8.3 is the quantity reported in Section 6.2 for which energy recovery codes are reported. If a quantity is reported in Section 8.8, subtract any associated off-site transfers for energy recovery:

§8.3 = §6.2 (energy recovery) - §8.8 (off-site energy recovery)

Two conditions need to be met to report the combustion of an EPCRA Section 313 chemical or chemical category in waste as energy recovery: the chemical or chemical category (1) must have a significant heating value and (2) must be combusted in an energy recovery unit, such as a waste heat boiler, an industrial furnace, or a kiln. If an EPCRA Section 313 chemical or chemical category that does not have a significant heating value (except metals and metal compounds) is sent off site for energy recovery, it must be considered off-site waste treatment (see 4.1.3.g). However, this

does not apply to metal and metal compounds. Metals and metal compounds sent off site for combustion in energy recovery units must be considered as sent off site for disposal because typically they will ultimately be disposed. Metals and metal portions of metal compounds will never be treated or combusted for energy recovery. Note that only the metal portion of metal compounds should be reported in the Form R. Also note that "NA" should be reported for EPCRA Section 313 chemicals and chemical categories that do not have a significant heating value. This includes metals, metal portions of metal compounds, halogens, HCFCs, and CFCs.

(4) **Quantity Recycled On-Site (Part II, Section 8.4 of Form R)** - Estimate the quantity of the EPCRA Section 313 chemical or chemical category recycled in wastes on site. This estimate should be the quantity of the chemical or chemical category recycled in the process for which codes were reported in Section 7C. A quantity should be reported in Section 8.4 when a method of on-site recycling is reported in Section 7C and vice versa. To estimate this quantity, you should determine if operating data exist that indicate a recovery efficiency and use that efficiency value combined with throughput data to calculate an estimate. If operating data are unavailable, available vendor specifications may be appropriate.

(5) **Quantity Recycled Off-Site (Part II, Section 8.5 of Form R)** - The quantity reported in Section 8.5 must be the same as the quantity reported in Section 6.2 for which recycling codes are reported. If a quantity is reported in Section 8.8, subtract any associated off-site transfers for recycling.

If the facility has knowledge about metals being recovered, this quantity should be reported in Section 8.5.

§8.5 = §6.2 (recycling) - §8.8 (off-site recycling)

COMMON ERROR - Direct Reuse vs. Recycling

The direct reuse of an EPCRA Section 313 chemical does not need to be included in the amount reported in Part II, Section 8 of Form R. However, recycling of the chemical should be included.

(6) **Quantity Treated On-Site (Part II, Section 8.6 of Form R)** - Waste treatment in Section 8 is limited to the destruction or chemical conversion of the EPCRA Section 313 chemical or

chemical category in wastes. The quantities reported in Section 8.6 will be those that have undergone processes that are a subset of the processes for which codes were reported in Section 7A, where treatment includes physical removal from a waste stream. To estimate the quantity treated, you should determine if operating data exist that indicate a treatment efficiency (e.g., destruction or chemical conversion of the EPCRA Section 313 chemical or chemical category) and use that efficiency value combined with throughput data to calculate an estimate. Because metals cannot be destroyed or chemically converted into something other than the metal or metal compound, metals cannot be reported as being treated in Section 8.6. Note that conversion of a metal from one oxidation state to another (e.g., Cr(VI) to Cr(III)) is not considered treatment for Section 8.6. If operating data are unavailable, available vendor specifications may be appropriate. Section 7A must be completed if a quantity is entered in Section 8.6.

(7) **Quantity Treated Off-Site (Part II, Section 8.7 of Form R) -** The quantity reported in Section 8.7 must be the same as the quantity reported in Section 6.2 for which treatment codes are reported plus quantities sent to a POTW as reported in Section 6.1 except for metals and metal compounds. If a quantity is reported in Section 8.8, subtract the amount sent off site for treatment:

§8.7 = §6.1 (except metals and metal compounds) + §6.2 (treatment) - §8.8 (off-site treatment)

Because metals cannot be destroyed or chemically converted into something other than the metal or metal compound, metals cannot be reported as treated in Section 8.7. Quantities of metals reported in Section 6.1 and 6.2 should be reported in Section 8.1 (Quantity Released) unless the facility has knowledge that the metal is being recovered.

(8) **Quantity Released to the Environment as a Result of Remedial Actions, Catastrophic Events, or One-Time Events Not Associated with Production Processes (Part II, Section 8.8 of Form R) -** The purpose of this section is to separate quantities recycled off site, used for energy recovery off site, treated off site, or released (including disposed) that are associated with normal or routine production from those quantities that are not. The quantity reported in Section 8.8 is the quantity of the EPCRA Section 313 chemical or chemical category released directly into the environment or sent off site for recycling, energy recovery, treatment, or disposal during the reporting year because of any of the following events:

- Remedial actions;
- Catastrophic events such as earthquakes, fires, or floods; or
- One-time events not associated with normal or routine production processes.

The quantity reported in Section 8.8 should not be included with quantities reported in Part II, Sections 8.1 through 8.7 of Form R, but should be included in Part II, Sections 5 and 6 of Form R as appropriate.

Spills that occur as a routine part of production operations and could be reduced or eliminated by improved handling, loading, or unloading procedures are included in the quantities reported in Section 8.1 through 8.7 as appropriate. This includes small drippings and spills that often occur during transfer operations and loading/unloading operations.

On-site releases and off transfers for further waste management from remediation of an EPCRA Section 313 chemical or chemical category or an unpreventable accident unrelated to production (such as a hurricane) are reportable in Section 8.8.

On-site treatment, energy recovery, or recycling of EPCRA Section 313 chemicals or chemical categories in wastes generated as a result of remedial actions, catastrophic events, or one-time events not associated with production processes are not reported in Part II, Section 8.8, nor in Sections 8.1 through 8.7 of Form R.

COMMON ERROR - Double Counting

Release and other waste management activities should not be inadvertently "double counted." A single wastewater discharge should not be listed as both a release to water (on site) and a discharge to POTW (off site). Similarly, a release to land should not be listed as both a release to land (on site) and as sent to an off-site landfill. Estimates of release and other waste management activities should be prepared for Sections 5 through 7 of the Form R. For the most part, Section 8 relies on the data collected to complete these previous sections. Therefore, Section 8 should be completed last. However, the data elements of Section 8 (8.1 through 8.7) are mutually exclusive and care should be taken to avoid double counting.

4.1.4 Step 4: Determine the Most Appropriate Method(s) to Calculate the Estimates for Release and Other Waste Management Activity Quantities

After you have identified all of the potential sources for release and other waste management activity types, you must estimate the quantities of each EPCRA Section 313 chemical and chemical category released and otherwise managed as waste. U.S. EPA has

identified four basic methods that may be used to develop estimates (each method has been assigned a code that must be included when reporting). The methods and corresponding codes are:

- Monitoring Data or Direct Measurement (M);
- Mass Balance (C);
- Emission Factors (E); and,
- Engineering Calculations (O).

Descriptions of these techniques are provided in the U.S. EPA publication, *Estimating Releases and Waste Treatment Efficiencies for the Toxic Chemical Release Inventory Forms* (1999 edition). They are also briefly described below. A more detailed discussion including examples of selected calculation techniques is presented in Appendix B. U.S. EPA does not require you to conduct additional sampling or testing for EPCRA Section 313 reporting; however, you are required to use the best readily available information to determine the method that will result in the most accurate estimate. For example, it may not be appropriate to use emission factors or engineering calculations if more accurate data, such as stack testing results, are available. You are required to identify the primary method used for each estimation.

Many potential sources of data exist for these (and other) methods of developing estimates. Table 4-2 presents potential data sources and the estimation methodology in which they are most likely to be used. Based on site-specific knowledge and potential data sources available, you should be able to determine the best method for calculating each release and other waste management activity quantity.

Once all potential release and other waste management activity sources, types, and estimation methods have been determined, an estimate for each EPCRA Section 313 chemical and chemical category can be developed corresponding to the elements on Form R.

Table 4-2

Potential Data Sources for Release and Other Waste Management Calculations

DATA SOURCES	
Monitoring Data • Air permits • Continuous emission monitoring • Effluent limitations • Hazardous waste analysis • Industrial hygiene monitoring data • NPDES permits • Outfall monitoring data • pH for acids and bases • POTW pretreatment standards • RCRA permit • Stack monitoring data • New Source Performance Standards • Title V permit data	**Mass Balance** • Air emissions inventory • Hazardous material inventory • Hazardous waste manifests • MSDSs • Pollution prevention reports • Spill event records • Supply and purchasing records
Emission Factors • AP-42 chemical specific emission factors • Facility or trade association derived chemical-specific emission factors	**Engineering Calculations** • Facility non-chemical specific emission factors. • Henry's Law • Raoult's Law • SOCMI* or trade association non-chemical specific emission factors • Solubilities • Volatilization rates

*Synthetic Organic Chemicals Manufacturing Industry

4.1.4.1 Monitoring Data or Direct Measurement (code M)

Using monitoring data or direct measurements is usually the best method for developing chemical release and other waste management activity quantity estimates. Your facility may be required to perform monitoring under provisions of the Clean Air Act (CAA), Clean Water Act (CWA), RCRA, or other statutory or regulatory requirements. If so, data should be available for developing estimates. Data may have also been collected for your facility through an occupational health and safety assessment. If only a small amount of direct measurement data are available or if you believe the monitoring data are not a representative sample (for instance, results from a worst-case scenario), you must decide if another estimation method would give a more accurate result.

Example - Monitoring Data

Data from the on-site wastewater treatment facility indicate the annual average concentration of cobalt in the discharge is 150 mg/L. The wastewater treatment facility processed 1.5 million gallons of water. The treated wastewater is discharged to an off-site POTW. The amount of cobalt transferred off site to the POTW (for Section 6.1 of the Form R) is estimated as follows:

Amount of cobalt transferred

$$= (150\ \text{mg/L}) \times \left(\frac{\text{g}}{1{,}000\ \text{mg}}\right) \times \left(\frac{\text{lb}}{453.59\ \text{g}}\right) \times \left(\frac{\text{L}}{0.2642\ \text{gal}}\right) \times (1{,}500{,}000\ \text{gal/yr})$$

= 1,877 lb/yr (rounded to 1,900 lb/yr with two significant figures)

COMMON ERROR - Treatment Efficiencies

Vendor data on treatment efficiencies often represent ideal operating conditions. You should adjust such data to account for downtime and process upsets during the year that would result in lower efficiencies. Remember that efficiencies reported by vendors are often general and may not apply to specific chemicals. For example, an incinerator or flare may be 99.99% efficient in destroying certain organic chemicals, but will have a 0% efficiency in destroying metals.

4.1.4.2 Mass Balance (code C)

A mass balance involves determining the amount of an EPCRA Section 313 chemical or chemical category entering and leaving an operation. The mass balance is written as follows:

Input + Generation = Output + Consumption

where:

- Input refers to the materials (chemicals) entering an operation. For example, chlorine added to process water as a disinfectant would be considered an input to the water treatment operation.

- Generation identifies those chemicals created during an operation (manufactured, including coincidental manufacturing). For example, when nitrogen sources are used in biological wastewater treatment

systems, nitrate compounds and additional ammonia may be coincidentally manufactured.

- Output refers to the materials (chemicals) leaving an operation by various avenues. Output (avenues) may include on-site release and other on-site waste management activities; transfers off site for recycling, energy recovery, treatment, storage, or disposal; or the amount of chemical that leaves with the final product. In a fabric painting operation, for example, pigments may leave the operation as part of the product (color paint on the fabric) or in the wastewater from the dye bath or rinse.

- Consumption refers to the amount of chemical converted to another substance during the operation (i.e., reacted). For example, in the phosphating process, accelerators may be added to enhance reaction speed, eliminate hydrogen production, or sludge formation control. Several materials can be used for this purpose, including nitrite or nitrate compounds, which would be consumed in the process.

The mass balance technique may be applied toward manufactured, processed, or otherwise used EPCRA Section 313 chemicals and chemical categories. It is typically most useful for otherwise used chemicals that do not become part of the final product, such as catalysts. For large inputs and outputs, a mass balance may not be the best estimation method because slight uncertainties in mass calculations can yield significant errors in the release and other waste management estimates.

Example - Mass Balance

A facility otherwise uses a volatile EPCRA Section 313 chemical as a solvent. The facility has an on-site recycling system for the solvent and adds 20,000 pounds to the recycling system (to make up for system losses). The chemical is released to the air from relief vents during system filling operations and from leaks in valves and fittings. During system maintenance, the lines are bled directly into water and the system is vented to the air. Monitoring data of the wastewater, including chemical concentrations and wastewater throughput, indicate that 1,200 pounds of the chemical were discharged to the wastewater. The remaining losses are assumed to be fugitive air release and are estimated as follows:

Fugitive air releases of the EPCRA Section 313 chemical

= Amount input (lb/yr) - Amount released to wastewater (lb/yr)

= 20,000 lb/yr - 1,200 lb/yr

= 18,800 lb/yr

= 19,000 lb/yr with two significant figures

COMMON ERROR - Mass Balances for Otherwise Used Chemicals

Facilities often do not account for the entire quantity of EPCRA Section 313 chemicals that are otherwise used. Such chemicals may or may not leave the facility with the product. For those instances where the EPCRA Section 313 chemical or chemical category does not leave the facility in the product, all throughput may be lost during processing through on-site releases to air, water, or land, or it may be shipped off site for further waste management. Thus, the entire throughput is often reportable on Form R as release and other waste management activities to various media. Be sure to consider the entire throughput in these circumstances and partition it as appropriate. A mass balance may be the best starting point to estimate the release and other waste management quantities. Commonly overlooked sources include container residue, chemicals in dust collected in baghouses and then sent off site, heated processes (which result in stack or fugitive air emissions), and scrap material that is landfilled.

4.1.4.3 Emission Factors (code E)

An emission factor is a representative value that attempts to relate the quantity of a chemical or chemical category released with an associated activity. These factors are usually expressed as the weight of chemical or chemical category released divided by a unit weight, volume, distance, or duration of the activity releasing the chemical (e.g., pounds of chemical released per pounds of product produced). Emission factors, commonly used to estimate air emissions, have been developed for many different industries and activities. You should carefully evaluate the source of the emission factor and the conditions for its use to determine if it is applicable to the situation at your facility. If there are more than one EPA published emission factors, you should determine which is the most appropriate for your operations and document your rationale.

The most widely known and used source for emission factors is U.S. EPA's publication *Compilation of Air Pollutant Emission Factors (AP-42)*. Volume I of AP-42 contains information on over 200 stationary source categories, including process descriptions and potential sources of air emissions from these processes. Methodologies for estimating the quantity of air pollutant emissions from these sources are presented as Emission Factors. For EPCRA Section 313 purposes only CHEMICAL-SPECIFIC emission factors can be reported as Code "E" - Emission Factor in Part II, Section 5, Column B, Basis for estimate, of the Form R. AP-42 contains emission factors for individual chemicals and for the chemical group Volatile Organic Compounds (VOCs). The VOC emission factors are NOT chemical specific and when used must be reported in Column B as Code "O" - Engineering Calculations. Each chapter in

Volume I covers a major industry or source category. Of special interest to textile manufacturing facilities is Chapter 4: Evaporation Loss Sources, in particular Section 4.11: Textile Fabric Printing; Chapter 6: Organic Chemical Process Industry; and Chapter 7: Liquid Storage Tanks.

AP-42 can be accessed at the following Internet site:

- **http://www.epa.gov/ttn/chief/ap42.html**

In an effort to provide current emissions data in an easy-to-access format, U.S. EPA has prepared a CD-ROM entitled Air CHIEF (Air ClearingHouse for Inventories and Emission Factors). The Air CHIEF CD-ROM is updated annually and is available from the Government Printing Office and can be ordered from their Web site. In addition to AP-42, the Air CHIEF CD-ROM contains the Factor Information Retrieval (FIRE) data system, a database management system containing U.S. EPA's recommended emission estimation factors for criteria and hazardous air pollutants. The CD-ROM also contains installable copies of software programs for air emission estimation models such as "TANKS" for VOC emission from storage tanks; "WATER8" for air emissions from wastewater systems; and "CHEMDAT8" for VOC emissions from Treatment, Storage, and Disposal Facility (TSDF) processes. Additional information on Air CHIEF and the CD-ROM is available at:

- **http://www.epa.gov/ttn/chief/airchief.html**

Your facility may have developed non-chemical-specific emission factors for fugitive or stack emissions based on stack tests for various air permits. Be sure to consider these emission factors if appropriate. However, if such factors are used, they are considered "engineering calculations" for the purposes of EPCRA Section 313 reporting.

Example - Emission Factors

Emission factors have been developed for air releases of fuel constituents and combustion products from boiler operations. AP-42 lists a range of formaldehyde emission factors when No. 6 fuel oil is consumed:

0.024 to 0.061 lb formaldehyde generated/10^3 gal No. 6 fuel oil fired.

Assuming a facility met reporting requirements for formaldehyde, the facility operating a boiler using No. 6 fuel oil could use the above emission factor to determine the amount of formaldehyde generated and subsequently released to the air. If 1,000,000 gallons of No. 6 fuel oil is used during a reporting year, the amount of formaldehyde generated would be between:

(0.024 lb/10^3 gal) × (1,000,000 gal) and (0.061 lb/10^3 gal) × (1,000,000 gal)

= 24 and 61 lb of formaldehyde generated

If there are no engineering controls or air pollution control devices that would destroy or remove the formaldehyde, this quantity should be reported in Part II, Sections 5.2 and 8.1 of the 1999 Form R.

NOTE: No. 6 fuel oil contains other EPCRA Section 313 chemicals and chemical categories and EPCRA Section 313 chemicals and chemical categories may also be coincidentally manufactured during combustion. All should be considered for EPCRA Section 313 reporting.

4.1.4.4 Engineering Calculations (code O)

Engineering calculations are assumptions and/or judgments used to estimate quantities of EPCRA Section 313 chemicals and chemical categories released or otherwise managed as waste. The quantities are estimated by using physical and chemical properties and relationships (e.g., Ideal Gas law, Raoult's law) or by modifying an emission factor to reflect the chemical properties of the chemical in question. Engineering calculations rely on the process parameters; you must have a thorough knowledge of your facility operations to complete these calculations.

Engineering calculations can also include computer models. Several computer models are available for estimating emissions from storage tanks, landfills, water and wastewater treatment, and other processes.

Examples - Engineering Calculations

Example 1:
Stack monitoring data are available for xylene but you are required to report for toluene. Your facility uses toluene and xylene for the same application and the concentrations of the chemicals in the liquid feedstock are approximately the same. You can estimate the emissions of toluene by adjusting the monitoring data of xylene by a ratio of the vapor pressure for xylene to toluene. This example is an engineering calculation based on physical properties and process operation information:

From facility stack monitoring data, an estimated 200 pounds of xylene are released as air emissions during the reporting year. Toluene is also present in the air emissions, but not monitored. The stack operates at approximately 20˚C. Based on literature data, the vapor pressure at 20˚C for toluene is 22 millimeters of mercury (mmHg) and for xylene is 6 mmHg. Using a ratio of the vapor pressures, the amount of toluene released as air emissions from the stack can be calculated:

$$\frac{\text{X lb/yr toluene}}{\text{200 lb/yr xylene}} = \frac{\text{22 mmHg (vapor pressure of toluene)}}{\text{6 mmHg (vapor pressure of xylene)}}$$

$$\text{X lb/yr toluene} = \frac{\text{(200 lb/yr xylene) (22 mmHg toluene)}}{\text{(6 mmHg xylene)}}$$

Completing the calculation, the facility determines that 730 pounds of toluene were released as stack air emissions during the reporting year. The quantity of toluene released should be reported in Sections 5.2 and 8.1 of the 1999 Form R.

Example 2:
A coating process uses 10,000 gallons per year of a paint that is 3% xylene by volume. All of the xylene in the paint is assumed to evaporate during the coating operation. The coating process is equipped with a fume collection hood that captures 80% (capture efficiency) of the paint vapors. The remaining 20% of the paint vapors are assumed to be released as fugitive air emissions. The collection hood routes the paint vapors to an incinerator that is vented to the atmosphere and has a destruction efficiency of 99% for xylene. The specific gravity of xylene is 0.86 and the density of water is 8.34 lb/gal. Fugitive air emissions and stack air emissions may be estimated as follows:

1. The total amount of xylene volatilized (assumed to be the total amount of xylene in paint)

   = (10,000 gal/yr paint) × (0.03 xylene) × (0.86 xylene specific gravity) × (8.34 lb/gal, density of water)

   = 2,152 lb/yr xylene evaporated from coating operations

2. The amount of xylene released as fugitive air emissions

   = (2,152 lb/yr) × (0.20)
   = 430 lb/yr

3. The amount of xylene released as stack air emissions

   = (2,152 lb/yr) × (0.80 capture efficiency) × (1.0 - 0.99 incinerated)
   = 17 lb/yr

   This should be reported in Sections 5.2 and 8.1 of the 1999 Form R.

Non-chemical-specific emission factors, Synthetic Organic Chemicals Manufacturing Industry (SOCMI) emission factors, industry-determined emission factors for processes or equipment, and site-specific emission factors also can be used, but must be classified as "Engineering Calculations" for EPCRA Section 313 reporting.

4.1.4.5 Estimating Release and Other Waste Management Quantities

Once all sources, types, and appropriate estimation methodologies have been identified, you can estimate the release and other waste management activity quantities of EPCRA Section 313 chemicals or chemical categories for each element of the Form R. The recommended approach is that you estimate amounts from all sources at your facility to each type as identified by the elements of Form R. Table 4-3 presents a work sheet that may be helpful in compiling this information.

If you prepare a Form R, you must also enter on-site treatment information in Section 7A, including the code for each treatment method used, the destruction and removal efficiency for the EPCRA Section 313 chemical or chemical category in the treated waste stream, and the concentration of the EPCRA Section 313 chemical or chemical category in the influent to treatment. You should report treatment methods that do not actually destroy or remove the chemical by entering "zero (0)" for removal efficiency. Similarly, on-site energy recovery methods and on-site recycling methods must be reported in Sections 7B and 7C, respectively.

Table 4-3

Release and Other
Waste Management Quantity Estimation Worksheet

Facility Name: _____ Date Worksheet Prepared: _____

EPCRA Section 313 Chemical or Chemical Category: _____ Prepared by: _____

CAS Registry Number: _____

Reporting Year: _____

ON SITE			
Release or Other Waste Management Activity Type	**Amount (lb)**	**Basis of Estimate**	**Form R Element* (1999 version)**
FUGITIVE AIR			
Equipment Leaks			5.1 and 8.1 or 8.8
Process Areas			5.1 and 8.1 or 8.8
Evaporative Losses, Spills, Surface Impoundments			5.1 and 8.1 or 8.8
Total =			5.1 and 8.1 or 8.8
STACK AIR			
Process Vents			5.2 and 8.1 or 8.8
Storage Tanks			5.2 and 8.1 or 8.8
Control Device Stacks			5.2 and 8.1 or 8.8
Other			5.2 and 8.1 or 8.8
Total =			5.2 and 8.1 or 8.8
RECEIVING STREAM/WATER BODY DISCHARGE			
Stormwater Discharge			5.3 and 8.1 or 8.8
On-Site Treatment Plant Discharge			5.3 and 8.1 or 8.8
Total =			5.3 and 8.1 or 8.8
ON-SITE UNDERGROUND INJECTION			
Underground Injection to Class I Wells			5.4 and 8.1 or 8.8
Underground Injection to Class II - V Wells			5.4 and 8.1 or 8.8
Total =			5.4 and 8.1 or 8.8

*Entries for Section 8.8 only if release is result of remedial action, catastrophic event, or one-time event not associated with production process.

Table 4-3 (Continued)

ON SITE			
Release or Other Waste Management Activity Type	**Amount (lb)**	**Basis of Estimate**	**Form R Element* (1999 version)**
ON-SITE LAND			
RCRA Subtitle C Landfill			5.5 and 8.1 or 8.8
Other Landfill			5.5 and 8.1 or 8.8
Land Treatment/Application Farming			5.5 and 8.1, 8.6, or 8.8
Surface Impoundment			5.5 and 8.1 or 8.8
Other Disposal			5.5 and 8.1 or 8.8
Total =			5.5 and 8.1 or 8.8
ON-SITE ENERGY RECOVERY			
Industrial Kiln			8.2
Industrial Furnace			8.2
Industrial Boiler			8.2
Other Energy Recovery Methods			8.2
Total =			8.2
ON-SITE RECYCLING			
Solvents/Organics Recovery			8.4
Metals Recovery			8.4
Acid Regeneration			8.4
Other Reuse or Recovery			8.4
Total =			8.4
ON-SITE TREATMENT			
Air Emissions Treatment			8.6
Biological Treatment			8.6
Chemical Treatment			8.6
Incineration/Thermal Treatment			8.6
Physical Treatment			8.6
Solidification/Stabilization			8.6
Total =			8.6

*Entries for Section 8.8 only if release is result of remedial action, catastrophic event, or one-time event not associated with production process.

Table 4-3 (Continued)

OFF SITE				
Release or Other Waste Management Activity Type	**Amount (lb)**	**Basis of Estimate**	**Form R Element* (1999 version)**	**Off-Site Location (name)**
OFF-SITE DISPOSAL				
Solidification/Stabilization (metals and metal compounds only)			6.2 and 8.1 or 8.8	
Amount of metal and metal compounds to POTW			6.1 and 8.1 or 8.8	
Wastewater Treatment (excluding POTWs) metals and metal compounds only			6.2 and 8.1 or 8.8	
Underground Injection			6.2 and 8.1 or 8.8	
Landfill/Surface Impoundment			6.2 and 8.1 or 8.8	
Land Treatment			6.2 and 8.1 or 8.8	
Other Land Disposal			6.2 and 8.1 or 8.8	
Other Off-Site Management			6.2 and 8.1 or 8.8	
Total =			6.2 and 8.1 or 8.8	
OTHER AMOUNTS SENT OFF SITE				
Amounts sent for storage			6.2 and 8.1 or 8.8	
Amounts sent for unknown waste management practice			6.2 and 8.1 or 8.8	
Total =			6.2 and 8.1 or 8.8	
OFF-SITE TREATMENT				
Solidification/Stabilization			6.2 and 8.7 or 8.8	
Incineration/Thermal Treatment			6.2 and 8.7 or 8.8	
Incineration/Insignificant Fuel Value			6.2 and 8.7 or 8.8	
Wastewater Treatment (to POTW excluding metals and metal compounds)			6.1 and 8.7 or 8.8	
Wastewater Treatment (excluding POTW and metal and metal compounds)			6.2 and 8.7 or 8.8	
Sent to Waste Treatment Broker			6.2 and 8.7 or 8.8	
Total =			6.2 and 8.7 or 8.8	

*Entries for Section 8.8 only if release is result of remedial action, catastrophic event, or one-time event not associated with production process.

Table 4-3 (Continued)

OFF SITE				
Release or Other Waste Management Activity Type	**Amount (lb)**	**Basis of Estimate**	**Form R Element* (1999 version)**	**Off-Site Location (name)**
OFF-SITE ENERGY RECOVERY				
Off-Site Energy Recovery			6.2 and 8.3 or 8.8	
Sent to Energy Recovery Broker			6.2 and 8.3 or 8.8	
Total =			6.2 and 8.3 or 8.8	
OFF-SITE RECYCLING				
Solvents/Organics Recovery			6.2 and 8.5 or 8.8	
Metals Recovery			6.2 and 8.5 or 8.8	
Other Reuse or Recovery			6.2 and 8.5 or 8.8	
Acid Regeneration			6.2 and 8.5 or 8.8	
Sent to Recycling Waste Broker			6.2 and 8.5 or 8.8	
Total =			6.2 and 8.5 or 8.8	

*Entries for Section 8.8 only if release is result of remedial action, catastrophic event, or one-time event not associated with production process.

4.2 Textile Industry and Process Description

The textile industry includes multiple processes and activities. Many facilities may only perform a subset of the four major textile manufacturing operations and may use only one raw material type. This section discusses the recommended approach for estimating quantities of EPCRA Section 313 chemicals or chemical categories for each operation. You should evaluate the processes at your facility and determine which operations apply. The four textile operations discussed are:

- Yarn Formation: preparing and spinning raw materials (natural and synthetic); texturizing man-made filament fibers.
- Fabric Formation: warping and slashing yarn; performing weaving and knitting operations.
- Wet Processing: preparing the fabric for dyeing and finishing; dyeing, printing, and finishing operations.
- Product Fabrication: cutting and sewing the fabric, performing final finishing operations.

Figure 4-3 provides a schematic view of a typical textile processing operation.

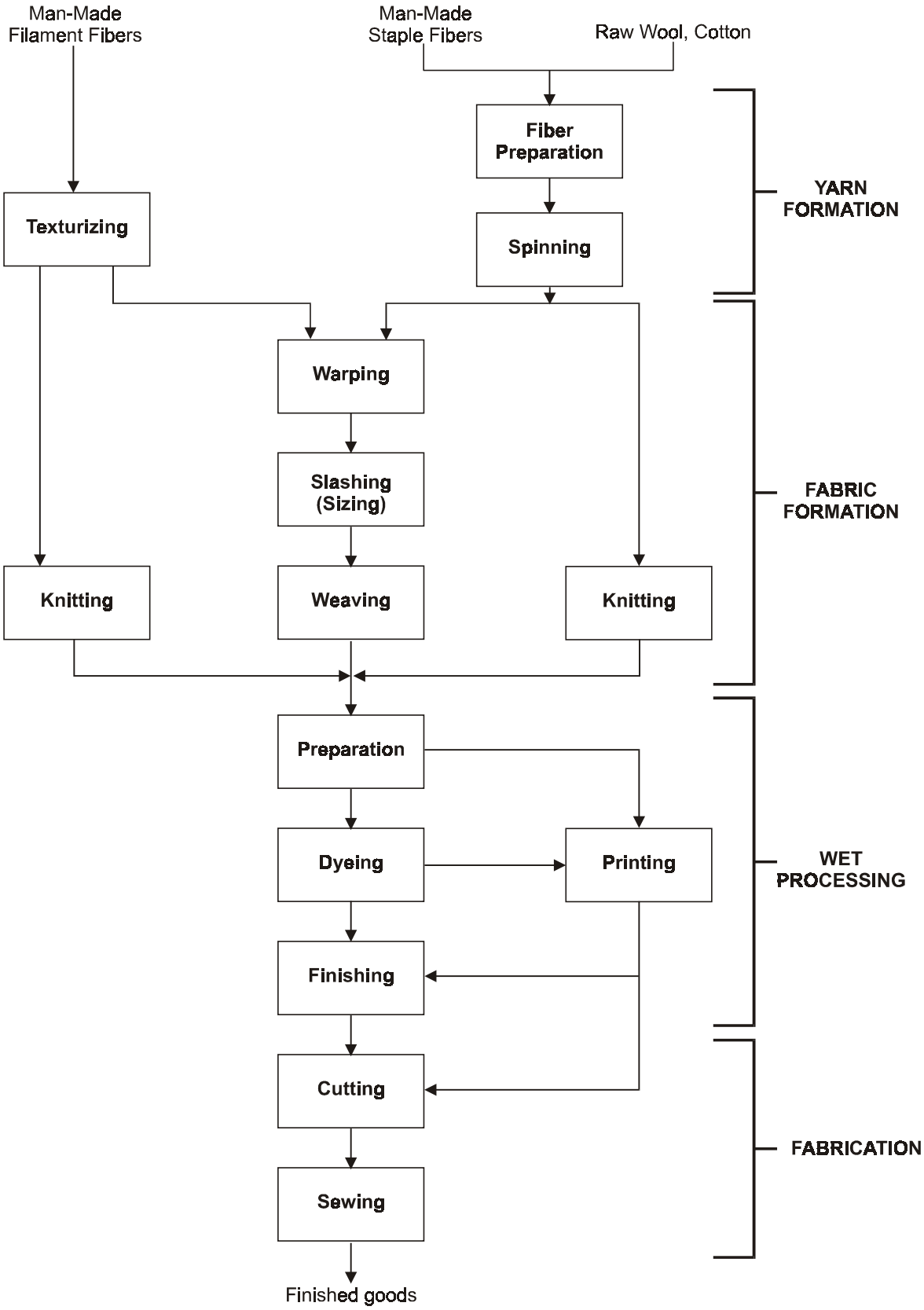

Figure 4-3. Typical Textile Processing Flow Diagram

Source: U.S. EPA, *Profile of the Textile Industry*, Office of Enforcement and Compliance Assurance, 1997.

The following sections present specific information on textile processes, release and other waste management sources and types, and sample calculations for estimating release and other waste management quantities for each of the four operations.

4.2.1 Yarn Formation

In the yarn formation process, fibers are bound using spinning operations, grouping, and twisting. Staple fibers, natural and man-made, are prepared for spinning through a combination of various processing steps such as blending, drawing, carding, opening, combing, and roving. These operations are primarily mechanical; but can include some chemical activities for the removal of impurities from the fiber and for machine maintenance. Man-made filament fibers may be manufactured using EPCRA Section 313 chemicals and chemical categories. Processing of these fibers, known as texturizing, can result in the removal and subsequent release and other waste management activities of the EPCRA Section 313 chemicals and chemical categories from the fiber. The use of EPCRA Section 313 chemicals is not common, however, you should review what chemicals are manufactured, processed, or otherwise used during yarn formation.

For EPCRA Section 313 reporting, it is important to identify all release and other waste management activity sources and types for each of the EPCRA Section 313 chemicals and chemical categories being reported. Remember to include both routine and accidental release and other waste management activities.

Step 1: Prepare a Process Flow Diagram

A site-specific process flow diagram should be prepared to help identify all potential sources and types of chemical release and other waste management activities. Figure 4-4 presents a typical yarn formation process and the possible release and other waste management sources by unit operation. A textile facility may not employ all of these processing steps; each facility should prepare its own diagram to reflect current unit operations.

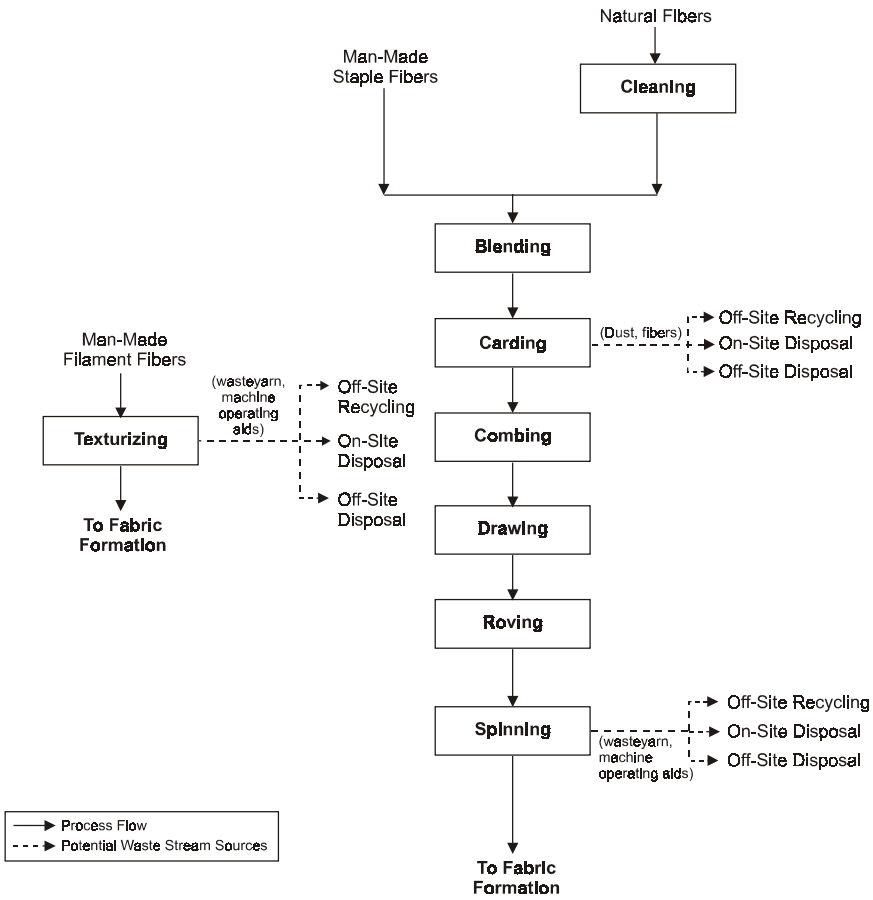

Figure 4-4. Typical Yarn Formation Process Flow Diagram

Step 2: Identify EPCRA Section 313 Chemicals and Chemical Categories and Potential Sources of Chemical Release and Other Waste Management Activities

EPCRA Section 313 chemicals and chemical categories are not commonly employed during yarn formation; however, EPCRA Section 313 chemicals or chemical categories may be processed or otherwise used during cleaning operations, or brought on site with the material. Potential liquid sources of EPCRA Section 313 chemicals and chemical categories include used oil, lubricants, and other machine maintenance chemicals. Solid waste sources include excess or waste yarn that may contain EPCRA Section 313 chemicals and chemical categories. This excess yarn is typically generated during texturizing, carding, and spinning.

Step 3: Identify Release and Other Waste Management Activity Types

Oils, lubricants, machine maintenance chemicals, and waste yarn and material are typically released on site to land or sent to off-site disposal. Off-site recycling may also be performed, but is not typical. Depending on your facility processes, you should evaluate the disposal and other waste management activities for these sources.

Step 4: Determine the Most Appropriate Method(s) and Calculate the Estimates for Release and Other Waste Management Activity Quantities

The most typical estimation methods for yarn formation, and the textile industry in general, are mass balances and engineering calculations. Purchasing records, along with MSDSs can be used to determine the total amount of a chemical brought on site. Operational data may be used to determine the quantity of the chemical processed or otherwise used in each unit operation. Engineering assumptions and process knowledge can help to determine the ultimate fate of the chemical(s).

Example -Mass Balance for Machine Maintenance Chemical

A textile facility otherwise uses an EPCRA Section 313 machine maintenance chemical. The chemical is collected and sent off site for recycling. Purchasing records show that five shipments of the chemical (5,000 pounds each) were received during the year, totaling 25,000 pounds of the chemical brought on site. Inventory records list 3,000 pounds of the chemical on site January 1 and 2,000 pounds on site December 31. The total amount of the chemical used during the year is calculated below:

Amount Used: 25,000 lb + 3,000 lb - 2,000 lb = 26,000 lb

Shipping records show that 24,000 pounds of the EPCRA Section 313 chemical were collected and sent off site for recycling. Based on process knowledge, the remaining amount of the chemical was disposed on site.

Amount Disposed: 26,000 lb Used - 24,000 lb Recycled = 2,000 lb

Textile facilities may manage solid waste, such as scrap yarn, by on-site or off-site land disposal. RCRA reports and hazardous waste manifests are potential sources of information for concentrations of EPCRA Section 313 chemicals and chemical categories and the volume of the waste disposed.

4.2.2 Fabric Formation

From the spun or filament yarn, fabric is formed by knitting or weaving operations. Yarn can be processed directly through knitting operations but typically requires preparation for weaving operations. Preparation for weaving includes warping and slashing (sizing). Sizing agents added to the yarn by solution or pad/dry techniques may contain EPCRA Section 313 chemicals and chemical categories. Other chemical additives may be added to increase yarn softness and pliability. Following drying operations, yarn may then be woven into fabric. Like yarn formation, both knitting and weaving operations are primarily mechanical. Chemical activities include the addition of sizing agents and chemical additives and the use of machine maintenance and cleaning chemicals.

Step 1: Prepare a Process Flow Diagram

A site-specific process flow diagram should be prepared to help identify all potential sources and types of chemical release and waste management activities. Figure 4-5 shows a typical fabric formation process and the possible release and other waste management sources by unit operation. A facility may perform only knitting or only weaving operations; each facility should prepare its own diagram to reflect current unit operations.

Step 2: Identify EPCRA Section 313 Chemicals and Chemical Categories and Potential Sources of Chemical Release and Other Waste Management Activities

EPCRA Section 313 chemicals and chemical categories are primarily otherwise used during fabric formation as fabric processing agents and equipment cleaning and maintenance chemicals. Fabric processing agents include sizing agents and performance-enhancing chemicals. Typical chemicals may include certain glycol ethers, ethylene glycol, and methanol. These chemicals typically volatilize or are washed off during fabric formation. However, some may remain with the fabric throughout the fabric formation process and into the wet processing and finishing operations.

Both fugitive and point source air emissions containing EPCRA Section 313 chemicals and chemical categories typically occur during the slashing (sizing) operation or during fabric drying operations. This includes chemicals used as sizing agents or performance-enhancing chemicals. Dust air emissions may also be generated during fabric formation, but will most likely be collected for disposal.

Potential liquid sources of EPCRA Section 313 chemicals and chemical categories include process wastewater from fabric cleaning and slashing operations; used oil, lubricants, and other machine maintenance chemicals; and wastewater from aqueous equipment cleaning operations. Process equipment cleaning operations do not qualify for the routine janitorial maintenance exemption.

Solid waste is the most common release and other waste management source from fabric formation. The primary source of solid waste is excess fabric material and scraps that may contain EPCRA Section 313 chemicals and chemical categories not volatilized or removed during fabric formation or chemicals brought on-site with the raw material (e.g., antimony oxide used as a fire resistant). Another solid waste source is dust containing EPCRA Section 313 chemicals and chemical categories that is collected by air pollution control devices or by floor sweepings. These solid wastes are usually generated during knitting or weaving operations. During slashing operations, residue left in sizing agent or other chemical agent containers may be a source of EPCRA Section 313 chemicals and chemical categories.

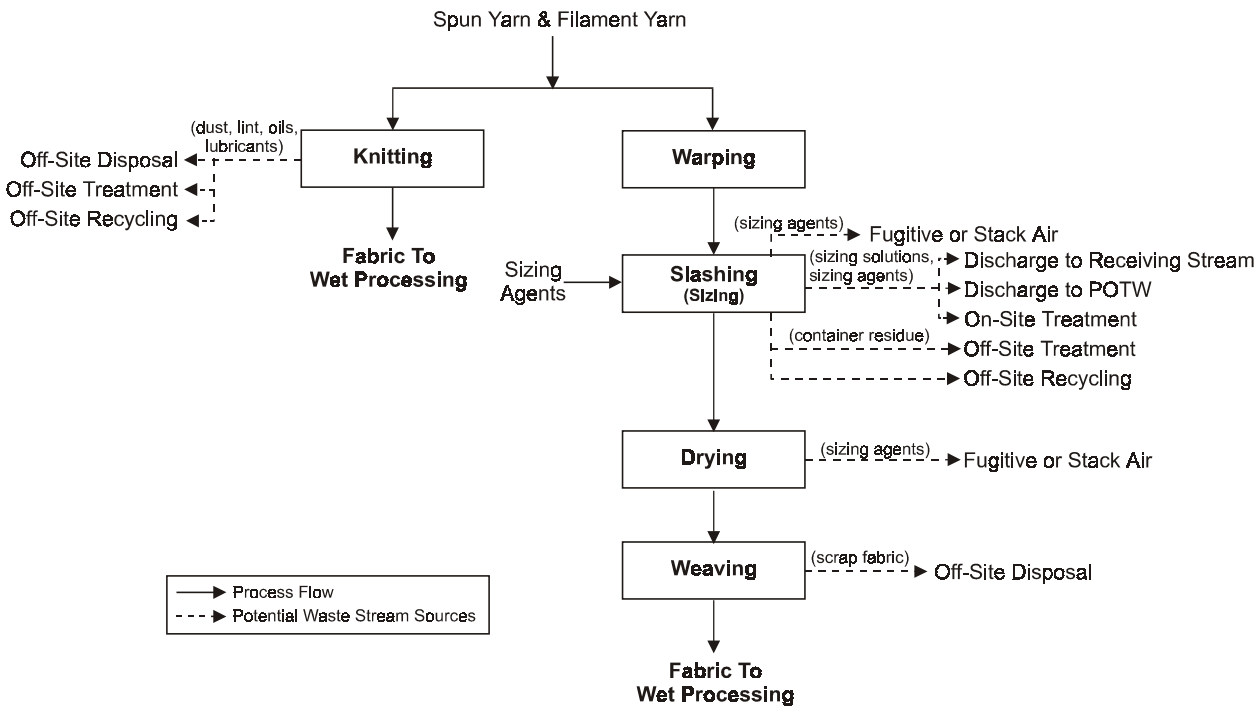

Figure 4-5. Fabric Formation Process for Producing Flat Fabrics

Step 3: Identify Release and Other Waste Management Activity Types

Both fugitive and point source air emissions are typical EPCRA Section 313 release and other waste management types during fabric processing. Fugitive emissions are most likely to result from slashing and drying operations when chemicals, such as methanol, evaporate. Dusts containing EPCRA Section 313 chemicals and chemical categories may be generated as potential fugitive emissions; however, they are typically collected (e.g., ventilation system filters, baghouses, etc.) and otherwise managed as waste. If air from any process is controlled through an air pollution control device, such as a scrubber, any chemical release from the device is considered to be point source, or stack emissions. Remember that metals and metal portions of metal compounds cannot be destroyed, but should still be reported as being sent through the treatment process, with a treatment efficiency of zero. Section 7A and 8.6 should be completed as appropriate (see example in Section 4.1.3(h)). Fugitive dust emissions may escape from air pollution control devices such as a baghouse (baghouses are typically 95 to 99 percent efficient in capturing dust particles).

Facilities typically combine wastewater streams from operations such as equipment cleaning, fabric cleaning, and slashing. This waste stream is then usually sent to a

POTW. A facility may also perform on-site treatment prior to discharging to a POTW or receiving stream.

Fabric scraps and dust containing EPCRA Section 313 chemicals and chemical categories are typically sent off site for disposal, but your facility may have another waste management activity for scraps. Keep in mind that dusts may be collected in floor sweepings or in air pollution control devices, such as baghouses. Oils, lubricants, and other machine operating aids may be sent off site for disposal, treatment, or recycling. Containers that may have residual EPCRA Section 313 chemicals and chemical categories are often sent back to the supplier for reuse (see Section 4.1.3 for examples pertaining to container residue).

Table 4-4 presents the most common release and other waste management activity types and EPCRA Section 313 chemicals typical to fabric formation operations.

Table 4-4

Common EPCRA Section 313 Chemicals and Chemical Categories Associated with Release and Other Waste Management Activity Types During Fabric Formation

Release and Other Waste Management Activity Types	Common EPCRA Section 313 Chemicals and Chemical Categories
Fugitive Air Release	Ammonia Methanol
Point Source Air Release	Ammonia Methanol
POTW	Ammonia Ethylene glycol

Step 4: Determine the Most Appropriate Method(s) and Calculate the Estimates for Release and Other Waste Management Activity Quantities

The most typical estimation methods for fabric formation are mass balances and engineering calculations. Information sources for mass balances include purchasing records, MSDSs, and operational data. Using engineering assumptions and process knowledge, you can

determine whether an EPCRA Section 313 chemical or chemical category is released and otherwise managed as waste or remains in the product. You must also determine to which media a chemical is released and otherwise managed as waste.

Both dusts and chemical emissions may be generated during fabric formation. Volatile chemicals not intended to remain in the fabric will most likely evaporate during processing or drying operations. Emission factors and engineering calculations are the most common approaches to calculating air release and other waste management amounts. Chemical-specific emission factors are not often available for typical textile processing operations. However, you can use general emission factors found in AP-42 in conjunction with engineering calculations to estimate quantities of EPCRA Section 313 chemicals and chemical categories emitted to air (remember that non-chemical-specific emission factors are considered to be engineering calculations for EPCRA Section 313 reporting).

Emission factor and engineering calculation sources include AP-42 emission factors, facility specific emission factors, SOCMI emission factors, and worker exposure data. Other data sources include operating permits, monitoring data, and air pollution control device information, such as testing data and control efficiency. Mass balances may also be used to estimate emissions by subtracting all other known release and other waste management activity amounts from the total amount used in the process, as shown in the following example.

Example -Mass Balance for Air Estimates

Your facility used 20,000 pounds of perchloroethylene to dry clean samples. Your dry cleaning operation area has no air control devices. Manifests show that 5,000 pounds of spent perchloroethylene was sent off site for disposal. You can calculate the air releases of perchloroethylene as follows:

Amount Released as Fugitive Emissions to Air = 20,000 lb used - 5,000 lb to off-site disposal
= 15,000 lb perchloroethylene released to air

When preparing the Form R for perchloroethylene, be sure to use the correct EPCRA Section 313 chemical name, tetrachloroethylene. A list of common EPCRA Section 313 chemical synonyms is located in U.S. EPA's *Common Synonyms for Chemicals Listed Under Section 313 of EPCRA*. (EPA 745-R-95-008), May 1995.

Dust containing EPCRA Section 313 chemicals and chemical categories may be collected by an air pollution control device or swept from floors as solid waste. Using engineering calculations, the amount of an EPCRA Section 313 chemical or chemical category

present in the dust may be estimated using the chemical concentration in the fabric and the amount of dust generated. If the amount of dust generated is unknown, a mass balance, using purchasing and production information, may be used to estimate the quantity.

In addition to RCRA reports and hazardous waste manifests, accidental spill records may supply information on solid waste release and other waste management activities. These records may include chemical concentrations and amount of waste disposed on site or collected for other release and waste management activities.

For information on calculating wastewater release and other waste management quantities, see Section 4.2.3 (Wet Processing), Step 4.

4.2.3 Wet Processing

Wet processing enhances appearance, durability, and serviceability of the fabric. Chemical agents, such as dyes, pigments, strength agents, and flame resistors are applied through a water-intensive process. Synthetic materials may be desized and scoured prior to dyeing or printing. After preparation for wet processing, dyeing or printing can occur, followed by rinsing, drying, or heat setting. Printing operations typically do not use water. The final wet processing step is mechanical and chemical finishing; these operations are used to improve appearance, texture, and performance of the fabric.

Dye application includes various dye types and methods. Equipment commonly used for textile dyeing includes beck, beam, jet, jig, package, pad, and vat dyeing machines. Dyes can be fixed to the textile chemically and/or physically. Dyes may be bonded to the fabric or precipitated by removal of a dye solubilizing agent. Color patterns can also be added to fabric using printing techniques such as rotary screen, direct, discharge, resist, flat screen, and roller printing. Color can be affixed through the use of pigments, solvents, and resin binders.

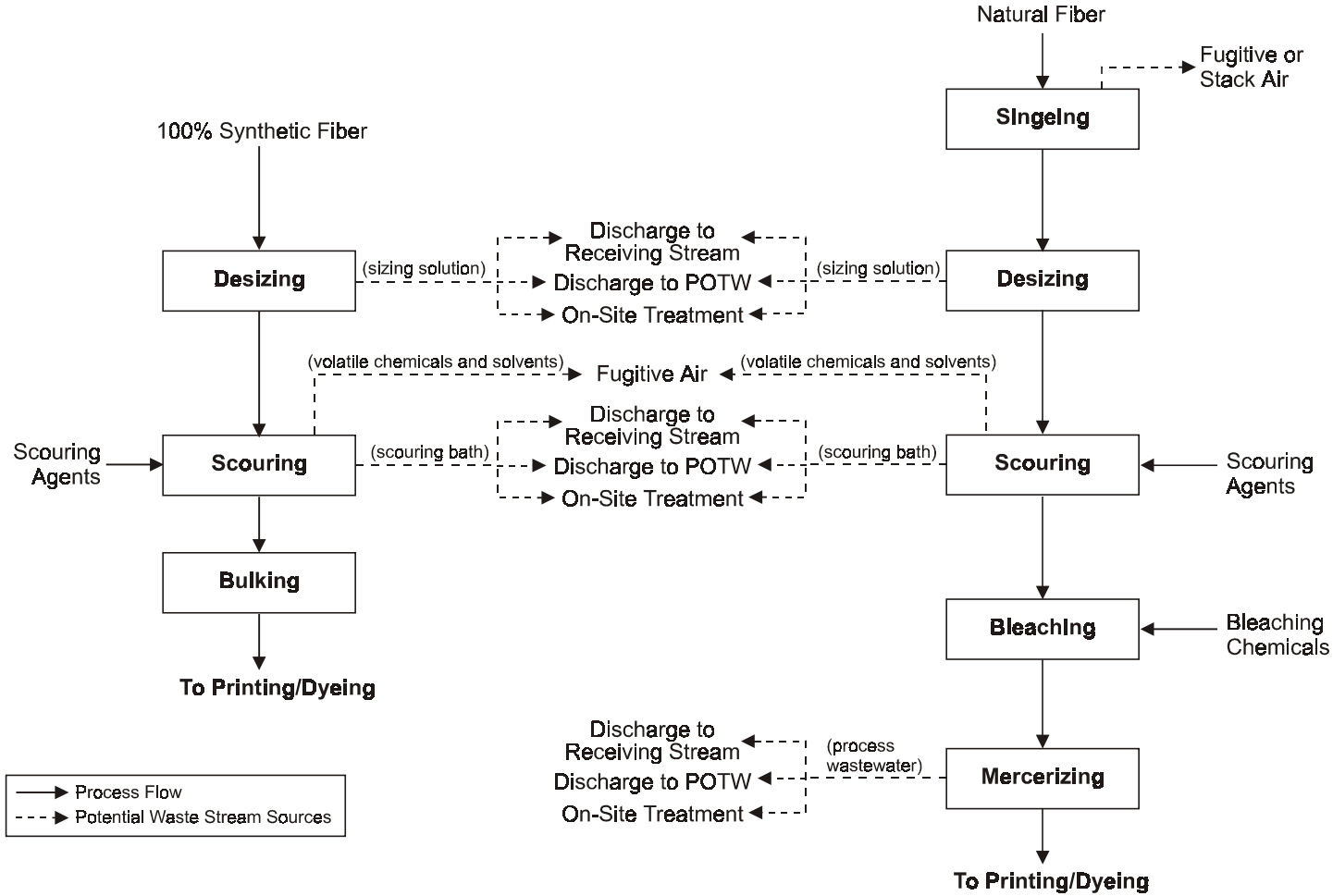

Figure 4-6. Wet Processing Fabric Preparation Flow Diagram

Source: U.S. EPA, *Profile of the Textile Industry*, Office of Enforcement and Compliance Assurance, 1997.

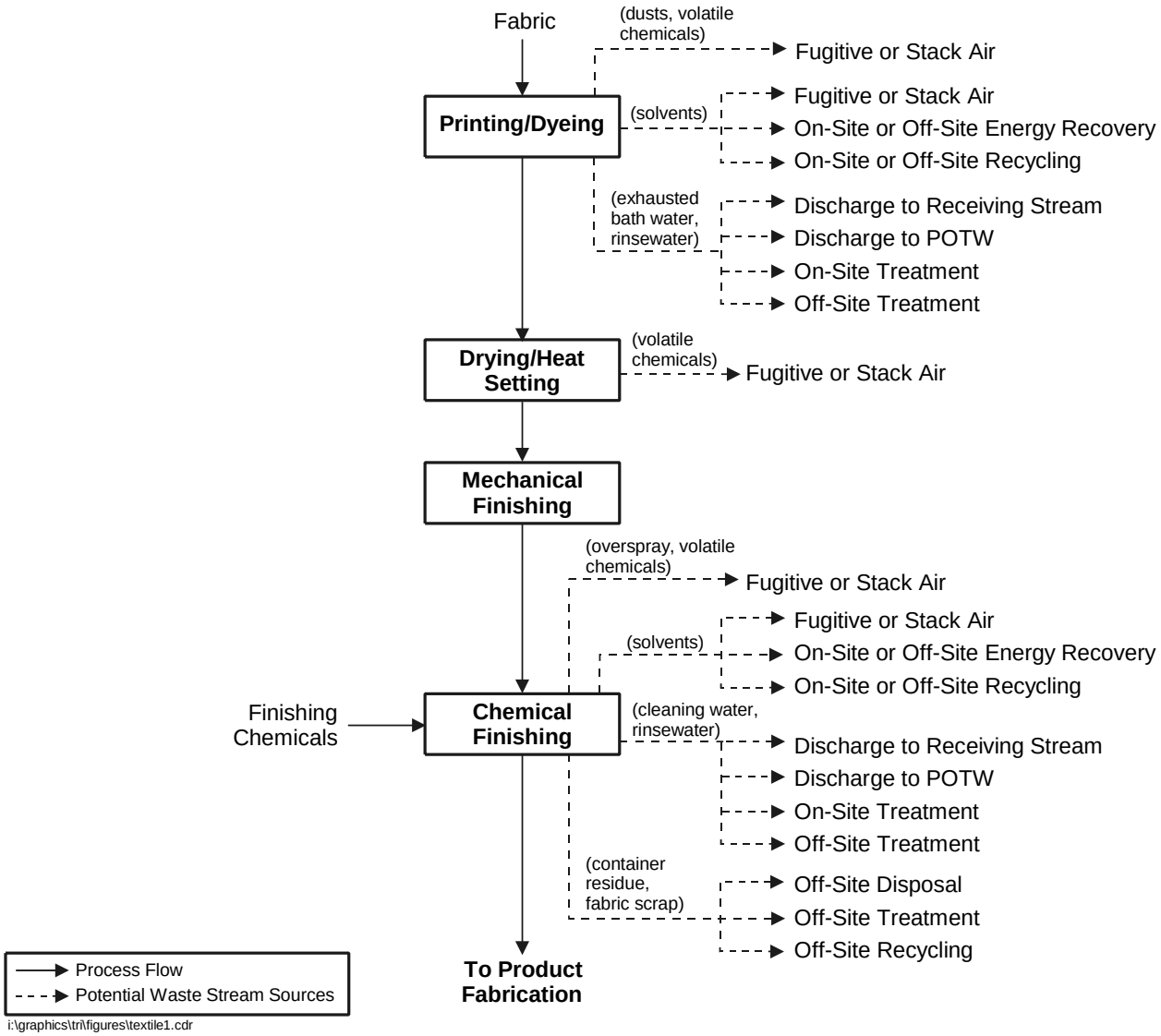

Figure 4-7. Wet Processing Printing, Dyeing, and Finishing Flow Diagram

Source: U.S. EPA, *Profile of the Textile Industry*, Office of Enforcement and Compliance Assurance, 1997.

Step 1: Prepare a Process Flow Diagram

A site-specific process flow diagram should be prepared to help identify all potential sources and types of chemical release and other waste management activities. Figures 4-6 and 4-7 present wet processing flow diagrams, including preparation and dyeing, printing, and finishing steps. The typical release and other waste management sources are shown by unit operation. The diagram shows two fabric preparation paths, one for synthetic fiber (e.g., nylon) and one for natural fiber (e.g., cotton, cotton blends).

Step 2: Identify EPCRA Section 313 Chemicals and Chemical Categories and Potential Sources of Chemical Release and Other Waste Management Activities

For the textile industry, wet processing operations are significant sources of EPCRA Section 313 chemical and chemical category release and other waste management activities. Typical chemicals include ammonia, certain glycol ethers, and methyl ethyl ketone. Alkaline or solvent solutions are used during scouring. Solvents, although used in the past, are being replaced with aqueous chemicals. Bleaching agents and other chemical additives are used during bleaching operations, however, these are usually not EPCRA Section 313 chemicals. Acids are used for neutralizing remaining caustic soda during mercerizing operations. During dyeing or printing operations, chemicals such as solubilizing agents, dye carriers, salts, and fixing agents may be employed to speed the process or enhance the process effects. Chemical activities during finishing operations include the use of optical brighteners, softeners, and flame resistant chemicals.

During fabric preparation, air emissions of chemicals may be generated from sources such as desizing, scouring, and singeing operations. Dusts containing EPCRA Section 313 chemicals and chemical categories and volatile EPCRA Section 313 chemicals and chemical categories may be emitted from sources such as printing and dyeing operations. EPCRA Section 313 chemicals and chemical categories may volatilize during drying, heat setting, and finishing operations. Other sources of EPCRA Section 313 chemical and chemical category air emissions are tanks that are used to store process chemicals prior to use in the wet process and the loading and unloading operations associated with these chemicals.

The primary liquid sources of EPCRA Section 313 chemicals and chemical categories are spent process baths, solutions, and rinses. Process wastewater sources include spent sizing solutions, scouring and dyeing baths, cleaning rinses, dyeing rinses, textile cleaning water, and mercerizing operations. Chemicals typically found in textile industry wastewater include dyes, pigments, and salts. Salts present in process wastewater may have been used as raw materials (e.g., metal compound salts) or may be byproducts from neutralization or other chemical reactions (e.g., nitrate compounds). Metal compounds such as copper compounds and chromium compounds are also commonly present in process wastewater streams. Other liquid

sources include equipment cleaning wastewater, container cleaning wastewater, and used lubricants and other machine operating aids. Cleaning solvents may become part of the wastewater after scouring operations and equipment cleaning. Note that process equipment cleaning operations do not qualify for the routine janitorial maintenance exemption.

Solid waste sources are similar to those found in yarn and fabric formation operations. Potential sources include textile and fabric scrap or off-specification product containing EPCRA Section 313 chemicals and chemical categories, dusts containing EPCRA Section 313 chemicals and chemical categories, container residue, and machine operating aids.

Step 3: Identify Release and Other Waste Management Activity Types

Fugitive and stack air emissions of EPCRA Section 313 chemicals and chemical categories occur during wet processing operations. Fugitive releases may include carrier chemicals such as formaldehyde. Fugitive emissions may result from singeing, desizing, scouring, printing, dyeing, drying, and finishing operations when chemicals evaporate. If the air emissions from any operation are captured by an air pollution control device, any releases from the device are considered to be point air releases. Also, air emissions from tank vents are classified as point air releases for EPCRA Section 313 reporting. As with fabric formation, dusts containing EPCRA Section 313 chemicals and chemical categories may be generated as fugitive emissions, however, the sources of these emissions are primarily the weighing and unloading of chemicals for use in the process. These dusts may be controlled by a baghouse or collected for disposal. Section 4.2.2 contains additional discussion on air pollution control devices, such as baghouses. Section 7A and 8.6 should be completed as appropriate (see example in Section 4.1.3(h)).

COMMON ERROR - Reporting Carrier Chemicals

Typically, carrier chemicals are otherwise used, and you can assume none of the chemical remains with the textile product. Therefore, the total amount of the chemical should be accounted for through air releases, amounts captured or destroyed in control devices, and amounts sent off site. The total amount is best determined from purchasing records.

Another common reporting error is overestimation of the amount of chemical in waste sent off site. If testing data is available, the quantity of waste sent off site should be based on an analysis of the waste. See Section 4.1.4.1 for information on the use of monitoring data. The total amount of waste shipped off site must be adjusted for the chemical concentration. Many off-site disposal facilities that receive waste will provide information on the concentration and quantity of a chemical present in each shipment. This information is a key component of a mass balance for estimating chemical release and other waste management quantities.

The wet processing operations generate the majority of wastewater in textile processes. Typically, the wastewater is sent to a POTW or to another off-site location for waste treatment. In addition, facilities may perform on-site wastewater treatment prior to discharge to a POTW or a receiving stream.

Solid waste containing EPCRA Section 313 chemicals or chemical categories may result in release and other waste management activity types such as disposal or recycling. Textile or fabric scraps, off-specification product, and dust are typically disposed of off site, but your facility may have other waste management activities. If the solid waste contains any EPCRA Section 313 chemicals or chemical categories, the amount sent off site or handled on site needs to be included during release and other waste management calculations. Keep in mind that dusts may be collected in floor sweepings or in air pollution control devices, such as baghouses. Oils, lubricants, and other machine operating aids may be disposed on site or sent off site for disposal or recycling. Containers that may have residual EPCRA Section 313 chemicals or chemical categories may be disposed, otherwise waste managed, or returned to the supplier for reuse. Calculating container residue quantities is described in Section 4.1.3(g). If on-site waste treatment is performed, sludges may be generated and then sent off site for disposal or other waste management activities.

Table 4-5 presents common release and waste management types and EPCRA Section 313 chemicals typical to wet processing operations.

Table 4-5

Common EPCRA Section 313 Chemicals and Chemical Categories Associated with Release and Other Waste Management Activity Types During Textile Wet Processing

Release and Other Waste Management Activity Types	Common EPCRA Section 313 Chemicals and Chemical Categories	
Fugitive Air Release	Certain glycol ethers Formaldehyde	Ammonia Methanol
Point Source Air Release	Ammonia Methanol	Formaldehyde Certain glycol ethers
Water Release	Certain glycol ethers	Formaldehyde
POTW	Ammonia Ethylene glycol	Certain glycol ethers Formaldehyde
On-Site Treatment	Certain glycol ethers	Formaldehyde

Step 4: Determine the Most Appropriate Method(s) and Calculate the Estimates for Release and Other Waste Management Activity Quantities

Mass balances combined with engineering calculations are the most widely used estimation methods for textile operations. Information that may be needed for completing the mass balance includes operational data such as batch recipes, inventory records, and production records. This can be used to determine the quantity of the EPCRA Section 313 chemical or chemical category that has been used on site. MSDSs contain information on EPCRA Section 313 chemicals and chemical categories contained in mixtures purchased by the facility that may also be used for mass balances. Finally, knowledge of your facility processes and engineering calculations may be used to determine how much of a chemical remains with the fabric. For air emission estimates, emission factors or engineering calculations may be used. Section 4.2.2 provides additional information on air emission calculations. The example below shows how vendor data may be used to estimate releases and other waste management activities of air emissions.

Example - Air Pollutant Controls for Chemical Finishing

Your facility uses 30,000 pounds of an organic coating with a 15% concentration of toluene, present as a solvent, during finishing operations. You have exceeded a threshold for toluene in other processes at your facility. In this example, it is assumed that the solvent volatilizes completely in the dryer. The dryer vent stack leads to a scrubber, which has a vendor-specified removal efficiency of 95 percent for volatile organic compounds. The scrubber water is then sent directly to a POTW.

The amount of toluene emitted to the dryer vent stack is:

(30,000 lb organic coating) × (0.15) = 4,500 lb toluene

Stack Air Release:

The amount of toluene passing through the scrubber and released as stack air is:

(4,500 lb toluene) × (1 - 0.95) = 225 lb

This quantity should be reported in Part II, Section 5.2 and Part II, Section 8.1 on the RY 1999 Form R.

Discharge to POTW:

The remaining toluene is discharged with the scrubber water:

(4,500 lb toluene) × (0.95) = 4,275 lb

This quantity should be reported in Part II, Section 6.1 and Part II, Section 8.7 (Quantity Treated Off Site) as appropriate.

Wet processing operations are water-intensive and calculating the quantity of EPCRA Section 313 chemicals and chemical categories released and otherwise managed as waste through process wastewater streams may be the most logical first step. Non-volatile EPCRA Section 313 chemicals and chemical categories that are otherwise used often become part of the process wastewater.

Your facility may have wastewater monitoring data that is more appropriate than mass balance calculations. Data containing chemical concentrations and stream throughput is often collected before discharges to a POTW or to a receiving stream (see Appendix B for an example of how to use NPDES monitoring data to estimate discharges to a receiving stream).

Example - Nonvolatile Wet Processing Chemical

Your facility receives and otherwise uses a surfactant solution in 500-pound steel drums with a concentration of 10% of a nonvolatile EPCRA Section 313 chemical. The solution is pumped from the drum directly into the process. In this example, you must determine the quantity of this chemical released and otherwise managed as waste from this use. It is assumed that you have exceeded a threshold due to activities involving the chemical elsewhere at your facility.

During the year, you receive and otherwise use 150 drums of the solution. The empty drums are then sent off site to a landfill. The total amount of the EPCRA Section 313 chemical received and subsequently used is:

$$(500 \text{ lb}) \times (0.10) \times (150 \text{ drums}) = 7{,}500 \text{ lb}$$

You have determined that none of the surfactant solution remains with the final product; rather, all that is introduced into the process is ultimately discharged with process wastewater to a POTW. Table 4-1 lists residue quantities that would remain in the drum after use, in weight percent of container capacity. The mean residue quantity for a surfactant solution in a steel drum that is emptied via pumping is 3.06%. The following amounts of the nonvolatile EPCRA Section 313 chemical should be reported:

Sent to Off-Site Land Disposal:

$$(7{,}500 \text{ lb}) \times (0.0306) = 230 \text{ lb}$$

This quantity should be reported in Part II, Section 6.2 and Part II, Section 8.1 of the RY 1999 Form R.

Discharged to POTW:

$$(7{,}500 \text{ lb}) \times (1.0 - 0.0306) = 7{,}270 \text{ lb}$$

This quantity should be reported in Part II, Section 6.1 and Part II, Section 8.7 of the RY 1999 Form R.

Textile dyeing operations use various bath constituents that may contain EPCRA Section 313 chemicals and chemical categories. Although these chemicals are intended to remain with the fabric, some, such as dyes, may be left in the bath process water. The amount of dye and dye components remaining in the process water can be calculated using fixation values as shown in the following equation.

$$\text{Dye remaining in process water} = \text{Dye Input} \times (1 - \textit{fixation})$$

The *fixation* value can be based on facility data, manufacturer's information, or a published factor. An average fixation value may be appropriate to determine the annual amount of dye lost to the process water for facilities with large volumes and variations in processes. Table 4-6 lists

some common fixation values by dye type that may be appropriate if site-specific information is not available.

Table 4-6

Typical Dye Fixation Values

Dye Class	Typical Fixation (%)
Acid	80 - 93
Basic	97 - 98
Direct	70 - 95
Disperse	80 - 92
Reactive	60 - 90
Sulfur	60 - 70
Vat	80 - 95

Source: U.S. EPA. *Profile of the Textile Industry*. Office of Enforcement and Compliance, 1997.

Example - Using Engineering Calculations to Estimate Dye Chemicals in Process Wastewater (Dye Fixation Values)

Metals in process wastewater are expected to be present from textile dyeing operations or from the use of dyeing aids. If no monitoring data exist, the quantity can be calculated using dye fixation data.

For example, your facility uses a chromium-complex dye with 2 weight percent chromium. From process information, you know typically 85% of the dye becomes fixed on the fabric. If 10,000 pounds of the chromium complex dye is used annually, the amount of chromium expected in the process water can be calculated as shown below.

Amount of Chromium in Process Water = (Weight of dye used) × (Weight % chromium) × (1 - *fixation*)
= (10,000 lb) × (0.02) × (1-0.85)
= 30 lb chromium

If you operate a continuous dyeing or printing process, include any amount of unused dye or pigment removed and subsequently released and otherwise managed as waste from the process in your calculations, as appropriate. Also include losses due to screen washing for printing processes. Estimates should be based on knowledge of unused bath volume and concentration of chemicals in the bath.

Process wastewater may be directly discharged or treated at an on-site or off-site treatment system. If you discharge directly to a surface water, you should have a NPDES or SPDES permit for your facility. This permit may require monitoring, may limit discharges, and may contain other information to help you determine the amount of EPCRA Section 313 chemicals that are discharged. A calculation example using NPDES permit data has been provided in Appendix B. Alteratively, if you indirectly discharge to a POTW, the wastewater may require pretreatment, monitoring, sampling and testing of the treated effluent, and flow rate measurements. This information can be used to estimate the quantities discharged in a manner similar to that presented in the example using NPDES data.

Example - Chromium Compounds in Wastewater

Your textile processing facility otherwise uses 11,000 pounds per year of a chromium compound, specifically, sodium dichromate ($Na_2Cr_2O_7$) as a metal salt.

For metal compounds, such as $Na_2Cr_2O_7$, you must apply the entire weight of the compound toward the threshold determination, therefore the otherwise used threshold (10,000 pounds per year) has been exceeded. You must report all releases and other waste management activity amounts for the parent metal, chromium.

When calculating release and other waste management activity amounts for reporting, use only the weight of parent metal in the compound. The weight of chromium per pound of sodium dichromate must be determined using the following atomic weights: Cr = 52.0 Na = 23.0 O = 16.0

In this example, engineering judgement is used to assume that all the sodium dichromate is removed from the process with the exhausted bath water. The amount of chromium in the wastewater from sodium dichromate can then be determined as follows:

Amount of chromium in wastewater =

$$\left(11{,}000 \text{ lb/yr } Na_2Cr_2O_7\right) \times \left(\frac{2\,(52.0) \text{ lb/lbmol of Cr}}{[2\,(52.0) + 2\,(23.0) + 7\,(16.0)] \text{ lb/lbmol of } Na_2Cr_2O_7}\right)$$

$$= 4{,}366 \text{ lb/yr}$$

You must report this amount on a Form R (not on a Form A), since the reportable amount exceeds 500 lb/yr. If the wastewater is sent to a POTW, this amount should be reported in Part II, Section 6.1 of the 1999 Form R. If the wastewater is discharged to a receiving stream, show this amount in Part II, Section 5.3 of the Form R. Remember that metals sent to a POTW are not considered to be treated for destruction. Therefore, they should also be reported in Part II, Section 8.1, Quantity Released, not in Part II, Section 8.7, Quantity Treated Off Site.

COMMON ERROR - Acids and Bases

If you use an EPCRA Section 313 mineral acid or base at your facility, but it is effectively neutralized to a pH between 6 and 9, EPA considers the quantity in the resulting stream to be less than 0.5 pound. You should report "zero" for the appropriate release and other waste management activity quantity. Keep in mind that the neutralization of an acid or base may result in the coincidental manufacture of another EPCRA Section 313 chemical. For example, neutralization of nitric acid in wastewater will coincidentally manufacture water dissociable nitrate compounds as a byproduct.

Also note any qualifiers for EPCRA Section 313 chemicals. For example, sulfuric acid and hydrochloric acid are only reportable as aerosols; therefore, any quantity of these acids that is released or otherwise managed as waste in solution should not be considered in the quantity reported.

4.2.4 Product Fabrication

Product fabrication includes cutting and sewing of the fabric to form the finished product. Some mills are stand-alone facilities and receive the dyed fabric from an off-site facility. Product fabrication mills need to determine which EPCRA Section 313 chemicals and chemical categories may be contained in the fabric received from off site.

Step 1: Prepare a Process Flow Diagram

Figure 4-8 shows a typical product fabrication operation. A site-specific process flow diagram should be prepared to help identify all potential sources and types of chemical release and waste management activities.

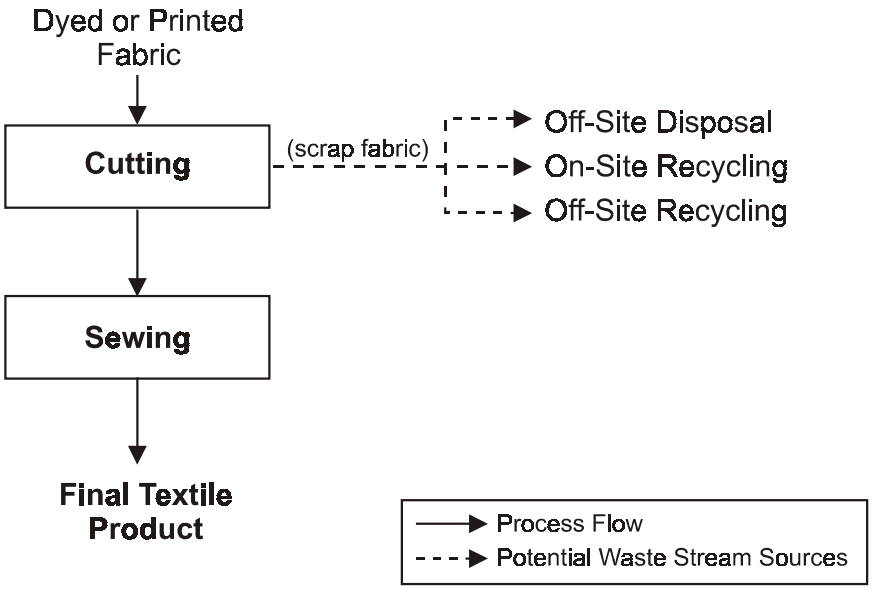

Figure 4-8. Textile Product Fabrication Process Flow Diagram

Step 2: Identify EPCRA Section 313 Chemicals and Chemical Categories and Potential Sources of Chemical Release and Other Waste Management Activities

As with yarn and fabric formation, EPCRA Section 313 chemicals and chemical categories may be present in solid textile scraps. These wastes are often generated from textile cutting and sewing operations. EPCRA Section 313 chemicals and chemical categories may also be used for equipment cleaning operations.

Potential liquid sources of EPCRA Section 313 chemicals and chemical categories include wastewater from equipment cleaning operations and used oil, lubricants, and other machine maintenance chemicals. Note that process equipment cleaning operations do not qualify for the routine janitorial maintenance exemption. Process wastewater may included any finishing chemical solutions used in the process.

The primary source of solid waste is excess fabric material and scraps that may contain EPCRA Section 313 chemicals and chemical categories not volatilized or removed during processing. Another solid waste source is collected dust containing EPCRA Section 313

chemicals or chemical categories. These solid wastes are usually generated during textile cutting operations.

Step 3: Identify Release and Other Waste Management Activity Types

Dusts containing EPCRA Section 313 chemicals and chemical categories may be generated as fugitive emissions, however, the dust is not typically released, rather it is often collected and otherwise managed as waste.

Solid waste sources of EPCRA Section 313 chemicals and chemical categories from product fabrication may result in release and waste management activity types such as disposal or recycling. Fabric scraps and dust are typically disposed of off site, but your facility may have another waste management activity for scraps. The ultimate disposition of EPCRA Section 313 chemicals and chemical categories in the dust should be reported as appropriate. Any scrap materials from final product components must also be considered when determining the amount of an EPCRA Section 313 chemical that is released and otherwise managed as waste. Oils, lubricants, and other machine operating aids may be disposed or sent off-site for recycling.

Step 4: Determine the Most Appropriate Method(s) and Calculate the Estimates for Release and Other Waste Management Activity Quantities

As with yarn formation (See Section 4.2.1, Step 4), the most typical estimation methods for product fabrication are mass balances and engineering calculations. Information sources for mass balances include purchasing records, MSDSs, and operational data. Using engineering assumptions and process knowledge, you can determine how much of an EPCRA Section 313 chemical or chemical category is released and otherwise managed as waste with fabric scraps and how much becomes part of the final product. See the previous Step 4 discussions in Sections 4.2.1 through 4.2.3 for information on how to use a mass balance for estimating the quantities of EPCRA Section 313 chemicals released and otherwise managed as waste.

Appendix A

TRI GUIDANCE RESOURCES

Appendix A

TRI GUIDANCE RESOURCES

A.1 EPCRA Section 313 RELATED REFERENCES

40 CFR 372, Toxic Chemical Release Reporting; Community Right-to-Know; Final Rule
See 53 FR 4500, February 16, 1988.

Toxic Chemical Release Inventory Reporting Forms and Instructions for the Current Reporting Year - See also Automated Toxic Chemical Release Inventory Reporting Software (ATRS) under Section A.2, Internet Sites.
U.S. EPA publishes this document each year to provide current guidance for preparing the Form R and Form A reports. This document contains the most up-to-date list of chemicals for which reports are required. It includes a blank Form R and Form A and provides step-by-step instructions for completing each report. It also has a list of U.S. EPA regional and state contacts for EPCRA Section 313 reporting. The current version of this document should always be consulted in preparing the EPCRA Section 313 report.

Common Synonyms for Chemicals Listed Under EPCRA Section 313 of the Emergency Planning and Community Right-to-Know Act (EPA 745-R-95-008)
This glossary contains chemical names and their synonyms for substances covered by the reporting requirements of EPCRA Section 313. The glossary was developed to aid in determining whether a facility manufactures, processes, or uses a chemical subject to EPCRA Section 313 reporting.

Consolidated List of Chemicals Subject to the Emergency Planning and Community Right-to-Know Act (EPCRA) and Section 112(r) of the Clean Air Act (as amended) (EPA 740-R-95-001)
List of chemicals covered by EPCRA Sections 302 and 313, CERCLA Hazardous Substances, and CAA 112(r). The list contains the chemical name, CAS Registry Number, and reporting requirement(s) to which the chemical is subject.

Data Quality Checks to Prevent Common Reporting Errors on Form R/A (EPA 745-R-98-012)

The Emergency Planning and Community Right-to-Know Act: EPCRA Section 313 Release Reporting Requirements, August, 1995 (EPA 745/K-95-052)
This brochure alerts businesses to their reporting obligations under EPCRA Section 313 and assists in determining whether their facility is required to report. The brochure contains U.S. EPA Regional contacts, the list of EPCRA Section 313 toxic chemicals and a description of the Standard Industrial Classification (SIC) codes subject to EPCRA Section 313.

EPCRA Section 313 Questions and Answers: 1998 Version, (EPA 745-B-98-004).

Executive Order 12856 - Federal Compliance with Right-to-Know Laws and Pollution Prevention Requirements: Questions and Answers (EPA 745-R-95-011)
This document assists federal facilities in complying with Executive Order 12856. This information has been compiled by U.S. EPA from questions received from federal facilities. This document is intended for the exclusive use of federal facilities in complying with Sections 302,

303, 304, 311, 312, and 313 of the Emergency Planning and Community Right-to-Know Act (EPCRA) of 1986 and the Pollution Prevention Act of 1990, as directed by the Executive Order.

Supplier Notification Requirements (EPA 560/4-91-006)
This pamphlet assists chemical suppliers who may be subject to the supplier notification requirements under EPCRA Section 313. The pamphlet explains the supplier notification requirements, gives examples of situations which require notification, describes the trade secret provision, and contains a sample notification.

Toxic Chemical Release Inventory - Data Quality Checks to Prevent Common Reporting Errors on Form R/Form A (EPA 745-R-98-012)
This is a compilation of Notices of Data Change, Significant Error, Noncompliance, or Technical Error. It provides a listing of common errors found on the Form R reports submitted to U.S. EPA. It also provides a discussion of the types of errors which result in each of the above Notices as well as a list of Notice of Technical Error codes and descriptions.

Trade Secrets Rule and Form
See 53 FR 28772, July 29, 1988. This rule implements the trade secrets provision of the EPCRA (Section 322) and includes a copy of the trade secret substantiation form.

A.2 INFORMATION SOURCES

Most of the materials included as reference in this manual are available from the following sources:

National Center for Environmental Publications and Information (NCEPI)
P.O. Box 42419
Cincinnati, OH 45242-2419
(800) 490-9198
Fax: (513)489-8695
Internet: *http://www.epa.gov/ncepihom/index.html*

Emergency Planning and Community Right-to-Know (EPCRA) Information Hotline
U.S. Environmental Protection Agency
(800) 424-9346 or (703) 412-9810 (for the Washington, D.C. metropolitan area)
TDD: (800) 553-7672

Internet Sites

- TRI homepage: *http://www.epa.gov/tri*
  This site contains information on the Toxic Release Inventory and provides links to a variety of data and documents related to the TRI program.

- Automated Toxic Chemical Release Inventory Reporting Software (ATRS): *http://www.epa.gov/atrs*
  This site provides access to the automated EPCRA Section 313 reporting forms for electronic submittal of required data to U.S. EPA.

- Air CHIEF CD-ROM

http://www.epa.gov/ttn/chief/airchief.html
This site provides information on the Air CHIEF CD-ROM, contents, ordering information, system requirements, and sources for additional information.

- Clearinghouse for Inventories and Emission Factors (CHIEF): *http://www.epa.gov/ttn/chief/*
  This site provides access to the latest information and tools for estimating emissions of air pollutants and performing emission inventories.

- Code of Federal Regulations, 40 CFR: *http://www.epa.gov/epacfr40*
  This site was created by U.S. EPA to expand access to Title 40 - Environmental Protections of the Code of Federal Regulations.

- Compilation of Air Pollutant Emission Factors (AP-42): *http://www.epa.gov/ttn/chief/ap42etc.html*
  This site provides access to files containing guidance for estimating emissions from specific sources and emission factors.

- Federal Register Notice: *http://www.epa.gov/EPA-TRI*
  This site provides access to all Federal Register notices related to the TRI program from 1994 to current.

- Material Safety Data Sheets (MSDSs): *http://msds.pdc.cornell.edu/issearch/msdssrch.htm*
  A key word searchable database of 325,000 MSDSs.

- TANKS: *http://www.epa.gov/ttn/chief/tanks.html*
  This site contains information on TANKS, a DOS-based computer software program that computes estimates of VOC emissions from fixed and floating-roof storage tanks.

- WATER8/CHEMDAT8: *http://www.epa.gov/ttn/chief/software.html#water8*
  WATER8 is an analytical model for estimating compound-specific air emissions from wastewater collection and treatment systems. CHEMDAT8 is a Lotus 1-2-3 spreadsheet for estimating VOC emissions from TSDF processes.

A.3 INDUSTRY-SPECIFIC TECHNICAL GUIDANCE DOCUMENTS

In 1988 and 1990, U.S. EPA developed a group of individual guidance documents for industries or activities in industries who primarily manufacture, process, or otherwise use EPCRA Section 313 chemicals. See list of industries/activities below. U.S. EPA is currently revising some of these documents and preparing additional documents. The newer versions will be available beginning in the Fall of 1998.

Chemical Distribution Facilities, January 1999 (EPA 745-B-99-005)

Coal Mining Facilities, January 1999 (EPA 745-B-99-002)

Coincidental Manufacture/By-Products (EPA 745-B-00-014)

Electricity Generating Facilities, January 1999 (EPA 745-B-99-003)

Estimating Releases and Waste Treatment Efficiencies

Food Processors, September 1998 (EPA 745-R-98-011)

Formulation of Aqueous Solutions

Foundry Operations (EPA 745-B-00-016)

Leather Tanning and Finishing Industry, April 2000 (EPA 745-B-00-012)

Metal Working and Electroplating Operations, April 2000 (EPA 745-B-00-015)

Metal Mining Facilities, January 1999 (EPA 745-B-99-001)

Monofilament Fiber Manufacture (EPA 745-B-00-013)

Pulp, Paper, and Paperboard Production (EPA 745-B-00-010)

Petroleum Terminals and Bulk Storage Facilities, January 1999 (EPA 745-B-99-006)

Presswood & Laminated Wood Products Manufacturing

Printing Industry, April 2000 (EPA 745-B-00-005)

RCRA Subtitle C TSD Facilities and Solvent Recovery Facilities , January 1999 (EPA 745-B-99-004)

Rubber and Plastics Manufacturing, April 2000 (EPA 745-B-00-017)

Semiconductor Manufacture (EPA 745-R-99-007)

Smelting Operations (EPA 745-B-00-009)

Spray Application and Electrodeposition of Organic Coatings, December 1998 (EPA 745-B-99-014)

Textile Processing Industry, April 2000 (EPA 745-B-00-008)

Welding Operations (EPA 745-B-00-011)

Wood Preserving Operations (EPA 745-B-00-007)

U.S. EPA, Office of Compliance, published a series of documents in 1995 called Sector Notebooks. These documents provide information of general interest regarding environmental issues associated with specific industrial sectors. The Document Control Numbers (DCN) range from EPA/310-R-95-001 through EPA/310-R-95-018.

A.4 CHEMICAL-SPECIFIC GUIDANCE DOCUMENTS

U.S. EPA has also developed a group of guidance documents specific to individual chemicals and chemical categories. These are presented below.

Emergency Planning and Community Right-to-Know EPCRA Section 313: Guidance for Reporting Aqueous Ammonia, July 1995 (EPA 745-R-95-012)

Emergency Planning and Community Right-to-Know EPCRA Section 313: List of Toxic Chemicals within the Chlorophenols Category, November 1995 (EPA 745-B-95-004)

Estimating Releases for Mineral Acid Discharges Using pH Measurements, U.S. Environmental Protection Agency, June 1991.

Guidance for Reporting Sulfuric Acid (acid aerosols including mists, vapors, gas, fog, and other airborne forms of any particle size), November 1997 (EPA-745-R-97-007)

Toxic Release Inventory List of Toxic Chemicals within the Glycol Ethers Category and Guidance for Reporting, May 1995 (EPA 745-R-95-006)

Toxic Release Inventory List of Toxic Chemicals within the Nicotine and Salts Category and Guidance for Reporting, February 1995 (EPA 745-R-95-004)

Toxic Release Inventory List of Toxic Chemicals within the Polychlorinated Alkanes Category and Guidance for Reporting, February 1995 (EPA 745-R-95-001)

Toxic Release Inventory List of Toxic of Chemicals within the Polycyclic Aromatic Compounds Category, February 1995 (EPA 745-R-95-003)

Toxic Release Inventory List of Toxic Chemicals within the Strychnine and Salts Category and Guidance for Reporting, February 1995 (EPA 745-R-95-005)

Toxic Release Inventory List of Toxic of Chemicals within the Water Dissociable Nitrate Compounds Category and Guidance for Reporting, May, 1996 (EPA 745-R-96-004)

Toxics Release Inventory - List of Toxic Chemicals Within Ethylenebisdithiocarbamic Acid Category, November 1994, EPA 745-B-94-003.

Toxics Release Inventory - Copper Phthalocyanine Compounds Excluded for the Reporting Requirements Under the Copper Compounds Category on the EPCRA Section 313 List, April 1995, EPA 745-R-95-007.

Toxics Release Inventory - List of Toxic Chemicals Within Warfarin Category, November 1994, EPA 745-B-94-004.

A.5 OTHER USEFUL REFERENCES

Burgess, W.A. Recognition of Health Hazards in Industry. Harvard School of Public Health. Boston, Massachusetts, John-Wiley & Sons.

CRC Handbook of Chemistry and Physics. Latest Edition, Robert C. Weast, Editor, CRC Press, Inc., Florida.

Kirk Othmer - Encyclopedia of Chemical Technology, Latest Edition, John Wiley & Sons, New York.

Locating and Estimating Air Emissions from Various Sources. Available from: National Technical Information Services (NTIS), (703) 487-4650.

The Merck Index. Latest Edition, Merck & Co., Inc., New Jersey.

Perry, R.H. and C.H. Chilton, Chemical Engineer's Handbook. Latest Edition, McGraw-Hill Book Company, New York.

Sax, N.I. and R.J. Lewis, Sr., Hawley's Condensed Chemical Dictionary. Latest Edition, Van Nostrand Reinhold Company, New York.

U.S. EPA, Profile of the Textile Industry, Latest Edition, Office of Enforcement and Compliance Assurance.

Appendix B

BASIC CALCULATION TECHNIQUES

Appendix B

BASIC CALCULATION TECHNIQUES

This section will provide the basic techniques needed to use specific types of data or engineering calculations. Examples are provided for:

(1) Stack monitoring data;

(2) Industrial hygiene data;

(3) Raoult's Law;

(4) Air emission factors;

(5) RCRA hazardous waste analysis data;

(6) NPDES monitoring data.

(1) Stack Monitoring Data

The following is an example of a release calculation using monitoring data.

Example: Stack monitoring data are available for a paint booth. The measured average concentration of toluene is 0.1 ppmv (dry gas basis). The moisture content in the stack is typically 10%, and stack conditions are maintained at 80°C and atmospheric pressure. The stack gas velocity is 8 m/s. The diameter of the stack is 0.3 m. Calculate the point air release of toluene.

Step 1. Calculate volumetric flow of stack gas stream.

$$\text{Volumetric flow} = (\text{gas velocity}) \times [(\pi) \times (\text{internal stack diameter})^2/4)]$$

$$\text{Volumetric flow} = (8.0\ \text{m/s}) \times [(\pi) \times (0.3\ \text{m})^2/4] = 0.6\ \text{m}^3/\text{s}$$

Step 2. Correct for moisture content in stack gas stream.

Stack exhausts may contain large amounts of water vapor. The concentration of the chemical in the exhaust is often presented on a dry basis. For an accurate release rate, correct the vent gas flow rate for the moisture content by multiplying by the term (1 - fraction water vapor). The dry gas rate can then by multiplied by the chemical concentration.

(Note: If the toluene concentration is on a wet gas basis, no correction is necessary for moisture content.)

$$\text{Dry volumetric flow} = (\text{Volumetric flow}) \times (1\text{-fraction water vapor})$$

Dry volumetric flow = (0.6 m^3/s) × (1-0.10) = 0.5 m^3/s

Step 3. Convert ppmv to mg/m^3.

- ppmv is defined as one part of a chemical in 10^6 parts of gas (1.0 $m^3/10^6$ m^3).
- Use the molar volume of a gas, corrected for stack temperature and pressure conditions, calculated by the ideal gas law (PV = nRT). Note that the molar volume of an ideal gas at 237 K and 1 atm is 22.4 L/mole.
- Molecular weight of toluene (MW) = 92.14 g/mole.
- R = the Ideal Gas Constant (0.082057 L - atm per mole-Kelvin)

To calculate the molar volume of stack gas, use the ideal gas equation.

$$\text{Molar volume} = \frac{V}{n} = \frac{RT}{P}$$

For the example, the stack conditions are 80º C (353 K) and atmospheric pressure (1 atm).

$$\text{Molar volume} = \left(0.082057\ \frac{\text{L-atm}}{\text{mole-K}}\right) \times (353\ \text{K})/(1\text{atm})$$

$$= 29.0\ \text{L/mole}$$

The conversion of ppmv to mg/m^3 can now be calculated.

$$\left(\frac{mg}{m^3}\right) = (\text{concentration of chemical, ppmv}) \times \left(\frac{1}{\text{molar volume of gas}}\right) \times (\text{MW})$$

Using the example, the concentration of toluene is calculated as follows:

$$\left(\frac{0.1\ \text{m}^3}{10^6\ \text{m}^3}\right) \times \left(\frac{\text{mole}}{29.0\ \text{L}}\right) \times \left(\frac{92.14\ \text{g}}{\text{mole}}\right) \times \left(\frac{\text{L}}{10^{-3}\ \text{m}^3}\right) \times \left(\frac{1{,}000\ \text{mg}}{1\ \text{g}}\right) = 0.3\ \text{mg/m}^3$$

Step 4. Calculate air releases.

Air releases are calculated as follows:

Air Release=(volumetric flow, m^3/s) × (concentration, mg/m^3) × (operating time, s/yr)

The paint booth is used 8 hours per day, 5 days per week, 52 weeks per year.

$$\text{Operating time} = \left(8\ \frac{\text{hr}}{\text{day}}\right) \times \left(5\ \frac{\text{day}}{\text{week}}\right) \times \left(52\ \frac{\text{week}}{\text{yr}}\right) = 2{,}080\ \text{hr/yr}$$

$$\text{Air Release} = (0.5\ \text{m}^3/\text{s}) \times (0.3\ \text{mg/m}^3) \times \left(\frac{3{,}600\ \text{s}}{\text{hr}}\right) \times \left(\frac{2{,}080\ \text{hr}}{\text{yr}}\right) \times \left(\frac{\text{lb}}{454\ \text{g}}\right) \times \left(\frac{\text{g}}{1{,}000\ \text{mg}}\right)$$

$$= 2.5\ \text{lb/yr of toluene}$$

It is important to note that this calculation assumes the measured emissions are representative of actual emissions at all times; however, this is not always the case. Ideally, a continuous emissions monitor provides the most representative data.

Also note that monitoring and stack data may have units that are different than those used in the example. Modify conversion factors and constants to reflect your data when calculating air releases.

(2) **<u>Industrial Hygiene Data</u>**

The following is an example of a release calculation using industrial hygiene data.

Example: Occupational industrial hygiene data shows that workers are exposed to an average of 0.1 ppmv benzene (wet gas basis). The density of benzene vapor is 0.2 lb/ft^3. The ventilation system exhausts 20,000 acfm of room air at 70°F. The plant operates 24 hours per day, 330 days per year.

The benzene concentration is on a wet gas basis, therefore a moisture correction of the ventilation flow rate is not necessary. The industrial hygiene data is collected at the same ambient conditions as the ventilation system, therefore no adjustment for temperature or pressure needs to be performed. A conservative estimation of benzene fugitive releases could be calculated as follows:

Air Release	=	(ventilation flow rate, ft^3/min) × (operating time, min/yr) × (concentration of chemical, ppmv) × (vapor density of chemical, lb/ft^3)

Benzene releases per year would be calculated as follows:

$$\left(\frac{20{,}000\ ft^3}{min}\right) \times \left(\frac{60\ min}{hr}\right) \times \left(\frac{24\ hr}{day}\right) \times \left(\frac{330\ day}{yr}\right) \times \left(\frac{0.1\ ft^3\ benzene}{10^6\ ft^3\ air}\right) \times \left(\frac{0.2\ lb}{ft^3}\right)$$

$$= 190\ lb/yr\ of\ benzene$$

(3) **<u>Raoult's Law</u>**

The following is an example of a release calculation using Raoult's Law. Raoult's Law states that the partial pressure of a compound in the vapor phase over a solution may be estimated by multiplying its mole fraction in the liquid solution by the vapor pressure of the pure chemical.

$$P_A = X_{A,L}P^o = X_{A,G}P_T$$

where:

$P°$	=	Vapor pressure of pure liquid chemical A;
$X_{A,L}$	=	Mole fraction of chemical A in solution;
$X_{A,G}$	=	Mole fraction of chemical A in the gas phase;
P_A	=	Partial pressure of chemical A in the gas phase; and
P_T	=	Total pressure.

Example: A wash tank holds a solution containing 10% by weight of o-xylene (A) and 90% by weight of toluene (B). The tank is vented to the atmosphere; the process vent flow rate is estimated as 100 acfm (2.83m^3/min) based on a minimum fresh air ventilation rate. The molecular weight of o-xylene is 106.17 g/mole and toluene is 92.14 g/mole. The vapor pressure of o-xylene is 10 mm of Hg (0.19 psia). The total pressure of the system is 14.7 psia (atmospheric conditions). The process tank is in service 250 days/yr. Calculate the air release of o-xylene.

Step 1: Calculate the mole fraction of o-xylene in the liquid solution.

$$X_{A,L} = \frac{\dfrac{\text{wt fraction A}}{MW_A}}{\dfrac{\text{wt fraction A}}{MW_A} + \dfrac{\text{wt fraction B}}{MW_B}}$$

Where:

$X_{A,L}$	=	Mole fraction of chemical A in liquid solution;
MW	=	Molecular weight of chemical, g/mole; and
wt fraction	=	Weight fraction of chemical in material.

$$X_{A,L} = \frac{\left[\dfrac{0.1}{106.17}\right]}{\left[\dfrac{0.1}{106.17} + \dfrac{0.9}{92.14}\right]}$$

$$X_{A,L} = 0.09$$

Step 2: Calculate the mole fraction of o-xylene in the gas phase.

$$X_{A,G} = \frac{X_{A,L} P^{\circ}}{P_T}$$

where:

$X_{A,G}$	=	Mole fraction of chemical A in gas phase;
$X_{A,L}$	=	Mole fraction of chemical A in liquid solution;
P°	=	Vapor pressure of pure liquid chemical A, psia; and
P_T	=	Total pressure of system, psia.

$$X_{A,G} = [0.09] \times \left[\frac{0.19 \text{ psia}}{14.7 \text{ psia}}\right] = 0.001$$

Step 3: Calculate releases using Raoult's Law.

$$\text{Emissions} = (X_{A,G}) \times (\text{AFR}) \times (t) \times (MW_A) \times \left(\frac{1}{MV}\right)$$

where:

Emissions	=	Air release of pollutant A, g-A/yr;
$X_{A,G}$	=	Mole fraction of chemical A in gas phase;
AFR	=	Air flow rate of room, m^3/min;
t	=	Operating time of wash tank, min/yr;
MW	=	Molecular weight of chemical, g/g-mole; and
MV	=	Gas molar volume (22.4 L/mole at standard temperature and pressure).

If conditions vary from standard temperature and pressure the gas molar volume can be calculated using the ideal gas law and tank conditions as presented in Example 1.

Emissions = (0.001) ×

$$\left(\frac{2.83\,m^3}{min}\right) \times \left(\frac{250\ day}{yr}\right) \times \left(\frac{24\ hr}{day}\right) \times \left(\frac{60\ min}{hr}\right) \times \left(\frac{mole}{22.4\,L}\right) \times \left(\frac{106.17\,g}{mole}\right) \times \left(\frac{L}{10^{-3}\,m^3}\right)$$

$= 4.8 \times 10^6$ g/yr

The emission of o-xylene is calculated as shown below.

$$\text{Emissions} = \left(4.8 \times 10^6\ g/yr\right) \times \left(\frac{lb}{454\ g}\right) = 10{,}570\ lb/yr\ \text{of o-xylene}$$

Air releases for toluene can be calculated in a similar manner.

(4) **<u>Air Emission Factor</u>**

The following is an example of a release calculation using air emission factors.

Example: An industrial boiler uses 300 gallons per hour of No. 2 fuel oil. The boiler operates 2,000 hours per year. Calculate emissions of formaldehyde using the AP-42 emission factors.

$$AE = (EF) \times (AU) \times (OT)$$

where:

AE	=	Annual emissions of pollutant, lb/yr
EF	=	Emission factor of pollutant, lb/10^3 gallon of fuel. EF for formaldehyde for an industrial boiler burning No. 2 fuel oil is 0.035 to 0.061 lb/10^3 gallons.
AU	=	Quantity of fuel used, gal/yr.
OT	=	Operating time, hr/yr.

Using an emission factor of 0.061 pounds of formaldehyde per gallon of fuel, the air releases are calculated as follows:

$$AE = \left(\frac{0.061\ \text{lb}}{10^3\ \text{gal}}\right) \times \left(\frac{300\ \text{gal}}{\text{hr}}\right) \times \left(\frac{2{,}000\ \text{hr}}{\text{yr}}\right) = 36.6\ \text{lb/yr of formaldehyde}$$

(5) **<u>RCRA Waste Analysis</u>**

The following is an example of a calculation using RCRA waste analysis data.

Example: Spent paint wastes were disposed at an off-site waste treatment facility. The quantity of paint waste shipped was five 55-gallon drums per year. Analysis of the waste showed 5% cadmium by weight. Estimating the density of the paint waste to be 9.5 lb/gallon, the amount of cadmium to off-site disposal is calculated as follows:

Amount of cadmium = (amount of paint waste disposed, gal/yr) × (concentration of cadmium, lb/lb) × (density of paint waste, lb/gal)

$$\left(\frac{5\ \text{drums}}{\text{yr}}\right) \times \left(\frac{55\ \text{gal}}{\text{drum}}\right) \times \left(\frac{9.5\ \text{lb}}{\text{gal}}\right) \times \left(\frac{5\,\text{lb Cd}}{100\,\text{lb waste}}\right) = 131\ \text{lb/yr of cadmium}$$

(6) **<u>NPDES Data</u>**

The following is an example of a calculation using NPDES data.

NPDES permits require periodic monitoring of the effluent stream. In this example, quarterly samples were taken to be analyzed for silver content. Each sample was an hourly, flowrate-based composite taken for one day to be representative of the discharge for that day. The total effluent volume for that day was also recorded. The following data were collected on each sample day.

Yearly Quarter Sample Number	Discharge Flow Rate (10^6 gal/day)	Total Silver (µg/L)
1	0.5	10
2	0.6	10
3	0.4	6
4	0.2	<3

To calculate the amount of silver in pounds discharged on each sample day, the concentration of silver in the discharge is multiplied by the discharge flow rate for that day, as shown below for the first quarter sample.

Amount of silver = (daily flow rate) × (silver concentration)

First Quarter: $$\left(\frac{10\,\mu g}{L}\right) \times \left(\frac{1\,g}{10^6\,\mu g}\right) \times \left(\frac{1\,lb}{454\,g}\right) \times \left(\frac{3.785\,L}{gal}\right)\left(\frac{0.5 \times 10^6\,gal}{day}\right)$$

= 0.04 lb/day of silver

The amount of silver discharged during each of the other three monitoring events was similarly determined to be:

0.05 lb/day; 0.02 lb/day, and 0.005 lb/day.

For the last data point the concentration of silver was reported by the laboratory to be less than the detection limit of 3 µg/L. For this calculation the detection limit was used to calculate the daily discharge, a conservative assumption.

The average daily discharge was calculated to be:

$$\left(\frac{0.04 + 0.05 + 0.02 + 0.005}{4}\right) \text{lb/day} = 0.03\,\text{lb/day}$$

The plant operates 350 days/year (plant shuts down for two weeks in July).

The estimated annual discharge of silver is calculated as follows:

Annual discharge = (350 day/yr) (0.03 lb/day) = 10.5 lb of silver/yr

Appendix C

GUIDANCE FOR REPORTING AQUEOUS AMMONIA

United States Environmental Protection Agency | Office of Pollution Prevention and Toxics Washington, DC 20460 | July 1995 EPA 745-R-95-012

EMERGENCY PLANNING AND COMMUNITY RIGHT-TO-KNOW EPCRA Section 313

Guidance for Reporting Aqueous Ammonia

EPCRA Section 313 of the Emergency Planning and Community Right-to-Know Act of 1986 (EPCRA) requires certain facilities manufacturing, processing, or otherwise using listed toxic chemicals to report their environmental releases of such chemicals annually. Beginning with the 1991 reporting year, such facilities also must report pollution prevention and recycling data for such chemicals, pursuant to section 6607 of the Pollution Prevention Act, 42 U.S.C. 13106. When enacted, EPCRA Section 313 established an initial list of toxic chemicals that was comprised of more than 300 chemicals and 20 chemical categories. EPCRA Section 313(d) authorizes EPA to add chemicals to or delete chemicals from the list, and sets forth criteria for these actions.

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Section 1. Introduction

On June 30, 1995 EPA finalized four actions in response to a petition received in 1989 to delete ammonium sulfate (solution) from the list of toxic chemicals subject to reporting under EPCRA Section 313 of the Emergency Planning and Community Right-to-Know Act of 1986 (EPCRA), 42 U.S.C. 11001. The four actions taken are summarized as follows: (1) deleted ammonium sulfate (solution) from the EPCRA Section 313 list of toxic chemicals, (2) required that threshold and release determinations for aqueous ammonia be based on 10 percent of the total aqueous ammonia present in aqueous solutions of ammonia, (3) modified the ammonia listing by adding the following qualifier: ammonia (includes anhydrous ammonia and aqueous ammonia from water dissociable ammonium salts and other sources; 10 percent of total aqueous ammonia is reportable under this listing), and (4) deleted ammonium nitrate (solution) as a separately listed chemical on the EPCRA Section 313 list of toxic chemicals. All actions are effective for the 1994 reporting year for reports due July 1, 1995, with the exception of the deletion of ammonium nitrate (solution) as a separately listed chemical, which is effective for the 1995 reporting year for reports due July 1, 1996. At the time that these actions were finalized, EPA indicated that the Agency would develop, as appropriate, interpretations and guidance that the Agency determines are necessary to facilitate accurate reporting for aqueous ammonia. This document constitutes such guidance for reporting under the ammonia listing.

Section 1.1 Who Must Report

A plant, factory, or other facility is subject to the provisions of EPCRA Section 313, if it meets <u>all</u> three of the following criteria:

- It conducts manufacturing operations (is included in Standard Industrial Classification (SIC) codes 20 through 39); <u>and</u>

- It has 10 or more full-time employees (or the equivalent 20,000 hours per year); <u>and</u>

- It manufactures, imports, processes, or otherwise uses any of the toxic chemicals listed on the EPCRA Section 313 list in amounts greater than the “threshold” quantities specified below.

Section 1.2 Thresholds

Thresholds are specified amounts of toxic chemicals used during the calendar year that trigger reporting requirements.

If a facility *manufactures* or *imports* any of the listed toxic chemicals, the threshold quantity will be:

- 25,000 pounds per toxic chemical or category over the calendar year.

If a facility *processes* any of the listed toxic chemicals, the threshold quantity will be:

- 25,000 pounds per toxic chemical or category over the calendar year.

If a facility *otherwise uses* any of the listed toxic chemicals (without incorporating it into any product or producing it at the facility), the threshold quantity is:

- 10,000 pounds per toxic chemical or category over the calendar year.

Section 1.3 Chemical Sources of Aqueous Ammonia

If a facility manufactures, processes, or otherwise uses anhydrous ammonia or aqueous ammonia, they must report under the ammonia listing. EPA is providing a table of Chemical Abstract Service (CAS) numbers and chemical names to aid the regulated community in determining whether they need to report under the ammonia listing for aqueous ammonia. This table includes a list of water dissociable ammonium salts which, when placed in water, are a source of aqueous ammonia. The table contains only commonly used ammonium salts and therefore is not exhaustive. If a facility manufactures, processes, or otherwise uses aqueous ammonia, regardless of its source, it must report under the ammonia listing, even if the source of the aqueous ammonia is not listed in the table provided in this document.

Section 1.4 *De Minimis* Concentrations

The ammonia listing is subject to the one percent *de minimis* concentration. Thus, solutions containing aqueous ammonia at a concentration in excess of *one percent of the 10 percent reportable under this listing* should be factored into threshold and release determinations.

Section 2. Guidance for Reporting Aqueous Ammonia

Note: for the purposes of reporting under the ammonia listing for aqueous ammonia, water dissociable ammonium salts means that the ammonium ion dissociates from its counterion when in solution.

Section 2.1 Determining Threshold and Release Quantities for Ammonia

If a facility manufactures, processes, or otherwise uses *anhydrous ammonia*, the quantity applied towards threshold determinations for the ammonia listing is the total quantity of the anhydrous ammonia manufactured, processed, or otherwise used. The quantity reported when calculating the amount of ammonia that is released, transferred, or otherwise managed is the total quantity of *anhydrous ammonia* released or transferred.

If the facility manufactures, processes, or otherwise uses *anhydrous ammonia* in quantities that exceed the appropriate threshold and subsequently dissolves some or all of the *anhydrous ammonia* in *water*, then the following applies: 1) threshold determinations are based on 100 percent of the *anhydrous ammonia* (simply 10 percent of *aqueous ammonia*); 2) release, transfer, and other waste management quantities for the *aqueous ammonia* are calculated as 10 percent of total ammonia; 3) release, transfer, and other waste management quantities for the *anhydrous ammonia* are calculated as 100 percent of the *anhydrous ammonia*.

If a facility manufactures, processes, or otherwise uses *aqueous ammonia*, the quantity applied toward threshold determinations for the ammonia listing is 10 percent of the total quantity of the *aqueous ammonia* manufactured, processed, or otherwise used. The quantity reported when calculating the amount of ammonia that is released, transferred, or otherwise managed is 10 percent of the total quantity of *aqueous ammonia* released or transferred.

If a facility dissolves a water dissociable ammonium salt in water that facility has manufactured *aqueous ammonia* and 10 percent of the total *aqueous ammonia* manufactured from these salts is to be included in manufacturing threshold determinations under the ammonia listing.

If *aqueous ammonia* from water dissociable ammonium salts is processed or otherwise used, then 10 percent of the total *aqueous ammonia* is to be included in all processing and otherwise use threshold determinations under the ammonia listing.

Example 1: In a calendar year, a facility places 25,000 lbs of anhydrous ammonia in water for processing and processes 25,000 lbs of aqueous ammonia from an ammonium salt. The facility must include all of the 25,000 lbs of anhydrous ammonia in the determination of the processing threshold, but only 10 percent (or 2,500 lbs) of the aqueous ammonia from the ammonium salt in the processing threshold determination.

Total aqueous ammonia is the sum of the two forms of ammonia (un-ionized, NH_3, and ionized, NH_4^+) present in aqueous solutions. A precise calculation of the weight of

total aqueous ammonia would require determining the ratio of the two forms of ammonia present using the pH and temperature of the solution. The weight of total aqueous ammonia can be more easily calculated by assuming that aqueous ammonia is comprised entirely of the NH_4^+ form or the NH_3 form. For the purpose of determining threshold and release quantities under EPCRA Section 313, EPA recommends that total aqueous ammonia be calculated in terms of NH_3 equivalents (i.e., for determining weights, assume total ammonia is comprised entirely of the NH_3 form). This method is simpler than using pH and temperature data to determine the ratio of the two forms present and is consistent with the presentation of total ammonia toxicity in a separate EPA document, *Ambient Water Quality Criteria for Ammonia* (EPA document #440/5-85-001, January 1985).

Section 2.2 Chemical Sources of Aqueous Ammonia

Aqueous ammonia may be generated in solution from a variety of sources that include the release of anhydrous ammonia to water and the dissociation of ammonium salts in water. Water dissociable ammonium salts are not reportable in their entirety under the ammonia listing; these salts are reportable to the extent that they dissociate in water, and only 10 percent of the total aqueous ammonia that results when these salts dissociate is reportable. If these salts are not placed in water, they are not reportable.

If these salts are purchased neat or as solids by a facility, then placed in water by that facility, the facility is *manufacturing* aqueous ammonia.

Section 2.2.1 Reporting Aqueous Ammonia Generated from Anhydrous Ammonia in Water

If the source of aqueous ammonia is anhydrous ammonia in water, total aqueous ammonia (calculated in terms of NH_3 equivalents) is equal to the quantity of anhydrous ammonia manufactured, processed, or otherwise used. A hypothetical scenario demonstrating the calculations involved in reporting aqueous ammonia generated from anhydrous ammonia in water is given in Example 2.

Example 2: In a calendar year, a facility uses 30,000 pounds of anhydrous ammonia to neutralize acids in a wastewater stream. The neutralized waste stream (containing aqueous ammonia from dissociated ammonium salts) is then transferred to a POTW. The quantity to be applied toward threshold determinations is the total quantity of anhydrous ammonia used in the waste stream neutralization, or 30,000 pounds. The quantity of ammonia reported as transferred is 10 percent of the total quantity of aqueous ammonia transferred, or 3,000 pounds.

Section 2.2.2 Reporting Aqueous Ammonia Generated from the Dissociation of Ammonium Salts (Other Than Ammonium Nitrate)

If the source of aqueous ammonia is the dissociation of ammonium salts in water, total aqueous ammonia (calculated in terms of NH_3 equivalents) is calculated from the weight percent (wt%) of the NH_3 equivalents of the ammonium salt. The NH_3 equivalent wt% of an ammonium salt is calculated using the following equation:

NH_3 equivalent wt% = (NH_3 equivalent weight)/(MW ammonium salt) × 100

If the source of aqueous ammonia is a monovalent compound (such as ammonium chloride, NH_4Cl, ammonium nitrate, NH_4NO_3, or ammonium bicarbonate (NH_4HCO_3), the NH_3 equivalent weight is equal to the MW of NH_3 (17.03 kg/kmol). If divalent compounds are involved (such as ammonium carbonate, $(NH_4)_2CO_3$), then the NH_3 equivalent weight is equal to the MW of NH_3 multiplied by two. Similarly, if trivalent compound are involved, then the NH_3 equivalent weight is equal to the MW of NH_3 multiplied by three.

<u>Example 3:</u>

The NH_3 equivalent wt% of ammonium chloride is calculated as follows:

NH_3 equivalent wt% = (NH_3 equivalent weight)/(MW ammonium chloride) × 100
NH_3 equivalent wt% = (17.03)/(53.49) × 100
NH_3 equivalent wt% = 31.84%

The NH_3 equivalent wt% of ammonium carbonate is calculated as follows:

NH_3 equivalent wt% = 2 × (NH_3 equivalent weight)/(MW ammonium chloride) × 100
NH_3 equivalent wt% = 2 × (17.03)/(96.09) × 100
NH_3 equivalent wt% = 35.45%

To aid the regulated community in reporting under the ammonia listing for aqueous ammonia, the table of chemical sources of aqueous ammonium provided in Section 3 of this document includes, in addition to CAS number, chemical name, and molecular weight, the NH_3 equivalent wt% of the commonly used, water dissociable ammonium salts listed in this table.

<u>Example 4</u>: In a calendar year, a facility uses 100,000 pounds of ammonium chloride, NH_4Cl, *in aqueous solution* which is released to wastewater streams, then transferred to a POTW. The NH_3 equivalent wt% of ammonium chloride is 31.84% (taken from Table 1 in Section 3 below or calculated as in Example 3 above). The total quantity of aqueous ammonia present in solution is 31.84% of the 100,000 pounds of ammonia chloride used, or 31,840 pounds. The quantity applied towards threshold determinations for the ammonia listing is 10 percent of the total quantity of aqueous ammonia present in solution, or 3,184 pounds. The quantity of ammonia reported as released or transferred is 10 percent of the total quantity of aqueous ammonia released or transferred, or 3,184 pounds.

Example 5: In a calendar year, a facility uses 500,000 pounds of ammonium carbonate, $(NH_4)_2CO_3$, and 400,000 pounds of ammonium bicarbonate, NH_4HCO_3, *in aqueous solution* which is released to wastewater streams, then transferred to a POTW. The NH_3 equivalent wt% of ammonium carbonate is 35.45%, and the NH_3 equivalent wt% of ammonium bicarbonate is 21.54% (taken from Table 1 in Section 3 below or calculated as in Example 3 above). The quantity of aqueous ammonia present in solution from ammonium carbonate is 35.45% of the 500,000 pounds of ammonia carbonate used, or 177,250 pounds. The quantity of aqueous ammonia present in solution from ammonium bicarbonate is 21.54% of the 400,000 pounds of ammonia bicarbonate used or 86,160 pounds. The total quantity of aqueous ammonia present in solution is 263,410 pounds. The quantity applied towards threshold determinations for the ammonia listing is 10 percent of the total quantity of aqueous ammonia present in solution, or 26,341 pounds. The quantity of ammonia reported as released or transferred is 10 percent of the total quantity of aqueous ammonia released or transferred, or 26,341 pounds.

Section 2.2.3 Reporting Aqueous Ammonia Generated from the Dissociation of Ammonium Nitrate

Some sources of aqueous ammonia may be reportable under other EPCRA Section 313 category listings. Ammonium nitrate (solution) is relevant to reporting under the ammonia listing to the extent that 10 percent of the total aqueous ammonia that results when ammonium nitrate dissociates is reported when determining thresholds and calculating releases. However, under the nitrate compound category listing, ammonium nitrate (and other mixed salts containing ammonium and nitrate) must be reported in its entirety. When reporting ammonium nitrate under this category listing, the total nitrate compound, including both the nitrate ion portion and the ammonium counterion, is included when determining threshold quantities. However, only the nitrate ion portion is included when determining the amount of ammonium nitrate that is released, transferred, or otherwise managed in wastes. The calculations involved in determining threshold and release quantities for reporting under the nitrate compound category listing are described in a separate directive, *List of Toxic Chemicals within the Water Dissociable Nitrate Compounds Category and Guidance for Reporting* (EPA document #745-R-95-002, February 1995). Note: reporting ammonium nitrate under the ammonia listing and nitrate compounds category listing is effective for the 1995 reporting year for reports due July 1, 1996.

Example 6: In a calendar year, a facility uses 1,250,000 pounds of ammonium nitrate, NH_4NO_3, *in aqueous solution* which is released to wastewater streams, then transferred to a POTW. The NH_3 equivalent wt% of ammonium nitrate is 21.28% (taken from Table 1 in Section 3 below or calculated as in Example 3 above). The total quantity of aqueous ammonia present in solution is 21.28% of the 1,250,000 pounds of ammonia chloride used, or 266,000 pounds. The quantity applied towards threshold determinations for the ammonia listing is 10 percent of the total quantity of aqueous ammonia present in solution, or 26,600 pounds. The quantity of ammonia reported as released or transferred is 10 percent of the total quantity of aqueous ammonia released or transferred, or 26,600 pounds. For determining thresholds and calculating releases under the nitrate compound category listing, see the separate directive, *List of Toxic Chemicals within the Water Dissociable Nitrate Compounds Category and Guidance for Reporting* (EPA document #745-R-95-002, February, 1995).

Example 7: In a calendar year, a facility transfers 100,000 pounds of nitric acid (HNO_3) to an on-site treatment facility. The nitric acid is neutralized with anhydrous ammonia, and treatment efficiency is 95 percent (the nitrate compound formed as a result of the treatment is ammonium nitrate, NH_4NO_3). The neutralized waste stream (containing aqueous ammonia from dissociated ammonium nitrate) is then transferred to a POTW. The quantity of nitric acid neutralized is 95 percent of 100,000 pounds or 95,000 pounds. The quantity of nitric acid neutralized is converted first to kilograms then to kilomoles using the following equations:

Kilograms HNO_3 neutralized = (lbs HNO_3 neutralized) × (0.4536 kg/lb)
Kilomoles HNO_3 neutralized = (kg HNO_3) ÷ (MW of HNO_3 in kg/kmol)

Substituting the appropriate values into the above equations yields:

Kilograms HNO_3 neutralized = 95,000 lbs × 0.4536 kg/lb = 43,092 kg
Kilomoles HNO_3 neutralized = 43,092 kg ÷ 63.01 kg/kmol = 683.9 kmol

The quantity of anhydrous ammonia used in kilomoles in the acid neutralization and the quantity of ammonium nitrate generated in kilomoles from the neutralization are equal to the quantity of nitric acid neutralized (683.9 kmol). The quantity of anhydrous ammonia used in kilograms and pounds in the acid neutralization is calculated as follows:

Kilograms NH_3 used = (kmol NH_3) × (MW of NH_3 in kg/kmol)
Pounds NH_3 used = (kg NH_3) × (2.205 lbs/kg)

Substituting the appropriate values into the above equation yields:

Kilograms NH_3 used = (683.9 kmol) × (17.03 kg/kmol) = 11,647 kmol
Pounds NH_3 used = (11,647 NH_3) × (2,205 lbs/kg) = 25,682 pounds

The quantity reported applied towards threshold determinations for the ammonia listing is the total quantity of anhydrous ammonia used in the acid neutralization, or 25,682 pounds. The quantity of ammonia reported as released or transferred is 10 percent of the total quantity of aqueous ammonia released or transferred, or 2,568 pounds. For determining thresholds and calculating releases under the nitrate compound category listing, see the separate directive, *List of Toxic Chemicals within the Water Dissociable Nitrate Compounds Category and Guidance for Reporting* (EPA document #745-R-95-002, February 1995).

Section 3. CAS Number and List of Some Chemical Sources of Aqueous Ammonia

EPA is providing the following table of CAS numbers and chemical names to aid the regulated community in determining whether they need to report under the ammonia listing for aqueous ammonia. If a facility manufactures, processes, or otherwise uses, *in aqueous solution*, a chemical which is listed below, they must report 10 percent of the total aqueous ammonia that is the result of the dissociation of this chemical. However, this list is not exhaustive. If a facility manufactures, processes, or otherwise uses, *in aqueous solution*, a water dissociable ammonium compound, they must report 10 percent of the total aqueous ammonia that is the result of the dissociation of the compound, even if the compound does not appear in the following table.

Table C-1
Listing by CAS Number and Molecular Weight of Some Chemical Sources of Aqueous Ammonia

Chemical Name	Molecular Weight*	NH_3 Equivalent Wt%	CAS Number
Ammonium acetate	77.08	22.09	631-61-8
Ammonium aluminum sulfate (Ammonium aluminum disulfate)	237.14	7.181	7784-25-0
Ammonium antimony fluoride (Diammonium pentafluoroantimonate)	252.82	13.47	32516-50-0
Ammonium arsenate (Ammonium arsenate, hydrogen) (Ammonium arsenate, dihydrogen)	158.97	10.71	13462-93-6
Ammonium arsenate (Diammonium arsenate) (Diammonium arsenate, hydrogen) (Diammonium arsenate, monohydrogen)	176.00	19.35	7784-44-3
Ammonium arsenite	124.96	13.63	13462-94-7
Ammonium azide	60.06	28.35	12164-94-2
Ammonium benzenesulfonate	175.20	9.720	19402-64-3
Ammonium benzoate	139.15	12.24	1863-63-4
Ammonium bromate	145.94	11.67	13843-59-9
Ammonium bromide	97.94	17.39	12124-97-9
Ammonium cadmium chloride (Ammonium cadmium trichloride)	236.81	7.191	18532-52-0
Ammonium carbamate	78.07	21.81	1111-78-0
Ammonium carbonate carbamate	157.13	21.68	8000-73-5
Ammonium carbonate (Diammonium carbonate)	96.09	35.45	506-87-3

Table C-1 (Continued)

Chemical Name	Molecular Weight*	NH_3 Equivalent Wt%	CAS Number
Ammonium carbonate, hydrogen (Ammonium bicarbonate)	79.06	21.54	1066-33-7
Ammonium cerium nitrate (Ammonium hexanitratocerate) (Ammonium hexanitratocerate (IV)) (Diammonium cerium hexanitrate)	548.23	6.213	16774-21-3
Ammonium cerous nitrate (Ammonium cerous nitrate, tetrahydrate)	486.22	7.005	13083-04-0
Ammonium chlorate	101.49	16.78	10192-29-7
Ammonium perchlorate	117.49	14.49	7790-98-9
Ammonium chloride	53.49	31.84	12125-02-9
Ammonium chromate (Ammonium chromate (VI)) (Diammonium chromate)	152.07	22.40	7788-98-9
Ammonium chromate (Ammonium dichromate) (Ammonium dichromate (VI)) (Ammonium bichromate) (Diammonium dichromate)	252.06	13.51	7789-09-5
Ammonium chromium sulfate (Ammonium chromic sulfate)	265.17	6.422	13548-43-1
Ammonium citrate (Ammonium citrate, monohydrogen) (Ammonium citrate, dibasic) (Diammonium citrate) (Diammonium citrate, hydrogen)	226.19	15.06	3012-65-5
Ammonium citrate (Ammonium citrate, tribasic) (Triammonium citrate)	243.22	21.01	3458-72-8
Ammonium cobalt sulfate (Ammonium cobaltous sulfate)	289.14	11.78	13596-46-8
Ammonium cupric chloride (Ammonium chlorocuprate (II)) (Diammonium copper tetrachloride) (Diammonium tetrachlorocuprate)	241.43	14.11	15610-76-1
Ammonium cyanate (Ammonium isocyanate)	60.06	28.35	22981-32-4
Ammonium cyanide	44.06	38.65	12211-52-8
Ammonium cyanoaurate, monohydrate (Ammonium tetracyanoaurate, monohydrate)	319.07	5.337	14323-26-3

Table C-1 (Continued)

Chemical Name	Molecular Weight*	NH_3 Equivalent Wt%	CAS Number
Ammonium cyanoaurate (Ammonium dicyanoaurate)	267.04	6.377	31096-40-9
Ammonium ferricyanide (Ammonium hexacyanoferrate (III)) (Triammonium hexacyanoferrate)	266.07	19.20	14221-48-8
Ammonium ferrocyanide (Ammonium hexacyanoferrate (II)) (Tetraammonium ferrocyanide) (Tetraammonium hexacyanoferrate)	284.11	23.98	14481-29-9
Ammonium fluoride	37.04	45.98	12125-01-8
Ammonium fluoride (Ammonium difluoride) (Ammonium bifluoride) (Ammonium fluoride, hydrogen) (Ammonium difluoride, hydrogen) (Ammonium bifluoride, hydrogen)	57.04	29.86	1341-49-7
Ammonium fluoroborate (Ammonium tetrafluoroborate)	104.84	16.24	13826-83-0
Ammonium fluorogermanate (IV) (Ammonium hexafluorogermanate (IV)) (Diammonium hexafluorogermanate)	222.66	15.30	16962-47-3
Ammonium fluorophosphate (Ammonium hexafluorophosphate)	163.00	10.45	16941-11-0
Ammonium fluorosulfate (Ammonium fluorosulfonate)	117.10	14.54	13446-08-7
Ammonium formate	63.06	27.01	540-69-2
Ammonium gallium sulfate	282.90	6.020	15335-98-5
Ammonium hydroxide	35.05	48.59	1336-21-6
Ammonium iodide	144.94	11.75	12027-06-4
Ammonium iridium chloride (Ammonium chloroiridate (III)) (Ammonium hexachloroiridate) (Triammonium hexachloroiridate)	459.05	11.13	15752-05-3
Ammonium iron sulfate (Ammonium ferric sulfate) (Ammonium iron disulfate)	269.02	6.330	10138-04-2
Ammonium iron sulfate (Ammonium ferrous sulfate) (Diammonium iron disulfate) (Diammonium ferrous disulfate)	286.05	11.91	10045-89-3

Table C-1 (Continued)

Chemical Name	Molecular Weight*	NH_3 Equivalent Wt%	CAS Number
Ammonium lactate (Ammonium 2-hydroxypropionate)	107.11	15.90	515-98-0
Ammonium laurate (Ammonium dodecanoate)	217.35	7.835	2437-23-2
Ammonium magnesium sulfate	252.50	13.49	14727-95-8
Ammonium malate	168.15	20.26	6283-27-8
Ammonium malate, hydrogen (Ammonium bimalate)	151.12	11.27	5972-71-4
Ammonium molybdate (Diammonium molybdate)	196.01	17.38	13106-76-8
Ammonium molybdate (Ammonium heptamolybdate) (Ammonium molybdate, hydrate) (Ammonium molybdate, tetrahydrate) (Ammonium *para*molybdate, tetrahydrate)	1,163.8	8.780	12054-85-2
Ammonium nickel chloride, hexahydrate	183.09	9.301	16122-03-5
Ammonium nickel sulfate (Ammonium nickel sulfate, hexahydrate) (Ammonium nickel disulfate, hexahydrate) (Diammonium nickel disulfate, hexahydrate)	286.88	11.87	7785-20-8
Ammonium nitrate	80.04	21.28	6484-52-2
Ammonium nitrate sulfate	212.18	24.08	12436-94-1
Ammonium nitrite	64.04	26.59	13446-48-5
Ammonium oleate	299.50	5.686	544-60-5
Ammonium oxalate	124.10	27.45	1113-38-8
Ammonium palladium chloride (Ammonium chloropalladate (II)) (Ammonium tetrachloropalladte (II)) (Diammonium tetrachloropalladate)	284.31	11.98	13820-40-1
Ammonium phosphate (Ammonium orthophosphate)	149.09	34.27	10124-31-9
Ammonium phosphate (Ammonium biphosphate) (Ammonium phosphate, hydrogen) (Ammonium phosphate, dihydrogen) (Ammonium orthophosphate, dihydrogen) (Ammonium phosphate, monobasic)	115.03	14.80	7722-76-1

Table C-1 (Continued)

Chemical Name	Molecular Weight*	NH_3 Equivalent Wt%	CAS Number
Ammonium phosphate (Ammonium phosphate, hydrogen) (Ammonium orthophosphate, monohydrogen) (Ammonium phosphate, dibasic) (Ammonium orthophosphate, dibasic) (Diammonium phosphate) (Diammonium orthophosphate) (Diammonium phosphate, hydrogen) (Diammonium phosphate, monohydrogen) (Diammonium orthophosphate, hydrogen)	132.06	25.79	7783-28-0
Ammonium phosphinate (Ammonium hypophosphite)	83.03	20.51	7803-65-8
Ammonium phosphite (Ammonium biphosphite) (Ammonium phosphite, dihydrogen)	99.03	17.20	13446-12-3
Ammonium picramate	216.15	7.879	1134-85-6
Ammonium propionate	91.11	18.69	17496-08-1
Ammonium rhodium chloride (Ammonium chlororhodate (III)) (Ammonium hexachlororhodate (III)) (Triammonium rhodium hexachloride) (Triammonium hexachlororhodate)	369.74	13.82	15336-18-2
Ammonium salicylate (Ammonium 2-hydroxybenzoate)	155.15	10.98	528-94-9
Ammonium selenide	115.04	29.61	66455-76-3
Ammonium silicon fluoride (Ammonium fluorosilicate) (Ammonium hexafluorosilicate) (Diammonium silicon hexafluoride) (Diammonium fluorosilicate) (Diammonium hexafluorosilicate)	178.15	19.12	16919-19-0
Ammonium stearate (Ammonium octadecanoate)	301.51	5.648	1002-89-7
Ammonium succinate (Diammonium succinate)	152.15	22.39	2226-88-2
Ammonium sulfamate (Ammonium amidosulfate) (Ammonium amidosulfonate)	114.12	14.92	7773-06-0
Ammonium sulfate (Diammonium sulfate)	132.13	25.78	7783-20-2

Table C-1 (Continued)

Chemical Name	Molecular Weight*	NH_3 Equivalent Wt%	CAS Number
Ammonium sulfate (Ammonium bisulfate) (Ammonium sulfate, hydrogen) (Ammonium sulfate, monohydrogen)	115.10	14.80	7803-63-6
Ammonium *per*sulfate (Ammonium peroxysulfate) (Ammonium peroxydisulfate) (Diammonium persulfate) (Diammonium peroxydifulsite)	228.19	14.93	7727-54-0
Ammonium sulfide (Ammonium bisulfide) (Ammonium sulfide, hydrogen)	51.11	33.32	12124-99-1
Ammonium sulfide (Ammonium monosulfide) (Diammonium sulfide)	68.14	49.99	12135-76-1
Ammonium sulfide (Diammonium pentasulfide)	196.39	17.34	12135-77-2
Ammonium sulfite, monohydrate (Diammonium sulfite, monohydrate)	116.13	29.33	7783-11-1
Ammonium sulfite (Ammonium bisulfite) (Ammonium sulfite, hydrogen)	99.10	17.18	10192-30-0
Ammonium tetrachloroaurate (III), hydrate	356.82	4.772	13874-04-9
Ammonium thiocarbamate	94.13	18.09	16687-42-6
Ammonium thiocarbonate (Diammonium trithiocarbonate)	144.27	23.61	13453-08-2
Ammonium thiocyanate (Ammonium isothiocyanate) (Ammonium sulfocyanate) (Ammonium rhodanate) (Rhodanid)	76.12	22.37	1762-95-4
Ammonium dithionate	196.19	17.36	60816-52-6
Ammonium thiosulfate (Ammonium hyposulfite) (Diammonium thiosulfate)	148.20	22.98	7783-18-8
Ammonium tin bromide (Ammonium bromostannate (IV)) (Ammonium hexabromostannate (IV)) (Diammonium hexabromostannate)	634.19	5.371	16925-34-1

Table C-1 (Continued)

Chemical Name	Molecular Weight*	NH_3 Equivalent Wt%	CAS Number
Ammonium tin chloride (Ammonium chlorostannate (IV)) (Ammonium hexachlorostannate (IV)) (Diammonium tin hexachloride) (Diammonium hexachlorostannate)	367.48	9.269	16960-53-5
Ammonium titanium fluoride (Ammonium fluorotitanate (IV)) (Ammonium hexafluorotitanate (IV)) (Diammonium titanium hexafluoride) (Diammonium hexafluorotitanate)	197.95	17.21	16962-40-6
Ammonium titanium oxalate, monohydrate (Diammonium dioxalatooxotitanate, monohydrate)	276.00	12.34	10580-03-7
Ammonium tungstate (Ammonium tungstate (VI)) (Ammonium *para*tungstate) (Hexaammonium tungstate)	1,779.2	5.743	12028-06-7
Ammonium tungstate (Ammonium tungstate (VI)) (Ammonium *para*tungstate) (Decaammonium tungstate)	3,058.6	5.568	11120-25-5
Ammonium valerate (Ammonium pentoate)	119.16	14.29	42739-38-8
Ammonium zinc chloride (Ammonium chlorozincate) (Ammonium tetrachlorozincate) (Diammonium tetrachlorozincate)	243.27	14.00	14639-97-5

*For hydrated compounds, e.g., ammonium sulfite, monohydrate, the molecular weight excludes the weight of the hydrate portion.

Appendix D

TOXIC RELEASE INVENTORY: LIST OF TOXIC CHEMICALS WITHIN THE GLYCOL ETHERS CATEGORY

United States Environmental Protection Agency
Office of Pollution Prevention and Toxics Washington, DC 20460
May 1995
EPA 745-R-95-006

TOXICS RELEASE INVENTORY

List of Toxic Chemicals within the Glycol Ethers Category

Section 313 of the Emergency Planning and Community Right-to-Know Act (EPCRA) requires certain facilities manufacturing, processing, or otherwise using listed toxic chemicals to report their environmental releases of such chemicals annually. Beginning with the 1991 reporting year, such facilities also must report pollution prevention and recycling data for such chemicals, pursuant to section 6607 of the Pollution Prevention Act, 42 U.S.C. 13106. When enacted, EPCRA Section 313 established an initial list of toxic chemicals that was comprised of more than 300 chemicals and 20 chemical categories. EPCRA Section 313(d) authorizes EPA to add chemicals to or delete chemicals from the list, and sets forth criteria for these actions.

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Section 1. Introduction D-2

Section 2. CAS Number List of Some Chemicals within the Glycol Ethers Category . . . D-5

Section 3. CAS Number List of Some Mixtures That Contain Glycol Ethers within the Category D-160

Section 4. CAS Number List of Some Oligomeric or Polymeric Chemicals That Might Contain Glycol Ether Components within the Category D-162

Section 1. Introduction

On June 28, 1994, EPA promulgated a final rule (published in the Federal Register July 5, 1994) modifying the definition of the glycol ethers category on the list of toxic chemicals under Section 313 of the Emergency Planning and Community Right-to-Know Act of 1986 (EPCRA), 42 U.S.C. 11001 *et.seq.* The effect of this modification, which is described at 59 FR 34386, is that many high molecular weight glycol ethers were excluded from the category. As described in the final rule, this modification was made retroactive for the 1993 reporting year for reports due July 1, 1994. This modification is also effective for all subsequent reporting years. As part of this modification and as the result of public comment, EPA changed the category name at 40 CFR 372.65(c) from 'glycol ethers' to 'certain glycol ethers.' However, this document will refer to the constituents of this category simply as glycol ethers. At the time of the modification, EPA indicated that the Agency would work with the public and the regulated community to develop, as appropriate, interpretations and guidance that the Agency determines are necessary to facilitate accurate reporting for the modified glycol ethers category. This document constitutes such guidance.

Who Must Report

A plant, factory, or other facility is subject to the provisions of EPCRA section 313, if it meets <u>all</u> three of the following criteria:

- It conducts manufacturing operations (is included in Standard Industrial Classification (SIC) codes 20 through 39); <u>and</u>

- It has 10 or more full-time employees (or the equivalent 20,000 hours per year); <u>and</u>

- It manufactures, imports, processes, or otherwise uses any of the toxic chemicals listed on the EPCRA section 313 list in amounts greater than the "threshold" quantities specified below.

Thresholds

Thresholds are specified amounts of toxic chemicals *manufactured, processed, or otherwise used* during the calendar year that trigger reporting requirements.

If a facility *manufactures* or *imports* any of the listed toxic chemicals, the threshold quantity will be:

- 25,000 pounds per toxic chemical or category over the calendar year.

If a facility *processes* any of the listed toxic chemicals, the threshold quantity will be:

- 25,000 pounds per toxic chemical or category over the calendar year.

If a facility *otherwise uses* any of the listed toxic chemicals, the threshold quantity is:

- 10,000 pounds per toxic chemical or category over the calendar year.

EPCRA section 313 requires threshold determinations for chemical categories to be based on the total of all chemicals in the category manufactured, processed, or otherwise used. For example, a facility that manufactures three members of a chemical category would count the total amount of all three chemicals manufactured towards the manufacturing threshold for that category. When filing reports for chemical categories, the releases are determined in the same manner as the thresholds. One report is filed for the category and all releases are reported on this form.

Glycol Ethers Category Definition

The glycol ethers category is defined by the following formula:

$$R - (OCH_2CH_2)_n - OR'$$

where:

n	=	1, 2, or 3;
R	=	Alkyl C7 or less, or phenyl or alkyl substituted phenyl;
R'	=	H or alkyl C7 or less, or OR' consisting of a carboxylic acid ester, sulfate, phosphate, nitrate, or sulfonate.

Chemicals that meet this category definition are reportable.

EPA is providing three lists of CAS numbers and chemical names to aid the regulated community in determining whether they need to report for the glycol ethers category. Section 2 (pages 5 to 159) lists individual chemicals that meet the definition of the EPCRA section 313 'certain glycol ethers' category. This list consists only of chemicals that have been assigned CAS numbers and, thus, is not exhaustive. If a facility manufactures, processes, or otherwise uses, in greater than threshold quantities, a glycol ether that meets the category definition, whether or not that chemical is on the list, they must report the chemical.

Section 3 (pages 160 to 161) lists chemical mixtures which contain glycol ethers that meet the definition of the EPCRA section 313 'certain glycol ethers' category. EPA has tried to make this list as complete as possible; however, not all mixtures that contain reportable glycol ethers will necessarily appear on this list. If a facility manufactures, processes, or otherwise uses a mixture which includes components, in greater than threshold quantities, that meet the definition of the EPCRA section 313 'certain glycol ethers' category, they must report the glycol ether component(s) that meet the category definition.

Section 4 (pages 162 to 180) lists oligomeric and polymeric chemicals (for the category formulae, $R - (OCH_2CH_2)_n - OR'$, n is unspecified) that might contain a glycol ether component (n = 1, 2, or 3). EPA has tried to make this list as complete as possible; however, not all oligomeric or polymeric chemicals that might contain glycol ethers will necessarily appear on

this list. If a facility manufactures, processes, or otherwise uses an oligomeric or polymeric chemical that contains components, in greater than threshold quantities, that meet the definition of the EPCRA section 313 'certain glycol ethers' category, they must report the glycol ether component(s) that meet the category definition.

Ethylene Glycol Ethers versus Propylene Glycol Ethers

The members of this category are glycol ethers derived from ethylene glycol, diethylene glycol, and triethylene glycol. This category does not contain glycol ethers based on propylene glycol, dipropylene glycol, or tripropylene glycol.

Individually Listed Glycol Ethers

There are two chemicals, 2-methoxyethanol (CAS number 109-86-4) and 2-ethoxyethanol (CAS number 110-80-5) that are on the individual chemical list and CAS number lists (40 CFR 37265(a) and (b)). Threshold determinations should be made for each of these chemicals individually and separately from the glycol ethers category.

***De Minimis* Concentrations**

The glycol ethers category is subject to the one percent *de minimis* concentration. Thus, mixtures that contain members of this category at concentrations in excess of one percent should be factored into threshold and release determinations.

Appendix E

UNIT CONVERSION FACTORS

(From U.S. Coast Guard Commandant Instruction M.16465.12A)

CONVERSION FACTORS

To Convert	To	Multiply By
Length		
inches	millimeters	25.4
inches	feet	0.0833
feet	inches	12
feet	meters	0.3048
feet	yards	0.3333
feet	miles (U.S. statute)	0.0001894
yards	feet	3
yards	miles (U.S. statute)	0.0005682
miles (U.S. statute)	feet	5280
miles (U.S. statute)	yards	1760
miles (U.S. statute)	meters	1609
miles (U.S. statute)	nautical miles	0.868
meters	feet	3.271
meters	yards	1.094
meters	miles (U.S. statute)	0.0006214
nautical miles	miles (U.S. statute)	1.152
Area		
square inches	square centimeters	6.452
square inches	square feet	0.006944
square feet	square inches	144
square feet	square meters	0.09290
square meters	square feet	10.76
square miles	square yards	3,097,600
square yards	square feet	9
Volume		
cubic inches	cubic centimeters	16.39
cubic inches	cubic feet	0.0005787
cubic feet	cubic inches	1728
cubic feet	cubic meters	0.02832
cubic feet	U.S. gallons	7.481
cubic meters	cubic feet	35.31
liters	quarts (U.S. liquid)	1.057
quarts (U.S. liquid)	liters	0.9463
U.S. gallons	barrels (petroleum)	0.02381
U.S. gallons	cubic feet	0.1337
U.S. gallons	Imperial gallons	0.8327
barrels (petroleum)	U.S. gallons	42
Imperial gallons	U.S. gallons	1.201
milliliters	cubic centimeters	1

CONVERSION FACTORS (Continued)

To Convert	To	Multiply By
Time		
seconds	minutes	0.01667
seconds	hours	0.0002778
seconds	days	0.00001157
minutes	seconds	60
minutes	hours	0.01667
minutes	days	0.0006944
hours	seconds	3600
hours	minutes	60
hours	days	0.04167
Mass or Weight		
pounds	kilograms	0.4536
pounds	short tons	0.0005
pounds	long tons	0.000464
pounds	metric tons	0.0004536
tons (short)	pounds	2000
tons (metric)	pounds	2205
tons (long)	pounds	2240
kilograms	pounds	2.205
tonnes (metric tons)	kilograms	1000
Energy		
calories	Btu	0.003968
calories	joules	4.187
Btu (British thermal units)	calories	252.0
Btu	joules	1055
joules	calories	0.2388
joules	Btu	0.0009479
Velocity		
feet per second	meters per second	0.3048
feet per second	miles per hour	0.6818
feet per second	knots	0.5921
meters per second	feet per second	3.281
meters per second	miles per hour	2.237
miles per hour	meters per second	0.4470
miles per hour	feet per second	1.467
knots	meters per second	0.5148
knots	miles per hour	1.151
knots	feet per second	1.689
pounds per cubic foot	grams per cubic centimeter	0.01602
grams per cubic centimeter	pounds per cubic foot	62.42
grams er cubic centimeter	kilograms per cubic meter	1000
kilograms per cubic meter	grams per cubic centimeter	0.001

CONVERSION FACTORS (Continued)

To Convert	To	Multiply By
Pressure		
ponds per square inch (absolute) (psia)	kilonewtons per square meter (kN/m^2)	6.895
psia	atmospheres	0.0680
psia	inches of water	27.67
psia	millimeters of mercury (torr)	51.72
pounds per square inch (gauge) (psig)	psia	add 14.70
millimeters of mercury (torr)	psia	0.01934
millimeters of mercury (torr)	kN/m^2	0.1333
inches of water	psia	0.03614
kilograms per square centimeter	millimeters of mercury (torr)	735.6
inches of water	kN/m^2	0.2491
kilograms per square centimeter	atmospheres	0.9678
atmospheres	kN/m^2	101.3
kilograms per square centimeter	psia	14.22
atmospheres	psia	14.70
bars	kN/m^2	100
kilonewtons per square meter (kN/m^2)	psia	0.1450
bars	atmospheres	0.9869
kilonewtons per square meter (kN/m^2)	atmospheres	0.009869
bars	kilograms per square centimeter	1.020
Viscosity		
centipoises	pounds per foot per second	0.0006720
pounds per foot per second	centipoises	1488
centipoises	poises	0.01
centipoises	Newton seconds per square meter	0.001
poises	grams per centimeter per second	1
grams per centimeter per second	poises	1
Newton seconds per square meter	centipoises	1000
Thermal Conductivity		
Btu per hour per foot per °F	watts per meter-kelvin	1.731
Btu per hour per foot per °F	kilocalories per hour per meter per °C	1.488
watts per meter-kelvin	Btu per hour per foot per °F	0.5778
kilocalories per hour per meter per °C	watts per meter-kelvin	1.163
kilocalories per hour per meter per °C	Btu per hour per foot per °F	0.6720
Heat Capacity		
Btu per pound per °F	calories per gram per °C	1
Btu per pound per °F	joules per kilogram-kelvin	4187
joules per kilogram-kelvin	Btu per pound per °F	0.0002388
calories per gram per °C	Btu per pound per °F	1

CONVERSION FACTORS (Continued)

To Convert	To	Multiply By
Concentration (in water solution)		
parts per million (ppm)	milligrams per liter	1
milligrams per liter	ppm	1
milligrams per cubic meter	grams per cubic centimeter	1×10^{-9}
grams per cubic centimeter	milligrams per cubic meter	1×10^{9}
grams per cubic centimeter	pounds per cubic foot	62.42
pounds per cubic foot	grams per cubic centimeter	0.01602
Temperature		
degrees Kelvin (°K)	degrees Rankine (°R)	1.8
degrees Rankine (°R)	degrees Kelvin (°K)	0.5556
degrees centigrade (°C)	degrees Fahrenheit (°F)	first multiply by 1.8, then add 32
degrees Fahrenheit (°F)	degrees centigrade (°C)	first subtract 32, then multiply by 0.5556
degrees centigrade (°C)	degrees Kelvin (°K)	add 273.2
degrees Fahrenheit (°F)	degrees Kelvin (°K)	add 459.7
Flow		
cubic feet per second	U.S. gallons per minute	448.9
U.S. gallons per minute	cubic feet per second	0.002228

Universal Gas Constant (R)

8.314 joules per gram mole-kelvin
1.987 calories per gram mole-kelvin
1.987 Btu per pound mole per °F
10.73 psia-cubic feet per pound mole per °F
82.057 atm-cubic centimeters per gram mole-kelvin
62.361 millimeters mercury liter per gram mole-kelvin

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