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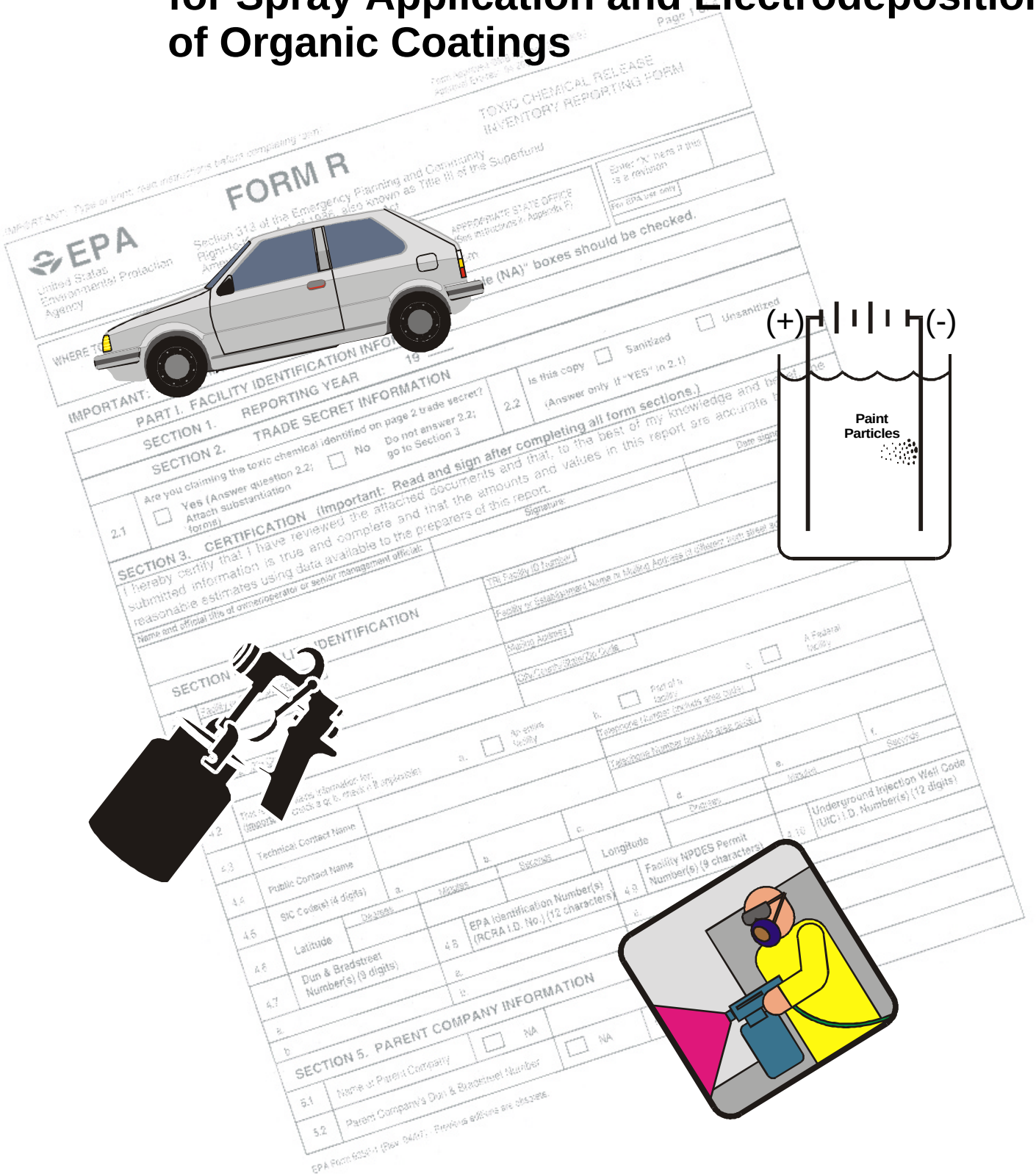
# Emergency Planning Community Right-To-Know Act Section 313 Reporting Guidance for Spray Application and Electrodeposition of Organic Coatings



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## ACKNOWLEDGMENT

The U.S. EPA wishes to acknowledge the valuable contributions made by the staff and members of the National Paint and Coatings Association (NPCA), the Association of International Automobile Manufacturers, Inc. (AIAM), and the American Automobile Manufacturers Association (AAMA). Without the insight provided by those in industry with actual experience in fulfilling the reporting requirements of EPCRA Section 313 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 Mr. David Darling, Assistant Director, Environmental Affairs, NPCA; Ms. Amy Lilly, Director, Manufacturing Operations, and Ms. Tara Vizzi, Regulatory Environmental Engineer, Manufacturing Operations, AIAM; and Mr. Dave Felinski, Manager of Occupational and Environmental Programs, AAMA for their hard work.

## OVERVIEW

This document supersedes the booklets entitled *Title III Section 313 Release Reporting Guidance, Estimating Chemical Releases from Electrodeposition of Organic Coatings* and *Title III Section 313 Release Reporting Guidance, Estimating Chemical Releases from Spray Application of Organic Coatings*, both dated January 1988. It is intended to assist establishments and facilities performing electrodeposition and spray application of organic coatings in complying with the Emergency Planning and Community Right-To-Know Act (EPCRA) Section 313 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 the new document include:

- More detailed examples;
- New EPCRA Section 313 regulations and guidance developed since 1988;
- U.S. Environmental Protection Agency's (U.S. EPA's) interpretive guidance on various issues specific to organic coating operations; and
- EPCRA Section 313 issues regarding processes not discussed in the earlier documents.

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 activity quantities.

The primary purposes for the application of organic coatings are protection and decoration. The most widely used methods of organic coating application in the Standard Industry Classification (SIC) Codes covered by EPCRA Section 313 are electrodeposition and spray application. They are also the coating technologies with the potential for the largest release and other waste management activity quantities. The application of an organic coating by either method is essentially a three-step process:

1. Surface preparation - cleaning and pre-treatment.
2. Application of the organic coating.
3. Flash-off and curing.

Steps 1 and 3 are similar, even identical, for both the application processes discussed in this document. Likewise, many of the EPCRA Section 313 chemicals and chemical categories in the application operations are similar, even identical. For these reasons, guidance for both coating technologies has been combined in this document.

It is recognized that not all organic coating establishments will have all unit operations described in this document. For example, original equipment manufacturers may not have an abrasive cleaning step to remove old coatings. However, each of the unit operations discussed are common operations found in organic coating establishments covered by EPCRA Section 313 reporting requirements. You should select the operation, or combination of operations, that most closely fits the activities at your establishment.

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

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

- Is your facility's primary 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. 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 should be kept to support your reporting.

Chapter 3 discusses how to calculate the activity thresholds (manufacture, process, and otherwise use) for the EPCRA Section 313 chemicals or chemical categories. Information is provided on how to determine which EPCRA Section 313 chemicals or chemical categories 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 or chemical categories exceed a reporting threshold.

Chapter 4 discusses how to estimate the release and other waste management activity 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 by the three typical activities in organic coating operations where EPCRA Section 313 chemicals and chemical categories are used:

surface preparation, coating application (spray application or electrodeposition), and curing. The commonly used EPCRA Section 313 chemicals and chemical categories, process descriptions, release and other waste management activity estimates, example calculations, and common problems are presented.

This document includes examples and common errors applicable to organic coating operations. These examples are based on information identified during voluntary site surveys of facilities that have filed EPCRA Section 313 reports in the past, discussion with representatives of the National Paint and Coatings Association, the Association of International Automobile Manufacturers, and the American Automobile Manufacturers Association, and on questions received by the EPCRA Hotline.

# CHAPTER 1 - INTRODUCTION

## 1.0 PURPOSE

The purpose of this guidance manual is to assist facilities performing electrodeposition or spray application of organic coatings 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 facilities that conduct these organic coating operations. Spray application and electrodeposition are the most widely used and prevalent coating techniques in the Standard Industry Classification (SIC) Codes covered by EPCRA Section 313. They are also the coating technologies with the potential for the largest release and other waste management activity quantities. Since each plant is unique, the recommendations presented may have to be modified for your particular facility.

This manual is intended solely for guidance and does not alter any statutory or regulatory requirements. The document should be used in conjunction with 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 documents entitled *Title III Section 313 Release Reporting Guidance, Estimating Chemical Releases from Electrodeposition of Organic Coatings* and *Title III Section 313 Release Reporting Guidance, Estimating Chemical Releases from Spray Application of Organic Coatings.* This new document includes:

- More detailed examples;
- New EPCRA Section 313 regulations and guidance developed since 1988;

- U.S. Environmental Protection Agency's (U.S. EPA's) interpretive guidance on various issues specific to organic coating operations; 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 organic coating operations. Used in conjunction with the most current *TRI Forms and Instructions* and *Estimating Releases 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/opptintr/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

The following overview of EPCRA, specifically 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 the amounts of over 600 EPCRA Section 313 chemicals and chemical categories released and otherwise managed as waste. 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 in use 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 releases 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 are 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 (for example, owners of an industrial park) 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:

- National Library of Medicine (NLM) TOXNET on-line system;
- U.S. EPA Internet site, http://www.epa.gov/opptintr/tri;

- Envirofacts Warehouse Internet site, http://www.epa.gov/enviro/html/tris;
- CD-ROM from the Government Printing Office;
- Microfiche in public libraries; and
- Magnetic tape and diskettes from the National Technical Information Service.

Information identified by the submitter as 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 of the 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 file 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.

Note that the annual reportable amount includes the quantity of the 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 activity 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 National Paint and Coatings Association, the Association of International Automobile Manufacturers, and the American Automobile Manufacturers

Association provided input on common problems, specific to organic coating operations, 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* also contains a discussion of common problems in completing the EPCRA Section 313 reports. You are encouraged to read this discussion 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. 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 a 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 which controls, is controlled by, or 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 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 multiple 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 in that facility must be considered for threshold determinations. Also, the combined release and other waste management activity quantities reported singly for each establishment must equal 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 SIC Code and employee criteria, release and other waste management activities from all establishments at the facility must be reported. The preceding discussion is particularly applicable to organic coating operations since they may be one of several industrial establishments using EPCRA Section 313 chemicals and chemical categories at a large manufacturing facility.

**Example - Multiple Establishments**

Your facility has several different establishments, all with SIC Codes covered under 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 the 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 (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)?

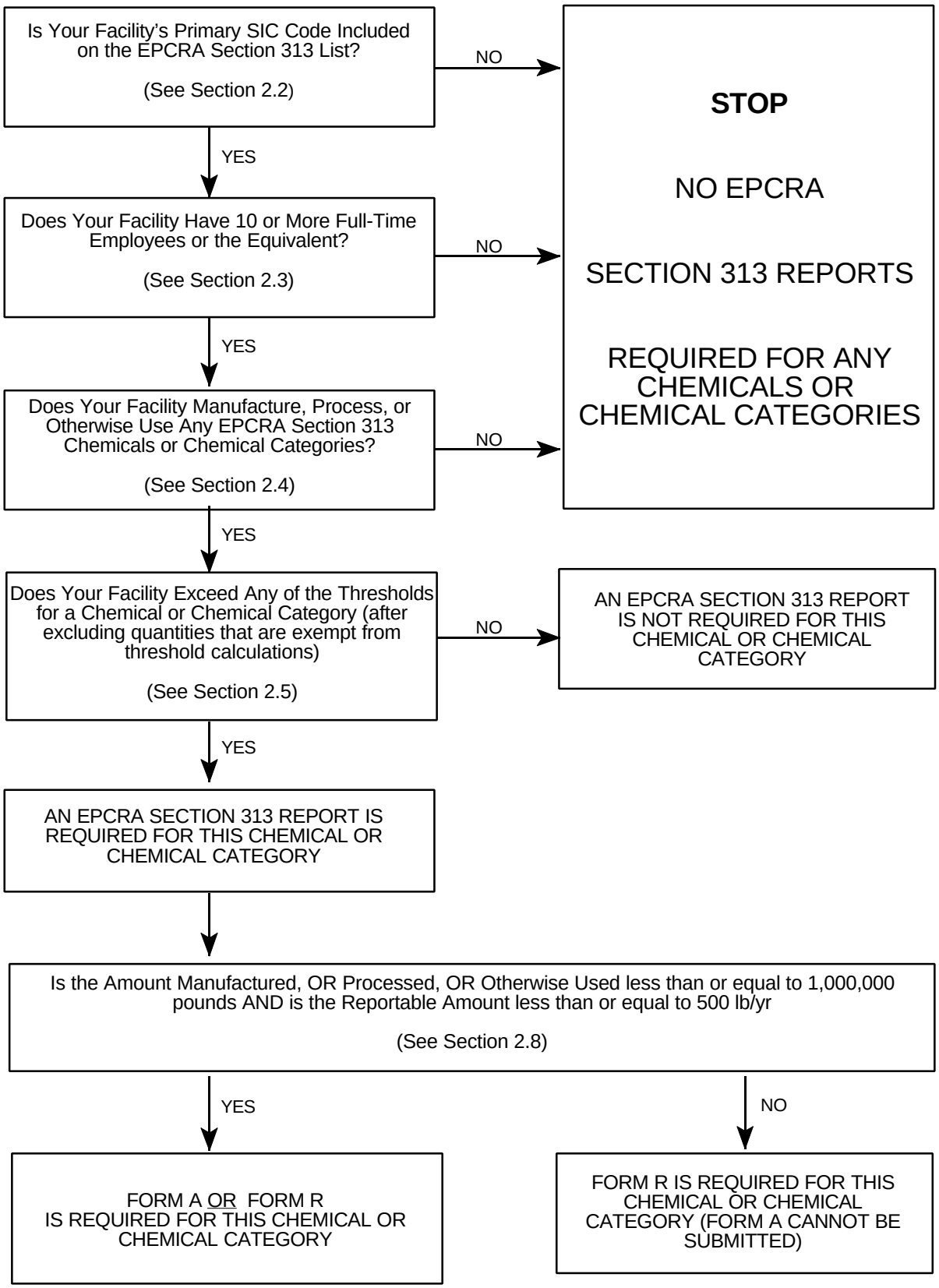


**Figure 2-1. EPCRA Section 313 Reporting Decision Diagram**

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 at the facility, and submit an EPCRA Section 313 report for each chemical and chemical category exceeding a 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 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 SIC Code for facilities typically engaged in the application of organic coatings, with brief descriptions. The application of organic coatings by electrodeposition or spray operations is commonly one of several unit operations conducted at a facility as part of larger manufacturing operations. 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.

As an independent activity, the application of organic coatings would most likely be included under SIC Code 347 - Coating, Engraving, and Allied Services (includes coloring and finishing of metal and formed products, coating of metals with plastics and resins, and rust preventive coatings). As an establishment at a manufacturing facility, organic coating applications could be included in one of several SIC Codes.

## Table 2-2

## SIC Codes for Facilities That May Include Organic Coating Operations

| SIC Code | SIC Description |
|---|---|
| 347 | Coating, Engraving, and Allied Services |
| 351 | Engines and Turbines |
| 352 | Farm and Garden Machinery and Equipment |
| 353 | Construction, Mining, and Materials Handling Machinery and Equipment |
| 354 | Metalworking Machinery and Equipment |
| 355 | Special Industry Machinery, except Metalworking Machinery |
| 356 | General Industrial Machinery and Equipment |
| 357 | Computer and Office Equipment |
| 358 | Refrigeration and Service Industry Machinery |
| 359 | Miscellaneous Industrial and Commercial Machinery and Equipment |
| 361 | Electric Transmission and Distribution Equipment |
| 362 | Electrical Industrial Apparatus |
| 363 | Household Appliances |
| 364 | Electric Lighting and Wiring Equipment |
| 365 | Household Audio and Video Equipment, and Audio Recordings |
| 366 | Communications Equipment |
| 367 | Electronic Components and Accessories |
| 369 | Miscellaneous Electrical Machinery, Equipment, and Supplies |
| 371 | Motor Vehicles and Motor Vehicle Equipment |
| 372 | Aircraft and Parts |

## Table 2-2 (Continued)

| SIC Code | SIC Description |
|---|---|
| 373 | Ship and Boat Building and Repair |
| 374 | Railroad Equipment |
| 375 | Motorcycles, Bicycles, and Parts |
| 376 | Guided Missiles and Space Vehicles and Parts |
| 379 | Miscellaneous Transportation Equipment |

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. Therefore, if an auxiliary facility's primary function is to support/service a facility with a covered SIC Code, the auxiliary facility is also covered by 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 any other establishment within the facility.

**Example - Primary SIC Code**

A facility has two establishments. The first, a general automotive repair service, is in SIC Code 7537. SIC Code 7537 is not a listed SIC Code. However, the second establishment, a metal products paint shop, is in SIC Code 3479, which is a listed SIC Code. The facility also determines the product is worth $500/unit as received from the establishment in the non-listed SIC Code and the value of the product is $1,500/unit after processing by the establishment in the listed SIC Code. The value added by the establishment in the listed SIC Code is more than 50% of the product value; therefore, the primary SIC Code is 3479, a listed 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 are also subject to reporting, but stand-alone warehouses that are auxiliary facilities and that do not assume a covered SIC Code as their primary SIC Code are not subject to reporting.

## 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 aggregate 20,000 or more hours in a calendar year, you meet the 10 or more employee criterion.

The following examples 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).

In general, if an individual is employed or hired to work at the facility, all the hours worked by that individual must 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 plant (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 plant 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 of all chemicals and chemical categories used by all establishments at the facility, including the chemicals and chemical categories found in mixtures and trade name products. 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 are met.

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. 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 organic coating operations. Some of the chemicals, e.g., xylene, toluene, methyl isobutyl ketone, etc., are used in both surface preparation and coating operations. 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 Organic Coatings Operations

| Process* | Chemicals |
|---|---|
| SP | Aluminum (fume or dust) |
| WWT | Ammonia (anhydrous and 10% of aqueous) |
| SP | n-Butyl alcohol |
| SP | Cadmium compounds |
| SP | Certain glycol ethers |
| WWT | Chlorine |
| SP | Chromium |
| SP & CA | Chromium compounds |
| SP | Cobalt |
| SP | Copper |
| SP | Copper compounds |
| SP | Cyanide compounds |
| SP | Dichloromethane |
| SP | Diisocyanates |

## Table 2-3 (Continued)

| Process* | Chemicals |
|---|---|
| SP | Dimethyl phthalate |
| SP | Ethylbenzene |
| SP | Ethylene glycol |
| SP | Hydrochloric acid (acid aerosols) |
| SP | Hydrogen fluoride |
| SP | Lead |
| SP & CA | Lead compounds |
| SP | Manganese |
| SP | Manganese compounds |
| SP | Methanol |
| SP | Methyl ethyl ketone |
| SP & CA | Methyl isobutyl ketone |
| SP | Naphthalene |
| SP | Nickel |
| SP | Nickel compounds |
| WWT | Nitrate compounds (only in water and water dissociable) |
| SP | Nitric acid |
| SP | Phosphoric acid |
| SP | Propylene |
| SP | Sulfuric acid (acid aerosols) |
| SP | Tetrachloroethylene |
| SP & CA | Toluene |
| SP | 1,1,1-Trichloroethane |
| SP | Trichloroethylene |
| SP | 1,2,4-Trimethylbenzene |
| SP & CA | m-Xylene |
| SP & CA | Xylene (mixed isomers) |
| SP | Zinc (fume or dust) |
| SP | Zinc compounds |

* SP = Surface Preparation
CA = Coating Application
WWT = Wastewater Treatment

## 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 that have been in effect since reporting year 1989 are 25,000 pounds per year for manufacturing, 25,000 pounds per year for processing, and 10,000 pounds per year for otherwise use. 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 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 incorporated into a product for distribution or not otherwise used on site during the reporting year, are not considered towards any activity thresholds.

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 (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. An example would be the production of ammonia or nitrate compounds in a wastewater treatment system. | 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 (usually the intentional incorporation of an EPCRA Section 313 chemical or chemical category into a product). For example, the addition of EPCRA Section 313 listed pigments to paint 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 |
| 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 is not intentionally 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). For example, toluene used as a carrier solvent for paint is classified as otherwise used.<br><br>On May 1, 1997 U.S. EPA revised the interpretation of otherwise use. The following new otherwise use definition becomes effective with the 1998 reporting year (62 FR 23834, May 1, 1997):<br><br>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:<br><br>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<br><br>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 |

## COMMON ERROR - Coincidental Manufacture

The coincidental manufacture of an EPCRA Section 313 chemical or chemical category is frequently overlooked. For example, in the phosphating process, during the coating reaction, crystalline structures of zinc and manganese compounds are formed. The consumption of the free acids raises the pH and the metal (Zn and/or Mn) cations cannot stay in solution. They deposit on the metal surface as crystalline zinc phosphate. The actual crystal structure is a function of the process chemistry. A typical reaction is:

$$3Zn^{+2} + 2H_2PO_4^{-1} + 4H_2O \rightarrow Zn_3(PO_4)_2 \bullet 4H_2O + 4H^{+1}$$

In this example, zinc phosphate has been coincidentally manufactured and the quantity formed should be applied to the manufacturing threshold determination for zinc compounds.
(Ref: Donofrio, J., "Zinc Phosphating"; *Organic Finishing Guidebook and Directory*, May 1996, pages 68-85).

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 calculations.

## Example - Relabeling

You buy a mixture in small containers that contains an EPCRA Section 313 chemical or chemical category. When it arrives you put your own label on each container and put the containers in a larger box with several other items you manufacture, and sell the larger box as a kit. The quantity of the EPCRA Section 313 chemical or chemical category in the small containers should not be counted toward the processing (because you did not repackage the chemical) or otherwise use thresholds, nor should it be counted toward the manufacturing activity threshold unless the small containers were imported. However, you must consider other EPCRA Section 313 chemicals and chemical categories that you manufactured in the kit toward manufacturing and processing threshold determinations.

## Example - Treatment of Wastes from Off Site

A covered facility receives a waste containing 12,000 pounds of Chemical A, an EPCRA Section 313 chemical, from off site. The facility treats the waste, destroying Chemical A and in the treatment process manufactures 10,500 pounds of Chemical B, another EPCRA Section 313 chemical. Chemical B is disposed on site.

Since the waste was received from off site for the purpose of waste management, the amount of Chemical A must be included in the otherwise used threshold determination for Chemical A. The otherwise use threshold is 10,000 pounds and since the amount of Chemical A exceeds this threshold, all releases and other waste management activities for Chemical A must be reported.

Chemical B was manufactured in the treatment of a waste received from off site. However, the facility disposed of Chemical B on site and waste received from off site for treatment for destruction, disposal, or stabilization is considered to be otherwise used and the amount of Chemical B must be considered in the otherwise used threshold determination. Thus, the reporting threshold for Chemical B has also been exceeded and all releases and other waste management activities for Chemical B must be reported.

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 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 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).

## 2.7 Form R

Form R is the more detailed and more common EPCRA Section 313 report. 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/opptintr/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.

## 2.8 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 or chemical categories released and otherwise managed as a waste. (59 FR 61488, November 1994; applicable beginning reporting year 1994 and beyond). A facility must meet the following two criteria to use a Form A:

- First, 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.
- Second, 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, combusted for energy recovery, and recycled, 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 1997 version of the Form R.

**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 or chemical category and processes 150,000 pounds of the same chemical or chemical category is eligible to use the Form A because the facility did not exceed the one million pounds for either activity, even though the total usage exceeds one million pounds.

The Form A Certification Statement must be submitted for each eligible EPCRA Section 313 chemical or 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.

Like the Form R, Form A includes facility identification information. However, no release and other waste management quantity estimations to any media are provided. You must simply certify that the total annual reportable amount did not exceed 500 pounds and that 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 submission of Form A.

## 2.9 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 or chemical category 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*.

## 2.10 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 use 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 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;
- Purchase records from suppliers;
- Inventory data;
- 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 and 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 or chemical category.

***Step 3)*** Calculate the quantity of each EPCRA Section 313 chemical or 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, chemical categories, compounds, 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 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 organic coating operations is toluene. Toluene (Chemical Abstracts Service (CAS) Registry No. 108-88-3) has several synonyms including: methylbenzene; methylbenzol; phenylmethane; and toluol. It must be reported on Form R (or Form A), Item 1.2, by its EPCRA Section 313 chemical name, toluene. 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).

The original list of chemicals and chemical categories subject to EPCRA Section 313 reporting was a combination of 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 an U.S. EPA initiative 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 potential acute and chronic human health effects and 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.

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 organic coating operations. As a guide, the most frequently reported EPCRA Section 313 chemicals and chemical categories for reporting year 1995 by organic coating operations, 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;
- 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 category 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 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 are one of the best sources of 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 customers of any EPCRA Section 313 chemicals and chemical categories present 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.

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. Beginning with the 1998 reporting year, seven additional industries will be covered by most of the EPCRA Section 313 reporting requirements, but will not be required to comply with most of the supplier notification regulations. These requirements can be found in the May 1, 1997 Federal Register (62 FR23834). For more information on supplier notification, see the current edition of *EPCRA Section 313 Question and Answers* (1998 edition is EPA 745-B-98-004; see Appendix A, Directive #9) or *Supplier Notification Requirements* (EPA 560/4-91-006).

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 or 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). In some cases, if the EPCRA Section 313 chemical or chemical category is present below the *de minimis* concentration, it may be exempt.

**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, a common chemical used in organic coating applications is xylene. Xylene is often purchased in large quantities for use as a solvent, among other things. Most facilities correctly report for xylene; however, ethyl benzene is typically present at up to 15% in solutions of xylene commercially available. Many facilities have historically overlooked the ethyl benzene in their bulk xylene purchases.

Several chemicals on the EPCRA Section 313 chemical and chemical category 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.

The qualifiers, associated chemicals and chemical categories, and typical applicability to organic coating operations are presented below. A detailed discussion of the qualifier criteria can be found in the *TRI Forms and Instructions*.

- **Fume or dust** - Three metals (aluminum, vanadium, 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 a paint component 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.

- **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 in coatings does not need to include this quantity in threshold determinations or release and other waste management calculations.

- **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 (see Appendix D).

- **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 determinations. 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 the plants and microorganisms ultimately degrade these chemicals, U.S. EPA considers the wastewater and/or sludge to be managed and 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 (see Appendix C).

- **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.

- **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.

- **Aluminum oxide (fibrous)** - Beginning with reports for calendar year 1989, 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.

- **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 toxic 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.

- **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.

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

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 these 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 |
|---|---|
| Manufacture (including import) | 25,000 pounds per year |
| Process | 25,000 pounds per year |
| Otherwise use | 10,000 pounds per year |

**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 releases 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 used activity.

**Example - Xylene Isomers**

Organic coating operations use the EPCRA Section 313 chemical xylene with the mixed isomers, CAS Registry No. 1330-20-7, being the most frequently reported type. Xylene is listed on the EPCRA Section 313 chemicals and chemical categories list in three isomeric forms and a mixture of these: ortho-, meta-, para-, and mixed. 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. 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 use 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 use 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.

**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 this 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 (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.

Each of the activity categories is divided into subcategories. 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 Organic Coating Operations* |
|---|---|---|
| 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. | Xylene, MEK, zinc compounds, glycol ethers |
| 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. | Zinc compounds, nickel compounds |
| 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 a mixture and is separated from that substance or mixture. EPCRA Section 313 chemicals or chemical categories produced and released as a result of waste treatment or disposal are also considered byproducts. | Metal compounds in phosphating process, xylene, toluene, n-butyl alcohol |
| 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. | Xylene, MEK, zinc compounds, glycol ethers |

* More complete discussions of the industry-specific examples can be found in Chapter 4 of this guidance manual.

## Table 3-3

## Definitions and Examples of Processing Subcategories

| Processing Activity Subcategory | Definition | Examples in Organic Coatings Operations* |
|---|---|---|
| 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. | Isocyanates, ethylene glycol, ethylene oxide, vinyl chloride |
| 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. | Toluene, xylene, butyl alcohol, cyclohexane, cyclohexanol, ethylene glycol, MTBE, N-methyl-2-pyrolidone, benzoyl peroxide, cresol, dibutyl phthalate, diethanol amine, formaldehyde, phenol, 2-mercaptobenzothiozole, thiourea, dioxane, C.I. dyes, tributyltin fluoride, tributyltin methacrylate, pesticides |

## Table 3-3 (Continued)

| Processing Activity Subcategory | Definition | Examples in Organic Coatings Operations* |
|---|---|---|
| Article component | A chemical or chemical category that becomes an integral component of an article distributed for industrial, trade, or consumer use. | Xylene, zinc compounds, glycol ethers, lead, copper, chromium, nickel |
| 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. | Lead, copper |

* More complete discussions of the industry-specific examples can be found in Chapter 4 of this guidance manual.

## Table 3-4

## Definitions and Examples of Otherwise Use Subcategories

| Otherwise Use Activity Subcategory | Definition | Examples in Organic Coatings Operations* |
|---|---|---|
| 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. | Xylene, MEK, zinc compounds, glycol ethers, toluene, nitric acid, n-butyl alcohol, MIBK, ethyl benzene, naphthalene |
| 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. | Xylene, MEK, zinc compounds, glycol ethers, toluene, n-butyl alcohol, ethylbenzene, naphthalene |
| 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. | Trichloroethylene, tetrachloroethylene, diisocyanates, chlorine, methanol |

* More complete discussions of the industry-specific examples can be found in Chapter 4 of this guidance manual.

**Example - Chemical Processing Aid**

A spray painting operation uses toluene as the carrier solvent. Ideally all the solvent would evaporate, however, studies have shown 1% of the applied solvent remains on the workpiece. Since the function of the solvent is to improve the application of the paint and is a non-incorporative activity, the entire amount of toluene is considered otherwise used. If the solvent's function was such that it was intended to remain with the workpiece, it would be considered processed, as is the case for pigments, binders, and other paint components intended to remain with the workpiece.

### 3.2.1 Concentration Ranges for Threshold Determination

You are required to use the best, readily available information 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 this situation 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 mid-point 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 assume the upper bound is 100% and calculate the mid-point as above.

- If only the upper bound concentration is provided you must 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 exempt activities. Exemptions are divided into four classes:

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

**COMMON ERROR - Exempt Activities**

If an EPCRA Section 313 chemical or chemical category is used in exempt activities, the quantity in these activities does not need to be included in your threshold 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). 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.

**Example - *De Minimis***

Your facility processes a mixture containing 1.1% phosphoric acid and 0.6% manganese. The *de minimis* exemption would apply to manganese because the concentration is below 1%; however, it would not apply to phosphoric acid. All of the phosphoric 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 as an impurity in a mixture and 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) × (1.25% - 0.99%) ÷ (1.25% - 0.25%)

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

(1.25% + 1.00%) ÷ (2)

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

$$\left[\frac{(8{,}000{,}000) \times (1.25\% - 0.99\%)}{(1.25\% - 0.25\%)}\right] \times \left[\frac{(1.25\% + 1.00\%)}{(2)}\right] = 23{,}400 \text{ pounds}$$

= 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) × (1.2% - 0.9%) ÷ (1.2% - 0.2%)

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

(1.2% + 1.0%) ÷ (2)

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

$$\left[\frac{(8{,}000{,}000) \times (1.2\% - 0.9\%)}{(1.2\% - 0.2\%)}\right] \times \left[\frac{(1.2\% + 1.0\%)}{(2)}\right] = 26{,}400 \text{ pounds}$$

= 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, many facilities treat waste solvents by incinerating them. If coal is used as the primary fuel source to incinerate these waste

solvents, combustion can result in the coincidental manufacture of sulfuric and hydrochloric acid aerosols and metal compounds. Since the *de minimis* exemption does not apply to the coincidental manufacture of EPCRA Section 313 chemicals or chemical categories as a byproduct or in a waste treatment process, the formation of these compounds must be considered for threshold determinations, and release and other waste management calculations.

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.

#### 3.2.2.2 Article 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 and process or otherwise use it without changing the shape or design, and your processing or otherwise use does not result in the release of more than 0.5 pound of the EPCRA Section 313 chemical or chemical category in a reporting year from 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 reporting.

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.

Any processing or otherwise use of an article that results in a release above 0.5 pound per year for each EPCRA Section 313 chemical or chemical category for all like articles 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 exemption as an article if the total 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 the release and other waste management quantity of the EPCRA Section 313 chemical or chemical category does not exceed 0.5 pound, then the article's exemption status is maintained. Also, if the processing or otherwise use of similar manufactured items results in a total release and other waste management quantity 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 to maintain their article exemption. The 0.5-pound limit does not apply to each individual article, but applies to the sum of all release and other waste management activity quantities 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 answers/discussions pertaining to the article exemption.

**Example - Article Exemption**

If an article, as part of a coating pre-treatment operation, is subjected to an etching process that removes a portion of an EPCRA Section 313 metal from the surface that is not recycled or reused, this process would constitute a release and negate the article exemption. For example, a copper plate is cleansed by dipping in a sulfuric acid solution. Some of the copper reacts with the acid to form copper sulfate and the used cleaning solution is discharged to a POTW. This process is considered a release of the copper and, if the release is greater than 0.5 pound per year, the plate has lost its article exemption.

### 3.2.2.3 Facility-Related Exemption

EPCRA Section 313 chemicals and chemical categories that are manufactured, processed, or otherwise used in laboratories are exempt from the threshold determination (and subsequent release and other waste management calculations). This exemption includes EPCRA Section 313 chemicals and chemical categories used in a laboratory under supervision of a technically qualified individual. This exemption may be applicable in such 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 Exemption**

A paint manufacturer at a separate research laboratory facility applies various formulations of organic coatings containing EPCRA Section 313 chemicals and chemical categories to two cars per day for testing for an automobile manufacturer. The testing is under the supervision of a "technically qualified individual" in the laboratory. The EPCRA Section 313 chemicals and chemical categories used in this activity would be exempt from EPCRA Section 313 reporting and should not be included in any threshold determination or release and other waste management calculations.

### 3.2.2.4 Activity-Related Exemptions

Some exemptions apply to the otherwise use of an EPCRA Section 313 chemical and chemical category. The specific quantities of EPCRA Section 313 chemicals and chemical categories used in these activities do not need to be included in a facility's threshold determination (nor the associated release and other waste management calculations). The following 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 found in 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 the facility such as in a facility operated cafeteria, store, or infirmary. Office supplies such as correction fluid are also exempt.

**Example - Personal Use Exemption**

Ammonia used to clean a cafeteria grill is exempt from threshold determinations and release and other waste management calculations.

- **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 cars, trucks, forklifts, locomotives, and aircraft. Note that this exemption applies to the OTHERWISE USE of the EPCRA Section 313 chemical and chemical category. The coincidental manufacture of EPCRA Section 313 chemicals and chemical categories resulting from combustion of gasoline is not exempt and should be considered as part of 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. The amount used for the latter purpose would be subtracted from the facility total **BEFORE** the facility total is compared to the activity threshold. Even if the facility still exceeds the otherwise use threshold, the amount in the anti-freeze is exempt from release and other waste management reporting.

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 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 chemicals and chemical categories in the lubricant should be applied to the otherwise use threshold.

- **EPCRA Section 313 chemicals and chemical categories in air or water drawn from the environment or municipal sources**. Included are 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 reporting.

### 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 or 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.

#### 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 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. 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 activity quantities of that chemical or chemical category must be reported, including release and other waste management activity quantities resulting from remediation.

Excavation of material already landfilled does not constitute a release or other waste management activity for EPCRA Section 313 reporting purposes. 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 recycled quantity should be counted only once for threshold calculations. (Please note that for reporting on-site waste management activities [Section 8 of Form R] the quantity of the EPCRA Section 313 chemical or chemical category should be counted every time it exits the recycling unit.) EPCRA Section 313 chemicals and chemical categories recycled off site and returned to the facility should be treated as newly purchased materials for EPCRA Section 313 threshold determination.

## 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 usage 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 results of over 100 site surveys 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 threshold for an EPCRA Section 313 chemical or chemical category, you must file an EPCRA Section 313 report for that chemical or chemical category, even if you have zero release and other waste management activity quantities. Exceeding the chemical activity threshold, not the quantity released or otherwise managed as waste determines whether you must report. Note that if the release and other waste management activity 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 2-8).

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 or chemical category at the facility as of January 1, add any amounts 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 how the work sheet can be used for the following example:

## Example - Threshold Worksheet

Assume your facility purchases two mixtures that contain xylene in the applicable reporting year. You purchased 25,000 pounds of Mixture A (which is 50% xylene according to the MSDS) and 110,000 pounds of Mixture B (which contains 20% xylene). 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 xylene (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 waste managed 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 chemical or chemical category manufactured, processed, or otherwise used.**

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

**Exempt quantity of chemical or chemical category 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 or Chemical Category 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: | 25,000 lb. | 25,000 lb. | 10,000 lb. |

**If any one of the thresholds is exceeded, reporting is required for all activities. [Do not submit this worksheet with Form R, retain it for your records.]**

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

**Facility Name:** Coatings 'R Us, Inc.
**EPCRA Section 313 Chemical or Chemical Category:** Xylene (mixed isomers)
**CAS Registry Number:** 1330-20-7
**Reporting Year:** 1997

**Date Worksheet Prepared:** May 1, 1998
**Prepared By:** A.B. Calloway

**Amounts of chemical or chemical category manufactured, processed, or otherwise used.**

| Mixture Name or Other Identifier | Information Source | Total Weight (lb) | Percent EPCRA Section 313 Chemical or Chemical Category by Weight | EPCRA Section 313 Chemical or Chemical Category Weight (lb) | Amount of the EPCRA Section 313 Chemical or Chemical Category by Activity (lb): | | |
|---|---|---|---|---|---|---|---|
| | | | | | Manufactured | Processed | Otherwise Used |
| 1. Mixture A | MSDS | 25,000 | 50% | 12,500 | --- | 12,500 | --- |
| 2. Mixture B | 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 chemical or chemical category 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 or Chemical Category Exempt from Above (lb): | | |
|---|---|---|---|---|---|
| | | | Manufactured | Processed | Otherwise Used |
| 1. Mixture A | none | | | | |
| 2. Mixture B | none | | | | |
| 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: | 25,000 lb. | 25,000 lb. | 10,000 lb. |

**If any one of three thresholds is exceeded, reporting is required for all activities. [Do not submit this worksheet with Form R, retain it for your records.]**

# CHAPTER 4 - ESTIMATING RELEASES AND OTHER WASTE MANAGEMENT QUANTITIES

## 4.0 PURPOSE

This chapter is intended to guide the user in developing a systematic approach for estimating quantities of EPCRA Section 313 chemicals and chemical categories released and otherwise managed as waste from electrodeposition and spray application of organic coating operations. 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 the electrodeposition and spray application of organic coatings. The general discussion (Section 4.1) is followed by a presentation of specific examples and issues (Section 4.2).

## 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.

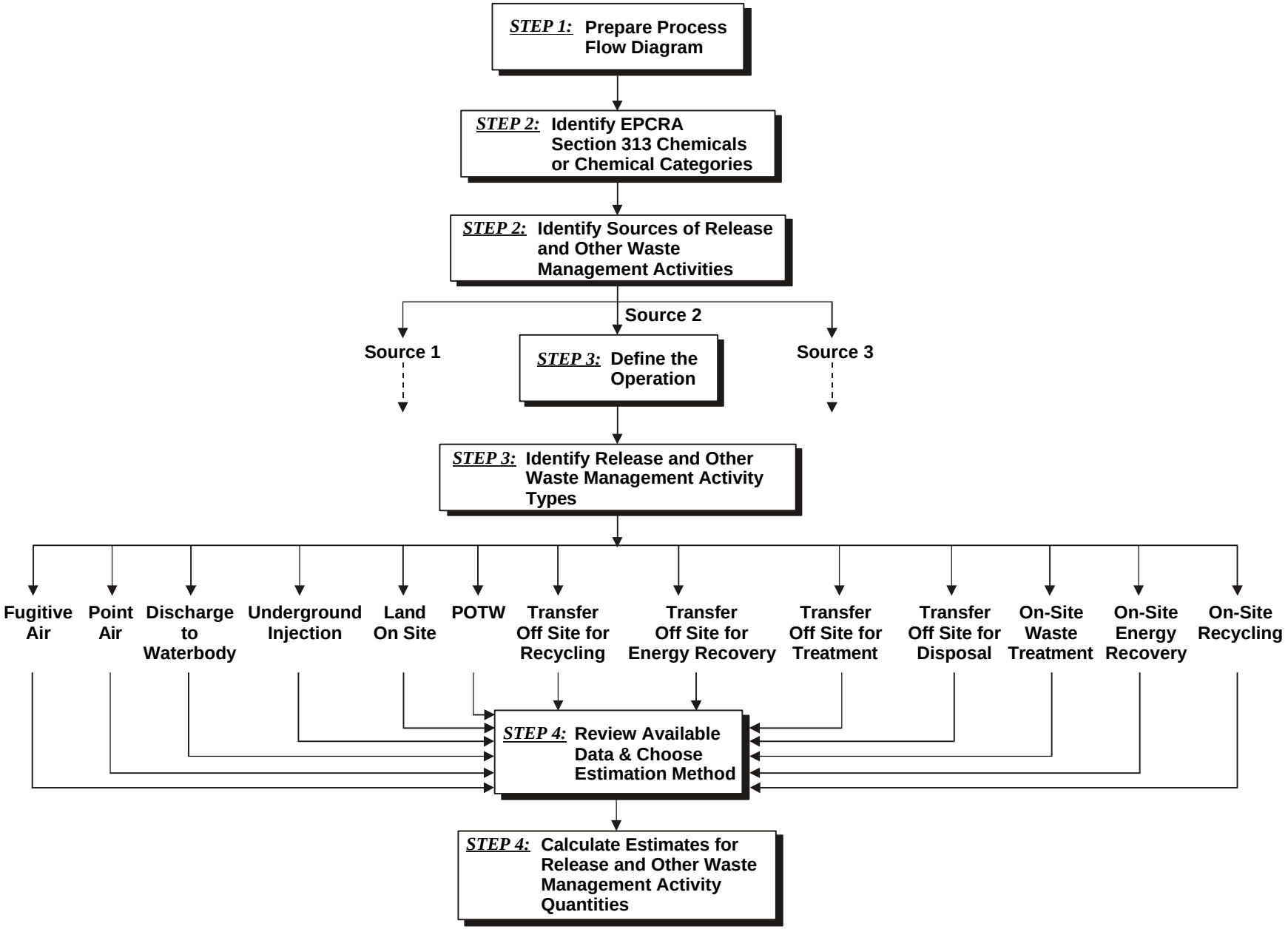


**Figure 4-1. Release and Other Waste Management Activity Calculation Approach**

For EPCRA Section 313 purposes, "sources" are defined as the streams or units that generate the release and other waste management activity (such as process vents, container residue, or spills) and "types" are defined as the environmental media corresponding to elements in Sections 5 through 8 of the 1997 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;
- Clean up and housekeeping practices;
- Combustion byproducts;
- Container residues;
- Fittings;
- Flanges;
- Process discharge stream;
- 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 the operations common to electrodeposition and spray application of organic coatings. 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 and chemical categories 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:

- 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;

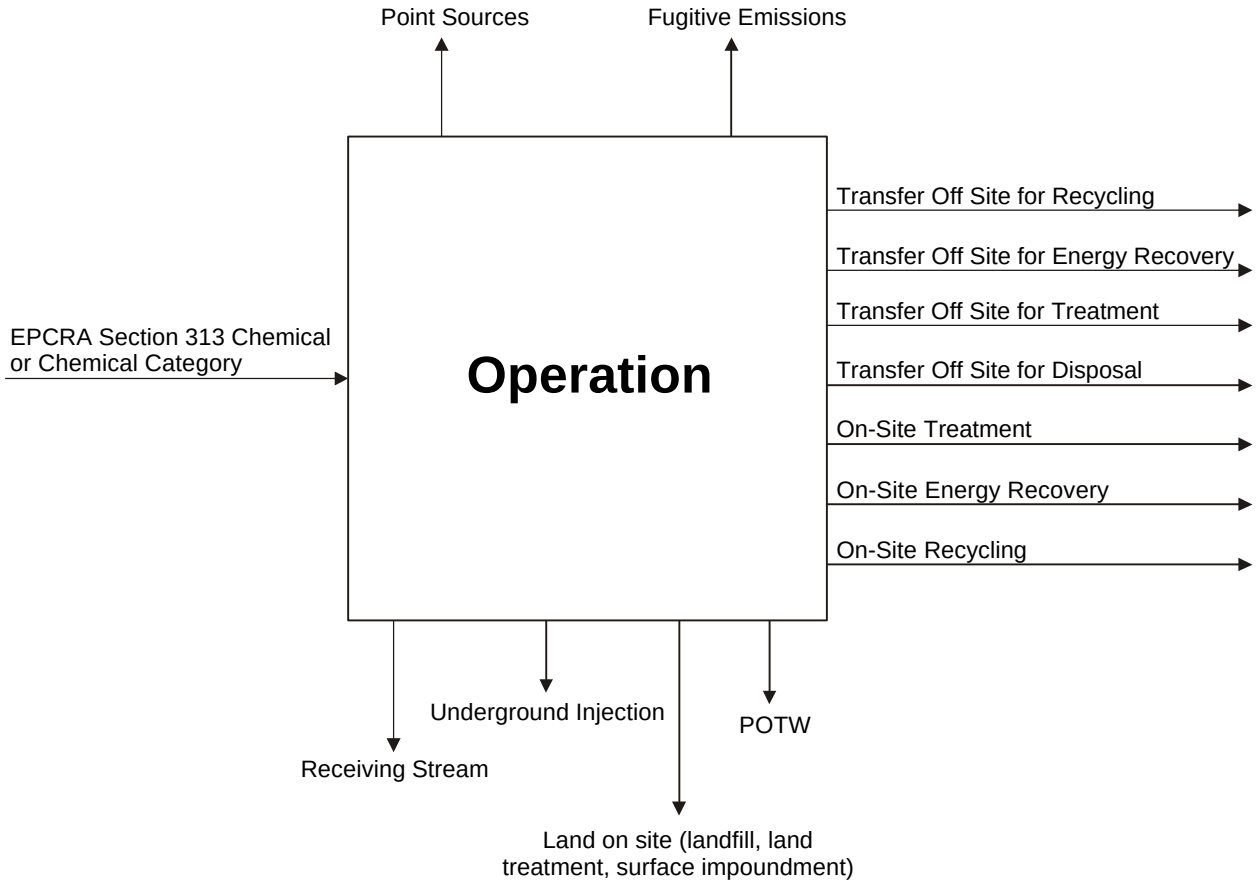


**Figure 4-2. Possible Release and Other Waste Management Activity Types for EPCRA Section 313 Chemicals and Chemical Categories**

- Evaporative losses from solvent cleaning tanks, surface impoundments, and spills; and
- Emissions from any other fugitive or non-point source.

**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. Air emissions from paint booths are often channeled through vapor recovery systems and/or air pollution control devices. These are considered stack emissions. 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 5.5.1A) or a non-hazardous waste landfill (Part II, Section 5.5.1B). 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 due to 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. You do not have to report quantities of an EPCRA Section 313 chemical or chemical category that are released to a surface impoundment as part of a wastewater treatment process 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 subject 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

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 results of over 100 site surveys to evaluate EPCRA Section 313 reporting quality. This survey found the largest source of overlooked releases 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.

Actual data and a knowledge of the unloading methods at your facility can be used to estimate the quantity of residual 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.

# 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<br>Mean | 1.93 - 3.08<br>2.48 | 1.84 - 2.61<br>2.29 | 1.97 - 2.23<br>2.06 | 3.06<br>3.06 |
| Pumping | Plastic drum | Range<br>Mean | 1.69 - 4.08<br>2.61 | 2.54 - 4.67<br>3.28 | 1.70 - 3.48<br>2.30 | Not Available |
| Pouring | Bung-top steel drum | Range<br>Mean | 0.244 - 0.472<br>0.404 | 0.266 - 0.458<br>0.403 | 0.677 - 0.787<br>0.737 | 0.485<br>0.485 |
| Pouring | Open-top steel drum | Range<br>Mean | 0.032 - 0.080<br>0.054 | 0.026 - 0.039<br>0.034 | 0.328 - 0.368<br>0.350 | 0.089<br>0.089 |
| Gravity Drain | Slope-bottom steel tank | Range<br>Mean | 0.020 - 0.039<br>0.033 | 0.016 - 0.024<br>0.019 | 0.100 - 0.121<br>0.111 | 0.048<br>0.048 |
| Gravity Drain | Dish-bottom steel tank | Range<br>Mean | 0.031 - 0.042<br>0.038 | 0.033 - 0.034<br>0.034 | 0.133 - 0.191<br>0.161 | 0.058<br>0.058 |
| Gravity Drain | Dish-bottom glass-lined tank | Range<br>Mean | 0.024 - 0.049<br>0.040 | 0.020 - 0.040<br>0.033 | 0.112 - 0.134<br>0.127 | 0.040<br>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/$cm^2$

The following example describes how the information in the table can be used to estimate the quantity of an EPCRA Section 313 chemical or chemical category in water that was used to clean drums on site.

**Example - Container Residue**

You have determined that a Form R for an EPCRA Section 313 chemical or chemical category 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.

From Table 4-1, the average drum residue quantity for this scenario is 2.29%. 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 of the EPCRA Section 313 chemical or chemical category transferred 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):

(2.29%) × (55 gal/drum) × (1,000 drums) × (8.34 lb/gal) = 10,504 pounds solution.

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

(10,504 lb solution) × (10%) = 1,050 pounds of the EPCRA Section 313 chemical or chemical category.

Therefore, 1,050 pounds of the EPCRA Section 313 chemical or chemical category are transferred to the POTW.

**h. On-Site Waste Treatment (Part II, Section 7A of Form R)** - Includes all on-site waste treatment of EPCRA Section 313 chemicals or 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 (combined removal and destruction) of the entire method or sequence; and whether efficiency data is based on actual operating data. Metals and metal portions of metal compounds treated in 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 or chemical categories.

## 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.

Both 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 or chemical categories. The table accompanying this example shows how Section 7A should be completed for each chemical or chemical category. 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 or chemical category 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 or chemical category 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 or chemical category in the influent to the first step of the process (oil/water separation). For this example, assume chemicals or chemical categories 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 or chemical category 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 or chemical category, as appropriate.

Chemical A

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

Chemical B

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

Chemical C

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

**[continued on next page]**

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 or chemical category 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 Section 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)[1]** - Provide information about source reduction and recycling activities related to the EPCRA Section 313 chemical or chemical category for which releases 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

[1]The Subsection 8.1 through 8.8 designations are for the 1997 Form R. Please refer to the current reporting year *TRI Forms and Instructions* for any changes.

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 only) - §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 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). Metals and metal compounds in a waste that are combusted on site will never be combusted for energy recovery and are considered to be disposed. Note that "NA" should be reported for EPCRA Section 313 chemicals or 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). 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 or 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:

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

(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 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 any associated off-site transfers 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 due to 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 associated with many painting processes.

On-site releases and off-site 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 a transfer to an off-site landfill. Estimates of releases 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) and 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. EPA has identified

four basic methods that may be used to develop estimates (each estimate has been assigned a code that must be identified 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**<br>• Air permits<br>• Continuous emission monitoring<br>• Effluent limitations<br>• Hazardous waste analysis<br>• Industrial hygiene monitoring data<br>• NPDES permits<br>• Outfall monitoring data<br>• pH for acids and bases<br>• POTW pretreatment standards<br>• RCRA permit<br>• Stack monitoring data | **Mass Balance**<br>• Air emissions inventory<br>• Hazardous material inventory<br>• Hazardous waste manifests<br>• MSDSs<br>• Pollution prevention reports<br>• Spill event records<br>• Supply records |
| **Emission Factors**<br>• AP-42 chemical specific emission factors<br>• Facility or trade association derived chemical-specific emission factors | **Engineering Calculations**<br>• Facility non-chemical specific emission factors.<br>• Henry's Law<br>• Raoult's Law<br>• SOCMI* or trade association non-chemical specific emission factors<br>• Solubilities<br>• 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 regulations. 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, 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 that the annual average concentration of copper in the discharge is 2 mg/L. The wastewater treatment facility processed 1.5 million gallons of water in 1997. The treated wastewater is discharged to an off-site POTW. The amount of copper transferred off site to the POTW (for Sections 6.1 and 8.1 of the Form R) is estimated as follows:

Amount of copper transferred

$$= (2\ \text{mg/L}) \times \left(\frac{\text{g}}{1{,}000\ \text{mg}}\right) \times \left(\frac{\text{lb}}{453.59\ \text{g}}\right) \times \left(\frac{\text{L}}{0.2642\ \text{gal}}\right) \times (1{,}500{,}000\ \text{gal/yr})$$

$$= 25\ \text{lb/yr}$$

**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, additional ammonia may be coincidentally manufactured.

- Output means any avenue by which the chemical leaves the operation. Output may include on-site releases 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 coating operation, for example, pigments in the paint may leave the operation as part of the product (the coating), in wastewater collected from overspray, and on paint spray booth filters sent for disposal.

- 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. Another illustration of consumption can be found in the coating reaction of the phosphating process. Here the phosphoric acid is consumed in a reaction with the metal to form the crystalline metal phosphate, in this case the crystalline zinc phosphate:

$$3Zn^{+2} + 2H_2PO_4^{-1} + 4H_2O \rightarrow Zn_3(PO_4)_2 \bullet 4H_2O + 4H^{+1}$$

(Ref: Donofrio, J., "Zinc Phosphating"; *Organic Finishing Guidebook and Directory*, May 1996, pages 68-85)

The mass balance technique may be applied toward manufactured, processed, or otherwise used chemicals and chemical categories. It is typically most useful for otherwise used chemicals or chemical categories 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 refrigerant and adds 20,000 pounds to the refrigeration 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 releases 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

**COMMON ERROR - Mass Balances for Otherwise Used Chemicals**

Facilities often do not account for the entire quantity of EPCRA Section 313 chemicals or chemical categories that are otherwise used. Many EPCRA Section 313 chemicals and chemical categories in electrodeposition and spray application of organic coating operations are classified as otherwise used. Such chemicals and chemical categories rarely leave the facility with the product. In these instances, 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 activities. Thus, the entire throughput is often reportable on Form R as releases 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 releases and other waste management quantities.

#### 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.

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

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 organic coating operations would be Chapter 4: Evaporation Loss Sources, in particular Sections 4.2, Surface Coating; and 4.6, Solvent Degreasing; Chapter 6: Organic Chemical Process Industry, in particular Sections 6.4, Paint and Varnish; and 6.18, Benzene, Toluene, and Xylenes; 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 from paint booths 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 judgement" 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.

A 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

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.

## Examples - Engineering Calculations

Example 1:
Stack monitoring data are available for xylene but you are required to report for toluene. Toluene is used in the same application as xylene at your facility 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 lb 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 125˚C. Based on literature data, the vapor pressures at 125˚C for toluene is 1.44 atmospheres and for xylene is 0.93 atmospheres. Using a ratio of the vapor pressures, the amount of toluene released as air emissions from the stack can be calculated:

$$\frac{\text{X lb/yr toluene}}{\text{200 lb/yr xylene}} = \frac{\text{1.44 atm (vapor pressure of toluene)}}{\text{0.93 atm (vapor pressure of xylene)}}$$

$$\text{X lb/yr toluene} = \frac{\text{(200 lb/yr xylene) (1.44 atm toluene)}}{\text{(0.93 atm xylene)}}$$

Completing the calculation, the facility determines that 310 lbs of toluene were released as stack air emissions during the reporting year.

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% 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 to air (assumed to be the total amount of xylene in paint)

   = (10,000 gal/yr paint) × (3% 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) × (20%)
   = 430 lb/yr

3. The amount of xylene released as stack air emissions

   = (2,152 lb/yr) × (80% capture efficiency) × (100% - 99% incinerated)
   = 17 lb/yr

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

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 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 or chemical category 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* (1997 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* (1997 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* (1997 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* (1997 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 Process Descriptions (Chemical Activities)

The primary purposes of the application of an organic coating to a workpiece are protection and/or decoration. The composition of the coating may be simple (a single chemical); however, it is almost always a complex formulation of a variety of materials, each having a specific function. Organic coating formulations generally have three permanent components, pigment, vehicle or binder, and additives, along with one temporary component, carrier fluid. The carrier fluid evaporates after application to allow the permanent components to become immobilized. EPCRA Section 313 chemicals or chemical categories may be found in any of the components.

Spray application of organic coatings is used extensively in the automotive industry for both original equipment manufacturing and refinishing. It is also widely used in the furniture manufacturing industry, and in other industries requiring application of an organic coating to a workpiece. In the spray application process, the coating material is atomized, and the workpiece to be coated is exposed to the resulting spray.

Electrodeposition of organic coatings, or electrocoating, is used extensively in the automotive industry and in the manufacture of appliances, heat exchangers, decorative items, and heat sensitive components. Electrodeposition is the use of an electric current to apply a coating to a metal part suspended in a dispersion of paint solids in water. The method has extremely high transfer efficiencies, typically in the 95 to 99% range, and results in the application of uniform coatings to even the most complex parts.

The application of organic coatings, by either spray or electrodeposition, is essentially a three-step process (see Figure 4-3); detailed process flow diagrams are presented in the subsequent discussion on each unit operation:

1. Surface preparation - cleaning and pre-treatment.
2. Application of the organic coating.
3. Flash-off and curing.

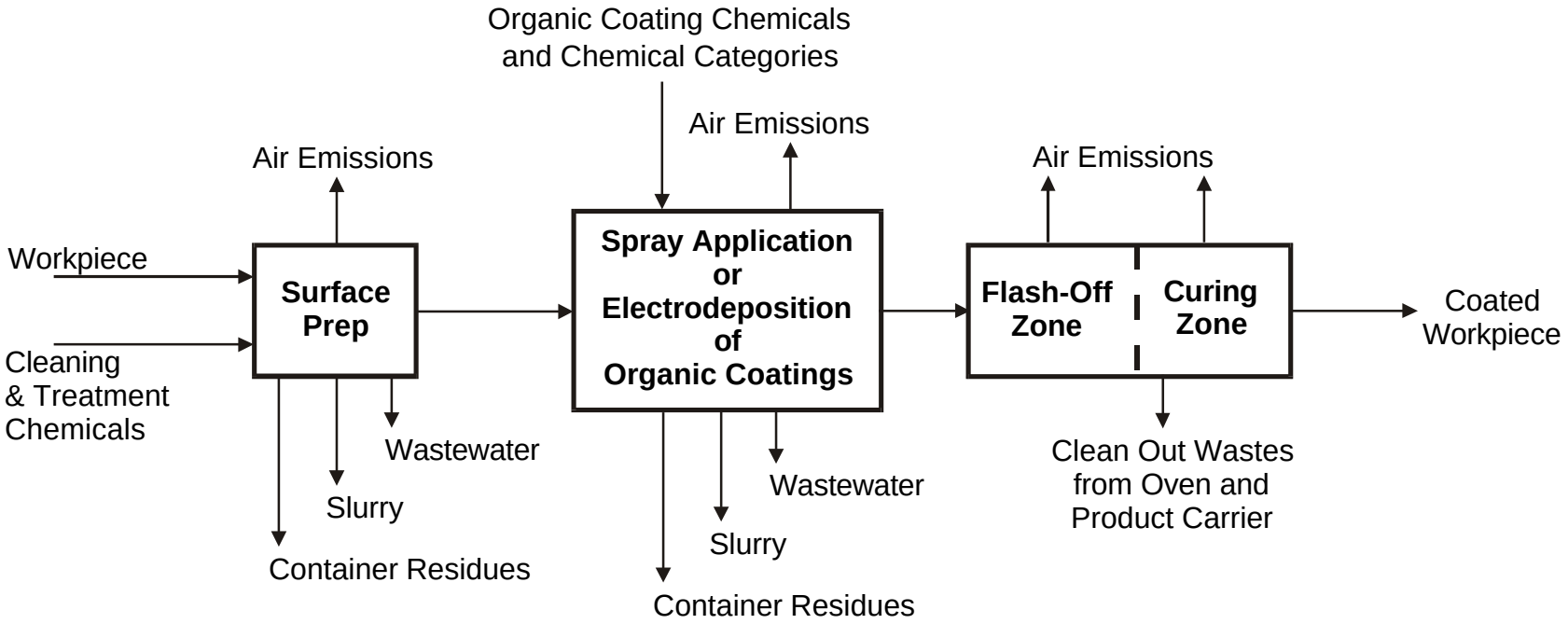


**Figure 4-3. Overall Process Flow Diagram - Application of Organic Coatings**

Steps 1 and 3 for the spray application and electrodeposition of organic coatings processes are similar and even identical in many instances. Both of the processes use many EPCRA Section 313 chemicals and chemical categories. Because of the many similarities, guidance for the two coating technologies is combined in this document.

It is recognized that not all organic coating establishments will have all unit operations described in this document. For example, original equipment manufacturers may not have an abrasive cleaning step to remove old coatings. However, each of the unit operations discussed are common operations found in organic coating establishments covered by EPCRA Section 313 reporting requirements. You should select the operation, or combination of operations, that most closely fits the activities at your establishment.

It is also recognized that flash-off and curing operations are physically separate functions. However, for EPCRA Section 313 reporting purposes they are very similar and have been combined in this document.

The following sections will discuss each of the steps in the application of organic coatings and the estimation of release and other waste management activity quantities.

### 4.2.1 Surface Preparation

The condition of the workpiece and the desired purpose of the coating application determine the type of surface preparation before the organic coating is applied. Surface preparation may include as many as four steps:

1. Mechanical/abrasive cleaning.
2. Cleaning/degreasing.
3. Special treatments.
4. Rinsing (generally following every step).

The following sections discuss the most common operations involved in surface preparation, and how to estimate release and other waste management activity quantities from those operations. Your facility may not perform all of these processes.

#### 4.2.1.1 Abrasive Cleaning

If the workpiece has an existing coating (such as rust, mill scale, or old paint), it usually requires mechanical or abrasive cleaning. In this cleaning process, abrasive particles are projected onto the workpiece using compressed air as the source of power. Silica sand, plastic beads, walnut shells, and metal pellets are typical abrasive materials. Most abrasives do not contain any EPCRA Section 313 chemicals or chemical categories; however, metal pellets, mined materials, and industrial slags are sometimes used as abrasives and may contain EPCRA Section 313 chemicals and chemical categories.

It should be noted that in the case of a coating being removed from a workpiece, such as old paint, the removed coating is not being manufactured, processed, or otherwise used, and any EPCRA Section 313 chemicals and chemical categories in the removed coating should not be included in any activity threshold calculations. However, if an activity threshold for an EPCRA Section 313 chemical or chemical category in the coating being stripped has been exceeded by other activities elsewhere in the facility, any release and other waste management activity amounts for the chemical or chemical category in the removed coating must be included in the reported amount. It should also be noted that if the contaminated abrasive material is sent off site for disposal, the receiving facility (if it meets the SIC Code and number of employees criteria) must consider any EPCRA Section 313 chemicals and chemical categories in the waste in otherwise use threshold determinations.

When evaluating items for the article exemption, the amount of any EPCRA Section 313 chemicals and chemical categories removed from the workpiece itself must be determined (e.g., chromium, manganese, nickel, or zinc (dust) from a steel workpiece). If this results in a release exceeding 0.5 pound/year from all like articles, the article exemption for the workpiece would be lost.

It is also important to note that any EPCRA Section 313 chemical or chemical category in the abrasive material itself must be included in the otherwise use activity threshold. If the activity threshold for such a chemical or chemical category is exceeded, the release and

other waste management amounts from the disposal of the material, such as used shot and of the breakdown dust from the use of the shot, must be reported.

**Step 1: Prepare Process Flow Diagram**

A site-specific process flow diagram should be prepared to help identify all potential sources and types of chemical and chemical category release and other waste management activities. A typical flow diagram is presented in Figure 4-4.

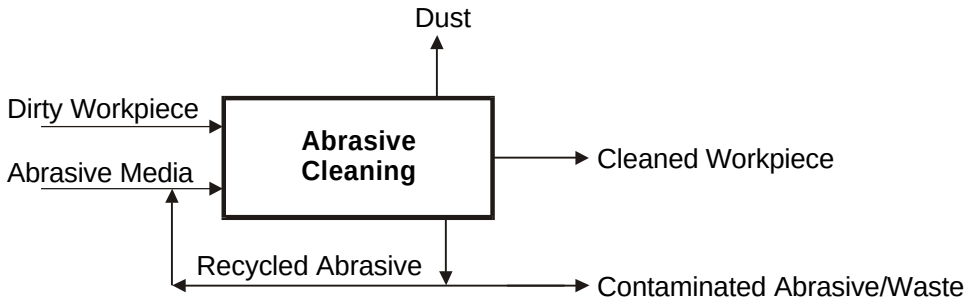


**Figure 4-4. Process Flow Diagram - Abrasive Cleaning**

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

The most common potential source of EPCRA Section 313 chemicals and chemical categories from abrasive cleaning is the dust generated by the abrasive activity. If the purpose of the cleaning process is to remove old paint, this dust may contain lead, chromium, and/or zinc if the original paint was applied prior to 1980. Most, if not all, post-1980 paints do not contain lead or chromium. Marine paints typically contain anti-fouling chemicals such as tributyl tin, copper, and pesticides. If the surface being cleaned is composed of aluminum, vanadium, or zinc, the creation of dust particles of these metals must be considered towards the manufacturing threshold because dust forms of these three metals have been created (manufactured) and they are separately listed as EPCRA Section 313 chemicals (see *Fume and Dust* qualifier discussion in Section 3.1).

EPCRA Section 313 chemicals and chemical categories could be released in the form of fugitive dust from any leaks in the cleaning enclosure or as a stack release from an air pollution control system, if present. Filters for the dust and the waste abrasive material may also contain EPCRA Section 313 chemicals and chemical categories and their disposal should be considered.

**Step 3: Identify Releases and Other Waste Management Activity Types**

The primary source of release is the cleaning unit itself. Release types include fugitive emissions to the air from leaks and fittings in the cleaning enclosure and point source emissions from air pollution control devices. Abrasive cleaning does not generally use volatile chemicals or chemical categories; therefore, the primary air releases are expected to be in the form of dust particulates. This dust may be collected in a baghouse or fabric filters. If so, the disposition of EPCRA Section 313 chemicals and chemical categories in the dust should be considered in your calculations (for example, the dust could be sent to landfills or other off-site waste management activities). The dust may also be recycled. The waste abrasive material from floor sweepings containing the dust can be land filled or otherwise disposed, on or off site. The abrasive material can also be recycled, after removal and disposal of the dust component. Typical release and other waste management activities and typical EPCRA Section 313 chemicals and chemical categories are:

| Typical Type of Release/Waste Management Activity | Typical EPCRA Section 313 Chemicals and Chemical Categories |
|---|---|
| Stack Air | Lead, zinc dust, chromium, and nickel |
| Fugitive Air | Lead, zinc dust, chromium, and nickel |
| Disposal to land or recycling | Lead, zinc dust, chromium, and nickel |

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

If the dust and waste abrasive materials are managed as a hazardous waste, analytical data should be available in hazardous waste manifests for estimating concentrations of EPCRA Section 313 chemicals or chemical categories and the weight of waste disposed. Additionally, efficiencies of treatment systems can be used to estimate stack and fugitive releases.

**Example - Abrasive Surface Preparation**

An earth-moving equipment manufacturer uses air blasting with a steel pellet abrasive to remove rust and old paint from refurbished equipment before it is repainted. The removed material separates by particle size with 10% dropping to the floor to be swept up, and 90% going to the bag filter dust collection system. According to the manufacturer, the bag filters have a 95% capture efficiency. The dust collection bags are replaced when the pressure drop across them reaches a designated amount. They are then removed from service and sent to an off-site landfill. Over a period of time it has been determined the average dust collection bag has a net weight gain of 50 pounds at the time when the pressure drop reaches the replacement level. The facility replaces the bags 25 times per year, with 5 bags replaced each time. Periodic chemical analysis of the captured dust has shown it contains 1.1% chromium.

Example 1: Off-Site Disposal of Collected Dust

Assuming the EPCRA Section 313 reporting threshold for chromium has been reached at the facility, the amount of chromium in the bags as collected dust that is disposed off site can be calculated as follows.

Total weight of collected dust = (25 times/year) × (5 bags) × (50 lb/bag)
= 6,250 lb/year
Chromium content of collected dust = (1.1%) × (6,250) = 69 lb/year.

This amount is only a portion of the chromium dust generated during the abrasive cleaning operation. Similar calculations should be made for the amounts of chromium in the floor sweepings, stack releases, and the fugitive dust releases.

Example 2: Stack Releases

Assuming 95% of the dust sent to the air pollution control device (APCD) is captured in the bag filters, the remaining 5% passes through the bags and is emitted as a stack release. The quantity can be estimated as follows:

| | |
|---|---|
| Total weight of collected dust | = 6,250 lb/year (calculated above) |
| Total quantity of dust into APCD | = (6,250 lb/year) ÷ (95%) |
| | = 6,580 lb/year |
| Dust escaping APCD (stack release) | = (Total into APCD) - (Total Collected) |
| | = 6,580 - 6,250 lb/yr |
| | = 330 lb/yr |
| Chromium escaping as a stack release | = (1.1%) × (330) |
| | = 3.6 lb/yr |

### 4.2.1.2 Cleaning /Degreasing

After abrasive cleaning, many facilities perform a cleaning/degreasing step. Note that some facilities that perform abrasive cleaning often degrease the workpiece first to minimize the contamination of the abrasive media. Cleaners generally fall into three chemical categories, each of which may contain EPCRA Section 313 chemicals or chemical categories: organic solvents, semiaqueous or emulsion cleaners, and aqueous-based products. Aqueous cleaning may involve one or more of the following mechanisms: wetting, emulsification, neutralization, solubilization, displacement, mechanical action, sequestration, and deflocculation.

Most work pieces are cleaned by immersing the object in a tank of degreasing solution or spraying the piece with the degreasing solution. In some instances cleaning may consist of wiping the work piece with a solution soaked rag. EPCRA Section 313 chemicals and chemical categories contained in cleaning solutions should be considered otherwise used, and are subject to the 10,000-pound reporting threshold.

**Step 1: Prepare Process Flow Diagram**

A site-specific process flow diagram should be prepared to help identify all potential sources and types of chemical and chemical category release and other waste management activities. A typical flow diagram is presented in Figure 4-5.

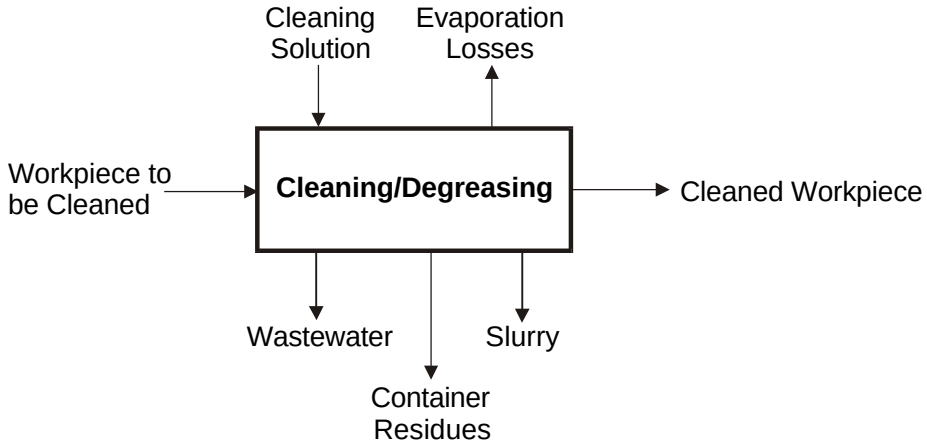


**Figure 4-5. Process Flow Diagram - Cleaning/Degreasing**

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

Typical sources of EPCRA Section 313 chemical and chemical category releases would be cleaning tank slurries, wastewater from spent cleaning solutions, evaporation of volatile cleaning components, and container residues (from "empty" containers of the cleaning solution). Other sources could be accidental spills and periodic dumping of entire tank contents.

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

Release and other waste management activity types from this process include fugitive emissions from evaporation of volatile cleaning compounds; releases to land or off-site transfer of the slurries for disposal; wastewater discharges (either direct or to a POTW); and transfers of "empty" shipping containers to off-site locations. Typical release and other waste management activities and the types of chemicals and chemical categories involved during the cleaning/degreasing process are:

| Typical Type of Release/Waste Management Activity | Typical EPCRA Section 313 Chemicals and Chemical Categories |
|---|---|
| Fugitive Air | Glycol ethers, toluene, xylene, MEK, MIBK |
| Receiving stream or POTW | Manganese, nickel, lead, zinc dust, and chromium |
| Disposal to land or recycling | Manganese, nickel, lead, zinc dust, and chromium |

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

Fugitive emissions from evaporative losses can be estimated using engineering calculations and mass balances based on purchasing records. Slurry disposal can be estimated based on the waste manifests.

Wastewater volumes are normally metered or may be estimated based on make-up quantities required. Wastewater concentrations of EPCRA Section 313 chemicals or chemical categories may already be monitored for compliance with discharge or pretreatment permit requirements. Flow and concentration data can be used to determine the amount of the EPCRA Section 313 chemical or chemical category managed in this fashion (see example (6) "NPDES Data" in Appendix B). Treatment of the wastewater may result in the generation of a sludge. Biodegradation of any organic chemicals in the sludge may occur. If the amount biodegraded is known, it should be estimated and included in Part II, Section 8.6 (On-Site Treatment) of the 1997 Form R. To avoid double counting, it should be subtracted from the total amount sent into the treatment system before the ultimate discharge is reported. The water soluble EPCRA Section 313 chemicals or chemical categories discharged with the slurries can be estimated using the water solubility of the chemical or chemical category and the water content of the slurry.

**Example - Cleaning/Degreasing (Estimating Fugitive Emissions)**

For this cleaning process, assume you are using a 1,200-gallon tank with a surface area of 28 sq ft containing a mixture of not less than 20% MEK, 30 to 40% toluene (by volume), from 5 to 15% proprietary chemicals (identified by the supplier on the MSDS as not EPCRA Section 313 chemicals), and water. The mixture is purchased ready to use in 55-gallon drums. The mixture in the tank is at room temperature (70 F) and is agitated with a sonic device. The tank is equipped with a slot exhaust system as an engineering control to reduce operator exposure to solvent vapors. Industrial hygiene evaluations have shown it to be 50% effective, i.e., it captures 50% of the volatilized vapors. The remaining 50% escapes into the general room air. The captured 50% is routed to an air pollution control device designed to remove 95% of the volatile organic compounds (VOCs) from the air stream.

The part to be cleaned is immersed in the tank for one to two minutes, removed from the liquid and allowed to drip drain below the level of the slot exhaust system for about another minute above the tank. An average of 50 gallons per week of the mixture are added to the tank to replace evaporative losses and drag-out. The slurry which builds up in the tank, has been analyzed and found to contain an average of 2% nickel, 5% chromium, 0.05% lead, 1% zinc, and 5% manganese on dry weight basis. An average of one 55-gallon drum of the slurry is collected and shipped off site to a RCRA landfill every month. The slurry is 50% water and 50% solids.

The amount of toluene released as fugitive emissions from this operation can be estimated as follows:

The relevant data are the amount of toluene lost from the tank and the amount not captured by the industrial hygiene control system. An average of 50 gallons per week of the mixture, containing 30 to 40% toluene by volume, is consumed. Toluene is a very volatile chemical and it is assumed that all losses are in the vapor form.

Amount of toluene evaporated
= (50 gal/week) × (0.35; mid-point of toluene concentration) × (7.28 lb/gal; density of toluene) × (52 weeks/year)
= 6,625 lb/year

Amount of toluene not captured by slot exhaust ventilation and released as fugitive emissions
= (50%; capture efficiency) × (6,625 lb/year)
= 3,313 lb/year

This amount is the fugitive emissions of toluene; you must also determine fugitive emissions of MEK and point source emissions of both toluene and MEK, as well as the amounts of EPCRA Section 313 chemicals and chemical categories in the slurry and any container residues. In every case, you should determine whether the EPCRA Section 313 reporting threshold has been reached for the individual chemical or chemical category before undertaking any release or other waste management quantity estimation calculations.

Quantities of EPCRA Section 313 chemicals or chemical categories in "empty" container residues subject to waste management can be estimated using established residue factors based on the method of cleaning or draining of the container (see Table 4-1 and the corresponding container residue example).

### 4.2.1.3 Rinsing

Normally, a rinse step follows every chemical pretreatment step and the electrodeposition application step to remove any solution that does not adhere to a surface. Rinsing can be performed in a single tank or as a multi-step, counter-current, or co-current flow process. In some multiple tank rinse processes, the first tank contains tap water and subsequent tanks contain deionized water. The spent rinsate may contain EPCRA Section 313 chemicals or chemical categories which should be considered otherwise used and are subject to the 10,000-pound reporting threshold.

**Step 1: Prepare Process Flow Diagram**

A site-specific process flow diagram should be prepared to help identify all potential sources and types of chemical and chemical category release and other waste management activities. A typical flow diagram is presented in Figure 4-6.

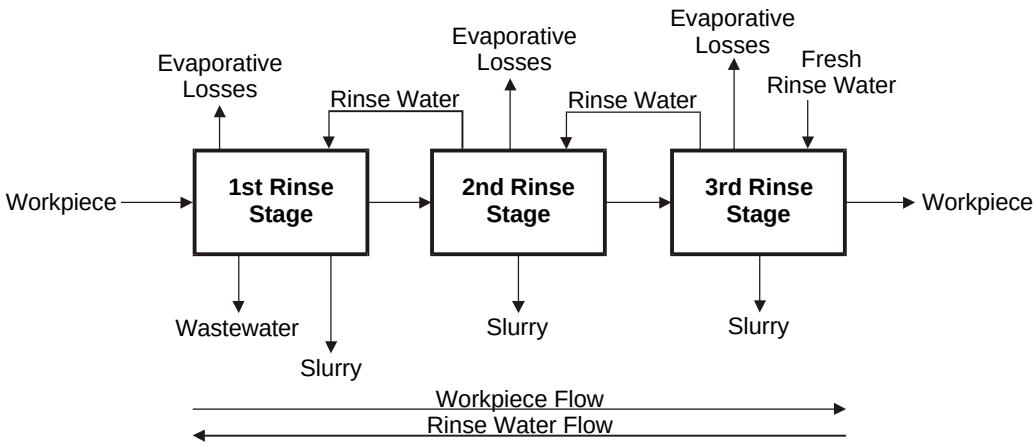


**Figure 4-6. Process Flow Diagram - Rinsing (counter-current)**

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

The rinsing process typically contains the same sources for release and other waste management activities as the cleaning/degreasing operations, except for the container residues. Potential losses are expected to have a much lower concentration of EPCRA Section 313 chemicals or chemical categories since they are diluted by the water in the rinse bath.

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

Release and other waste management activities from this process, of chemicals or chemical categories carried over on the workpiece, include fugitive air from evaporation of volatile cleaning compounds, releases to land or off-site transfer of the slurries, and wastewater discharges (either direct or to a POTW). Typical release and other waste management activities and the types of EPCRA Section 313 chemicals or chemical categories involved during the rinsing process are:

| Typical Type of Release/Waste Management Activity | Typical EPCRA Section 313 Chemicals and Chemical Categories |
|---|---|
| Fugitive Air | Xylene, MEK, MIBK, toluene, glycol ethers |
| Receiving stream or POTW | Lead, manganese, zinc dust, nickel, chromium, and glycol ethers |
| Land or off-site disposal of slurries | Lead, manganese, zinc dust, nickel, chromium, and glycol ethers |

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

Evaporative losses can be estimated using engineering calculations and mass balances based on purchasing records. Slurry disposal can be estimated based on waste manifests.

Wastewater volumes are normally metered or may be estimated based on make-up quantities required. Wastewater concentrations of EPCRA Section 313 chemicals and chemical categories may already be monitored in compliance with discharge or pretreatment permit requirements. Flow and concentration data can be used to determine the amount of the EPCRA Section 313 chemical or chemical category managed in this fashion (see Appendix B). See Step 4 of Cleaning/Degreasing (paragraph 4.2.1.2) for discussion on sludge generation in wastewater treatment.

**Example - Rinsing (Estimating Aqueous Discharges)**

In this example, the annual amount of manganese sent to an on-site wastewater treatment plant from a rinsing operation is estimated.

An automobile manufacturer has a two-step counter-current flow water rinsing operation following the chromate rinse in the phosphating process.

Deionized water flows continuously into the final rinse tank, with the overflow going to the first stage rinse tank. The overflow from this tank is collected and sent to the facility wastewater treatment plant. It is monitored for flow rate, pH, and concentrations of Ni, Cr, Zn, and Mn. Based on a year of monitoring data, the flow rate averages 15,000 gal/day, the pH ranges from 6.5 to 8.5, the Ni concentration averages 50 mg/L, Cr averages 25 mg/L, Zn averages 100 mg/L, and Mn averages 75 mg/L. The facility operates 350 days/year (the entire plant shuts down for two weeks in July).

The amount of Mn sent to the treatment plant =
(15,000 gal/day) × (350 days/year) × (75 mg/L) × (3.78 L/gal) × (2.2 lb/kg) × (10E-6 kg/mg)
= 3,275 lb/year

Similar calculations must also be performed for the other EPCRA Section 313 chemicals and chemical categories that have met a reporting threshold.

### 4.2.1.4 Phosphating

To promote better paint bonding, the cleaned workpiece may require some pretreatment before the coating application. For steel-based work, a phosphate coating may be applied to the workpiece prior to the organic coating to improve corrosion resistance and organic coating adhesion. Phosphate coatings consist of crystalline salts of the metal being treated, e.g., iron, and/or crystalline salts of metals, e.g., manganese or zinc, which have been added to the phosphating solution. When the metal workpiece comes in contact with the phosphating solution, pickling occurs, which results in a reduction of acid concentration at the liquid-metal

interface. At this point, iron is dissolved, hydrogen is evolved, and the phosphate coating is deposited. Should the solution contain additional metals, such as manganese or zinc, phosphate coatings of these ions are also deposited (Ref: Guss, B., "Iron Phosphating"; *Metal Finishing: Organic Finishing Guidebook and Directory Issue*, 1996 Edition, page 63). A final rinse containing chromates, such as a mixture of hexavalent and trivalent chromium, provides the highest level of corrosion resistance (Ref: Gorecki, G., "Function of Final (Seal) Rinses in a Phosphating Operation"; *Metal Finishing: Organic Finishing Guidebook and Directory Issue*, 1996 Edition, page 109).

All phosphate coatings are produced by the same chemical reaction: the acid bath, containing the coating chemicals, reacts with the metal to be coated, and at the interface, a thin film of solution is neutralized because of its attack on the metal. Iron phosphate coatings, the most common in the industry, are usually derived from solutions that contain very little iron. They are produced on ferrous metals through the combined use of acid phosphate salts, free phosphoric acid, and accelerators. Many auto manufacturers use phosphate coatings containing manganese, zinc, and nickel. EPCRA Section 313 chemicals or chemical categories used in phosphate coating operations are considered processed and are therefore subject to the 25,000-pound reporting threshold. Where manganese, nickel, or zinc coatings are applied to the workpiece, the creation of compounds of these metals is considered coincidental manufacturing and is subject to the 25,000-pound reporting threshold.

**Step 1: Prepare Process Flow Diagram**

A site-specific process flow diagram should be prepared to help identify all potential sources and types of chemical and chemical category release and other waste management activities. A typical flow diagram is presented in Figure 4-7.

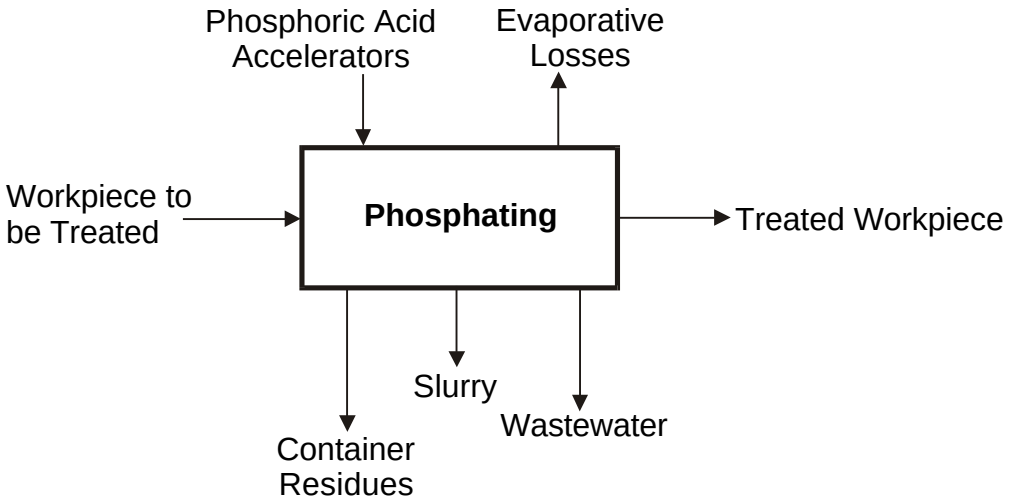


**Figure 4-7. Process Flow Diagram - Phosphating**

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

The phosphate coating process may generate metal compounds in the coatings, phosphating tank slurries, wastewater from used phosphating and chrome rinse solutions. Potential sources of these and other EPCRA Section 313 chemicals and chemical categories are evaporation of volatile components, container residues, and accidental spills and releases.

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

Types of release and other waste management activities may include fugitive air emissions from evaporation of volatile compounds, releases to land from the slurries, wastewater discharges (either direct or to a POTW), and transfers to off-site locations for management of "empty" containers. Typical release and other waste management activities and the types of EPCRA Section 313 chemicals and chemical categories involved during the phosphate coating process are:

| Typical Type of Release/Waste Management Activity | Typical EPCRA Section 313 Chemicals and Chemical Categories |
|---|---|
| Fugitive Air | Potentially could include some metals (Mn, Zn dust, Ni) |
| Receiving stream or POTW | Phosphoric acid, Cr, Mn, Ni, and metal compounds |
| Land or off-site disposal of slurries | Phosphoric acid, Cr, Mn, Ni, and metal compounds |
| Off-site management of container residue (energy recovery, recycle, treatment, or disposal as appropriate) | Applicable chemicals purchased in containers |

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

The quantity of manganese, nickel, and/or zinc compounds manufactured in the phosphating operation can be estimated based on the surface area being treated and the design phosphate coating thickness. Keep in mind that it is the weight of the metal compound that must be used to determine the activity threshold quantity, while it is only the weight of the parent metal that is used in calculating release and other waste management activity amounts.

Due to similarities in this tank based operation to those of the rinsing step, release and other waste management activity quantities related to evaporative losses and slurry and wastewater generation can be evaluated as described in Step 4 of the Rinsing Operation discussion, paragraph 4.2.1.3.

Quantities of EPCRA Section 313 chemicals or chemical categories in “empty” container residues subject to waste management can be estimated using established residue factors based on the method of cleaning or draining of the container (see Table 4-1 and the corresponding container residue example).

**Example - Phosphating (Wastewater Discharges)**

In this example, the amount of nickel discharged to a POTW is estimated.

An automobile manufacturer applies a phosphate coating by immersing the part in a solution containing nickel phosphate.

The phosphate solution is continuously replenished through a pipe and spent solution is removed from an overflow weir. The spent solution is neutralized to a pH between 6 and 9 and the Ni concentration is monitored (to comply with a POTW pre-treatment permit) and known to average 500 mg/L. The wastewater volume averages 10,000 gallons per month. The amount of Ni to be reported as otherwise waste managed and discharged to the POTW from this operation is:

(10,000 gal/month) × (12 months/year) × (3.78 L/gal) × (500 mg/L) ×
(2.2 lb/kg) × (10E-6 kg/mg)
= 500 lb Ni

This quantity should be reported in Sections 6.1 and 8.1 of the Form R. Since the mineral acid is treated to a pH between 6 and 9, the amount of phosphoric acid reported as discharged to a POTW (Section 6.1) should be zero.

A similar concentration and volume calculation can be performed for any discharges from the chromate final rinse, if applicable.

### 4.2.2 Spray Application

Spray application of organic coatings is usually conducted in a mechanically ventilated enclosure known as a spray booth. The primary purposes of the ventilation are the protection of the worker from exposure to the chemicals in the paint and minimization of the air emissions from the operation. The air movement also serves to speed the drying of the paint through removal of the volatilized components. The two major types of spray booths are cross draft and down draft. In the cross draft booth the air moves from behind the operator toward the filter (dry or water curtain), parallel to the floor. In the down draft booth, the air moves from the ceiling vertically downward toward the exhaust plenum in the floor. A combination, called the semi-down draft, moves the air in a diagonal direction. Air movement can be from the ceiling in the front of the booth toward the floor at the back. The air can also come from the center of the ceiling and move toward exhaust plenums along the side walls of the booth. The choice of the type of booth is generally driven by the type of workpieces to be painted.

The air flow is normally directed toward either a water curtain or a dry filter for the removal of overspray paint particles and other particulate contaminants. Overspray is the amount of sprayed paint which does not adhere to the workpiece. It is discussed in more detail in

Step 4 of this section. Volatile chemicals may be released as fugitive emissions into the general workplace or captured and channeled through an air pollution control system as stack emissions. Typically, all of the paint solvent (carrier fluid) in spray painting operations can be considered potential emissions. The percentage of VOC emissions during the application/flash-off step ranges from 70 to 90%, depending on the industry, with the remainder emitted in the curing stage (Ref: Air & Waste Management Association, *Air Pollution Engineering Manual*, (AP-40), 1992, page 365). As discussed earlier, while flash-off and curing are separate processes, they are considered together in Section 4.2.4.

EPCRA Section 313 chemicals and chemical categories may be processed (e.g., paint pigments that remain on the workpiece) or otherwise used (e.g., carrier solvents that evaporate) during spray application. They would therefore be subject to the 25,000-pound processing activity threshold or the 10,000-pound otherwise use activity threshold, respectively.

**Step 1: Prepare Process Flow Diagram**

A site-specific process flow diagram should be prepared to help identify all potential sources and types of chemical and chemical category release and other waste management activities. A typical flow diagram is presented in Figure 4-8.

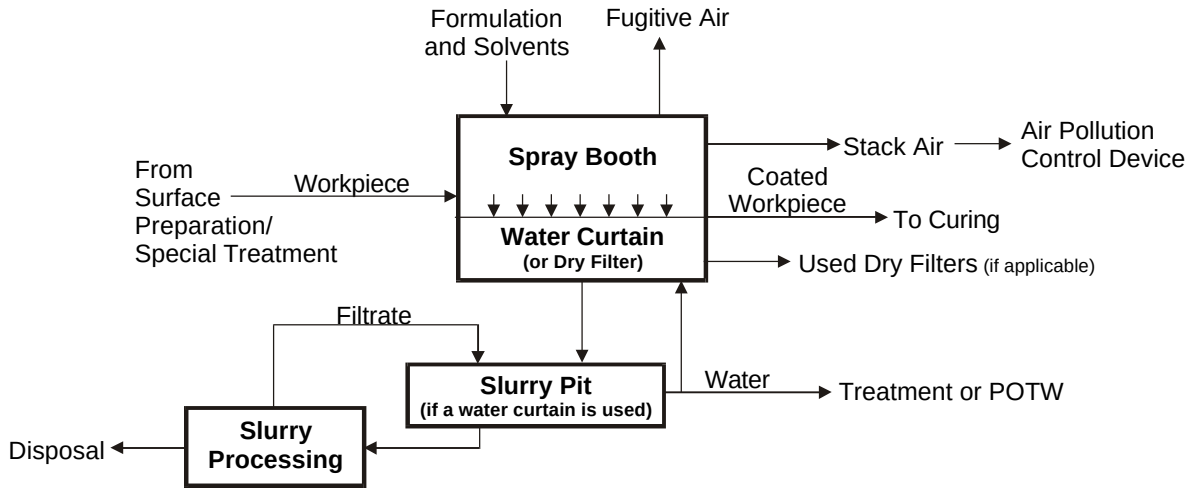


**Figure 4-8. Process Flow Diagram - Spray Application**

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

Typical sources of EPCRA Section 313 chemicals and chemical categories would include evaporation of volatile paint components, slurries and wastewater from water curtain operation, chemicals captured in filters, and container residues. The cleaning of process equipment may also generate waste solutions containing contaminated solvents and paint solids, such as scrapings.

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

Typical types of EPCRA Section 313 chemical and chemical category release and other waste management activities would include fugitive and/or stack air releases from the spray operation. Water curtain wastewater could be treated on site or sent to a POTW. Water curtain slurries, dry filter elements and container residues can be managed on site or sent off site. It should be noted that the chemical systems are different for water-based versus solvent-based points. Typical release and other waste management activities and the EPCRA Section 313 chemicals and chemical categories involved are:

| Typical Type of Release/Waste Management Activity | Typical EPCRA Section 313 Chemicals and Chemical Categories |
|---|---|
| Fugitive Air | Methyl ethyl ketone, xylene, toluene |
| Stack Air | Methyl ethyl ketone, xylene, toluene |
| Receiving stream or POTW | Zinc and chromium compounds |
| Landfill or off-site disposal of slurries and dry filters and solids from process equipment cleaning | Zinc and chromium compounds |
| Off-site management of container residue (energy recovery, recycle, treatment, or disposal as appropriate) | Applicable chemicals purchased in containers |

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

Air releases can be estimated using control technology efficiencies, engineering calculations, and published overspray efficiency values (see Example - Spray Application, page 4-53).

The percent overspray is the ratio of the coating solids not deposited to the coating solids used. It is a function of the spraying method and the shape and complexity of the workpiece surface. Table 4-4 presents typical overspray percentages for various spraying methods and workpiece configurations.

## Table 4-4

## Estimated Percentage of Overspray Resulting from Listed Spray Methods

| Spraying Method | Estimated Percentage of Overspray | | |
|---|---|---|---|
| | Flat Surfaces | Table Leg Surfaces | Bird Cage Surface |
| Air Atomized | 50 | 85 | 90 |
| Airless | 20-25 | 90 | 90 |
| Electrostatic | | | |
| • Disc | 5 | 5-10 | 5-10 |
| • Airless | 20 | 30 | 30 |
| • Air atomized | 25 | 35 | 35 |

(Ref: Salman, David; Transfer Efficiency and Regulatory Guidance for Spray Coating Operations; presented at the National Air Pollution Control Technology Advisory Committee. November 19-21,1991.

Several other factors also play a role in the transfer efficiency:

- The skill, technique and fatigue level of the operator;
- The wear level and maintenance history of the spray equipment;
- The paint being sprayed and its amenability to spraying;
- Operating parameters such as spray booth ventilation rate, spray gun to workpiece distance, and the spacing of the parts on the conveyor (if used); and

- For automated spray applications, process control parameters such as whether spray is continuous or shut off between parts, must also be considered.

The data presented in Table 4-4 can be used in conjunction with engineering judgment to estimate release and other waste management activity quantities from spray application operations. The data in the table can be used as a reasonable starting point and be modified based on operational experience at your facility.

Water releases can be estimated using monitoring data and water flow rates. This information should be available whether the wastewater is discharged to an off-site treatment facility or is treated in an on-site wastewater treatment plant. In most cases an off-site facility receiving the wastewater will require monitoring data to determine treatment fees and/or to verify permit compliance. Influent concentration data is typically available for operational control monitoring of an on-site wastewater treatment system. If a water curtain is used in the spray booth, the manufacturer's collection efficiency data can be used for particulate removal, if actual operating performance data is not available. If neither is available, you can assume a 95% particulate removal efficiency as water curtains generally achieve at least 95% control of particulates. (Ref: Whitall, K.L., "Air Pollution Control in the Finishing Industry"; *Metal Finishing: Organic Finishing Guidebook and Directory Issue*; 1996 Edition, p. 342-351.)

Quantities of EPCRA Section 313 chemicals and chemical categories in "empty" containers subject to waste management, can be estimated using established container residue factors based on the container construction and method of cleaning or draining (see Table 4-1 and the corresponding container residue example).

EPCRA Section 313 chemicals and chemical categories in the sludge generated in the treatment of wastewater from the water curtain can be estimated based on analytical data, if available, or can be estimated as the difference between the solids in the overspray and the amount carried over in the wastewater. Organic chemicals in the sludge may undergo biodegradation. If applicable, this biodegraded quantity should be considered in the quantity treated on site and should be subtracted from the total amount before the ultimate discharge is reported.

Another potential source of solid waste containing EPCRA Section 313 chemicals and chemical categories is spent filters from the spray booth itself and from the air pollution control system. Collection efficiencies for several types of dry filters are shown in Table 4-5. These values can be used in the absence of actual operating data from your facility.

## Table 4-5

## Collection Efficiencies for Dry Particulate Collection Filters

| Description | Efficiency (%) | |
|---|---|---|
| | **High Solids Baking Enamel Average Efficiency Range** | **Water-Borne Baking Enamel Average Efficiency Range** |
| Standard filter | 96.5 - 97.5 | 93.0 - 94.0 |
| High-capacity filter | 94.0 - 96.0 | 91.5 - 92.5 |
| High-efficiency filter | 98.5 - 99.5 | 97.0 - 98.0 |

(Ref: U.S. EPA, *Pollution Prevention in the Paint and Coatings Industry*, EPA 625-R-96-003, September 1996, Office of Research and Development.)

Filters and the collected particulates may be discarded as solid wastes or the filters may be washed and the particulates transferred to a water stream. Be sure to account for the actual management of the EPCRA Section 313 chemicals and chemical categories in the correct section of the Form R.

The cleaning of process equipment, including the interior surfaces of the paint booth, can also generate solid wastes in the form of scrapings, coatings, etc. This can be estimated by weighing the waste material and applying concentration factors from the paint composition to determine the EPCRA Section 313 chemical and chemical category amounts.

## Example - Spray Application

This example focuses on estimating the release amounts of one volatile EPCRA Section 313 chemical, xylene, in the solvent/carrier fluid in the spray application of a paint. Keep in mind the paint may contain several other volatile and non-volatile EPCRA Section 313 chemicals and chemical categories in the pigment or other paint components. These chemicals and chemical categories must also be considered in any threshold determinations and release and other waste management quantity estimations.

A spray painting operation in a facility manufacturing large appliances, SIC Industry group 363, uses 500 gallons/week of a paint containing 70% o-xylene, by volume, as the carrier fluid. o-Xylene is volatile and is not expected to remain with the workpiece. 100% of the paint solvent in a spray application operation can be considered potential air emissions, with approximately 80% generated in the application/flash-off and 20% in the curing oven. o-Xylene is essentially insoluble and the amount volatilized in the spray booth would be either removed by the booth exhaust fan or become fugitive emissions from the booth into the general room air. In this example, the booth manufacturer estimates the exhaust fan will capture 95% of the amount released in the booth. The booth exhaust is routed to an air pollution control incineration device, which has a measured efficiency of 99% for VOC control.

**Treated on Site**

The following calculation estimates the amount of o-xylene (density = 7.36 lb/gal) volatilized from this operation and treated by the air pollution control incinerator (for reporting in Part II, Section 8.6 of the 1997 Form R, "Quantity Treated On-Site"):

Quantity of o-xylene used = (500 gal/week) × (52 weeks/year) × (70%; o-xylene content) × (7.36 lb/gal; density of o-xylene)
= 134,000 lb/year

Quantity of o-xylene treated by incinerator
= (134,000 lb/year) × (80%; volatilized in application/flash-off) × (95%; captured and sent to incinerator) × (99%; incinerator efficiency)
= 100,800 lb

**Stack Air Release**

The quantity released from the air pollution control device (for reporting in Part II, Section 5.2 and included in Part II, Section 8.1) can be calculated as follows:

Quantity of o-xylene used = 134,000 lb/yr (calculated above)

Quantity of o-xylene emitted from incinerator
= (134,000 lb/yr) × (80%; volatilized in application) × (95%; captured) × (1%; not destroyed by incinerator)
= 1,020 lb

**[continued on next page]**

**Fugitive Release**

The quantity released as fugitive air emission (for reporting in Part II, Section 5.1 and included in Part II, Section 8.1) can be calculated as follows:

Total quantity of fugitive emissions
= (fugitive emission of o-xylene from application/flash off) + (fugitive emission of o-xylene from curing)

Quantity of o-xylene fugitive emissions from application/flash off
= (134,000 lb/yr) × (80%; volatilized in application ) × (5%; not captured by exhaust fan)
= 5,360 lb

Quantity of o-xylene fugitive emissions from curing
= (134,000 lb/yr) × (20%; volatilized in curing)
= 26,800 lb

Total quantity of o-xylene fugitive emissions
= 5,360 lb + 26,800 lb
= 32,160 lb

### 4.2.3 Electrodeposition

In the electrodeposition (EDP) process, the electrically charged (usually negatively) workpiece is immersed into a dip tank where paint particles carrying the opposite charge are attracted to the workpiece and form the desired coating. A typical EDP bath consists of 80-90% deionized water and 10-20% paint components, resins, pigments, and small amounts of solvents (Ref: Oravitz, J.J., "Electrocoating"; *Metal Finishing: Organic Finishing Guidebook and Directory Issue*, May 1996, pages 203-207). The workpiece immersion time ranges from seconds up to 3 minutes for large pieces. The intimate contact between workpiece and paint and the recycling of paint particles from the rinse waters, result in very high transfer efficiencies of coating solids to the workpiece. If actual data are not available, 95% efficiency can be assumed (Ref: Air & Waste Management Association, *Air Pollution Engineering Manual*, (AP-40), 1992, page 362).

The workpiece is removed from the bath and rinsed several times to remove excess paint. The rinsate is returned to the bath to conserve undeposited paint. It is necessary to purge the system of the excess water from the rinses. This is accomplished through the use of an ultrafiltration system in which semipermeable membranes selectively allow low molecular weight chemicals such as water, and dissolved substances such as solvents, solubilizers, and salts

(impurities), to emerge from the system as the filtrate, while retaining the paint pigments and additives. The retained pigments and additives are referred to as the reject stream and this is returned to the EDP tank. Although each plant uses a unique rinse process, it is typical to use the filtrate from the ultrafiltration system as one of the rinses. Sometimes it is used for the first rinse after the part leaves the tank and the water and rinsed paint are returned to the EDP tank immediately. Other arrangements may allow for the filtrate to run counter-current to the emerging part allowing the final rinses to be performed by the most pure filtrate. A three-stage rinse system recovers approximately 85% of the paint solids in the drag out (liquid which clings to the workpiece but is not deposited electrically). (Ref: Brower, G.E.F., "Electrodeposition of Organic Coatings"; *Metal Finishing: Special Organic Finishing Guidebook and Industry Issue*; 1993 Edition, pp. 112-118.) Because some chemical contaminants such as chloride ions, phosphates, chromates and amine solubilizer, build up in the system, a portion, typically around 10%, of the ultrafiltrate is "bled" (diverted) to a waste stream.

In the EDP process EPCRA Section 313 chemicals and chemical categories may be processed (e.g., paint pigments that remain on the workpiece) or otherwise used (e.g., solvents that evaporate). These EPCRA Section 313 chemicals and chemical categories would therefore be subject to the 25,000-pound processing activity threshold or the 10,000-pounds otherwise use activity threshold, respectively.

**Step 1: Prepare Process Flow Diagram**

A site-specific process flow diagram should be prepared to help identify all potential sources and types of chemical and chemical category release and other waste management activities. A typical flow diagram is presented in Figure 4-9.

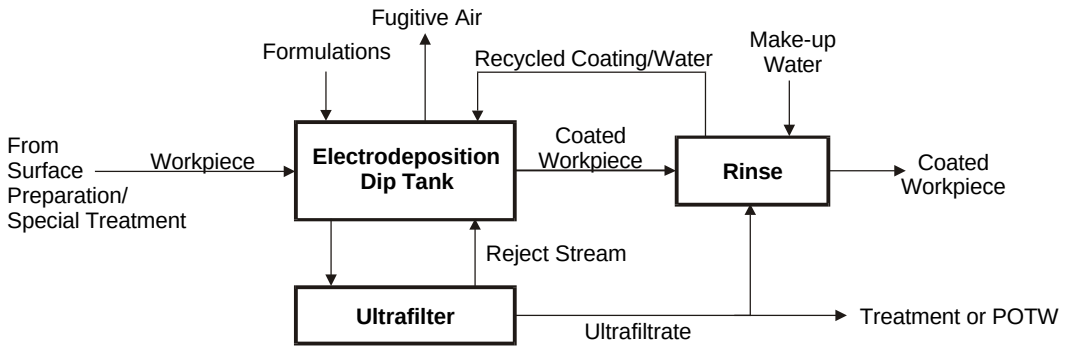


**Figure 4-9. Process Flow Diagram - Electrodeposition**

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

Typical sources of EPCRA Section 313 chemicals and chemical categories would include wastewater from ultrafiltration operation, evaporation of volatile paint components, and container residues. The cleaning of process equipment may also generate contaminated solvents and paint solids.

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

The primary release and other waste management activity types are wastewater discharges, either direct to a receiving stream or indirect to a POTW. Note that EPCRA Section 313 chemicals and chemical categories sent to a POTW are considered to be treated off site, except for metals which are not treated but are ultimately disposed. Thus, any EPCRA Section 313 metals sent to a POTW are considered to be released and should be reported in Sections 6.1 and 8.1. Other types of releases could include minimal fugitive air releases from evaporation of volatile compounds. Other release and other waste management activities could also include releases to land for the slurries and transfers to off-site locations from management of "empty" shipping containers. Typical release and other waste management activities and the EPCRA Section 313 chemicals and chemical categories involved are:

| Typical Type of Release/Waste Management Activity | Typical EPCRA Section 313 Chemicals and Chemical Categories |
|---|---|
| Fugitive Air | Glycol ethers |
| Off-site management of container residue and slurries (energy recovery, recycle, treatment, or disposal, as appropriate) | Applicable chemicals purchased in containers and zinc and chromium compounds |
| Receiving stream or POTW | Zinc and chromium compounds |

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

Air releases of EPCRA Section 313 chemicals and chemical categories from EDP processes are expected to be very minimal. They can be estimated from purchasing records combined with the use of engineering estimations based on volatility and surface area of the EDP tank or a mass balance around the system.

EPCRA Section 313 chemicals and chemical categories in wastewater can be estimated using monitoring data and water flow rates. This information should be available whether the wastewater is discharged to an off-site treatment facility or is treated in an on-site wastewater treatment plant. In most cases an off-site facility receiving the wastewater will require monitoring data to determine treatment fees and/or to verify permit compliance. Influent concentration data are typically available for operational control monitoring of an on-site wastewater treatment system.

The wastewater from the ultrafiltration unit can be expected to contain the soluble paint components and a certain amount of the insoluble components. For the water soluble components you can use the solubility of the EPCRA Section 313 chemical or chemical category multiplied by the amount of wastewater discharged to estimate the total chemical discharge (see example (6) “NPDES Data” in Appendix B).

Quantities of EPCRA Section 313 chemicals and chemical categories in “empty” containers subject to waste management, can be estimated using established container residue

factors based on the container construction and method of cleaning or draining (see Table 4-1 and the corresponding container residue example).

## Example - Electrodeposition

Note that several EPCRA Section 313 chemicals and chemical categories may be involved in this EDP process. Each must be accounted for and, if activity thresholds are exceeded the appropriate EPCRA Section 313 reports prepared. This example focuses on the quantity of lead in the primer paint pigments sent off site for recycling. When filing an EPCRA Section 313 report for metal compounds it is important to keep in mind that the weight of the metal compound is used for the threshold determination while the weight of the parent metal is used in the release and other waste management calculations.

The lead compounds in the paint pigment are processed and are subject to the 25,000 pound per year activity threshold for reporting. An automobile assembly plant, SIC Code 3711, uses electrodeposition (EDP) to apply primer coat to the auto frames. The facility uses 250,000 gallons of primer paint during the year. The pigment is shipped to the facility in 55-gallon bung-top steel drums and has a viscosity and surface tension similar to motor oil. According to the MSDS, the paint pigment contains 2.5% lead chromate ($PbCrO_4$) and has a density of 9.25 lb/gal. The drum contents are poured into the EDP tank and the "empty" drums shipped off site to a drum recycler, where the pigment residual is collected for recycle.

The frames undergo a surface preparation process consisting of alkaline cleaning, acid etching, and chrome-phosphate conversion coating. An electric charge is applied to the frame. The frame is submerged in an EDP tank followed by a three-stage countercurrent flow rinse process. The overflow from the first rinse tank is returned to the EDP tank. The excess water in the EDP tank is purged by an ultrafiltration unit. The reject stream from the ultrafilter is returned to the EDP tank. 90% of the filtrate from the ultrafilter is transferred to the first stage rinse tank, and the remainder is discharged to a POTW. Analysis of the filtrate is conducted frequently and the amount of lead is found to average 20 mg/L, and the amount of chromium averages 5 mg/L. The volume of wastewater sent to the on-site treatment plant is 500,000 gallons per year.

The final step for the auto frame is curing in a heated curing oven. The entire system, from surface preparation through curing, is totally enclosed to prevent dust from contaminating the process.

**Threshold Determination**

The activity threshold calculation is based on the weight of the metal compound.

(250,000 gal) × (9.25 lb/gal) × (2.5% lead chromate)
= 57,813 lb of $PbCrO_4$

This amount exceeds the processing activity threshold (25,000 pounds/year) for lead and chromium compounds and an EPCRA Section 313 report must be prepared for both lead and chromium compounds.

**Release and Other Waste Management Calculations**

The release and other waste management calculations are based on the weight of the lead or chromium and not the amount of the lead or chromium compound.

**[continued on next page]**

**Off-Site Recycling (Part II, Section 6.2 and Part II, Section 8.5 of the 1997 Form R)**

The amount of lead in the "empty" drums sent to the off-site recycling facility can be estimated using Table 4-1. The residue of a liquid with motor oil characteristics, in a bung-top steel drum, emptied by pouring, is an average of 0.737 percent.

Based on the molecular weight of lead and lead chromate, the mass of lead per pound of lead chromate is:

$$= \frac{(207\,\text{lb moles lead})}{(323\,\text{lb moles lead chromate})}$$

= 0.64 lb of lead/lb of lead chromate

Therefore, the quantity of lead sent to the off-site recycling facility as drum residual is:

= (250,000 gal) × (0.737% residual) × (9.25 lb lead chromate/gal) × (0.64 lb lead/lb lead chromate)
= 11,000 lb lead

Similarly, the amount of chromium sent to the off-site recycling facility is:

$$= \frac{(52\,\text{pound moles chromium})}{(323\,\text{pound moles lead chromate})}$$

= 0.16 lb of chromium/lb of lead chromate

= (250,000 gal) × (0.737% residual) × (9.25 lb lead chromate/gal) × (0.16 lb chromium/lb lead chromate)
= 2,800 lb chromium

**Discharge to a POTW (Part II, Section 6.1) and Quantity Released (Part II, Section 8.1 of the 1997 Form R)**

Metals are not treated in a wastewater treatment system, but are ultimately disposed. Thus, any EPCRA Section 313 metals sent to a POTW must be reported as a release in Section 8.1 and a discharge in Section 6.1.

The amount of lead sent to the POTW =

$$(500{,}000\,\text{gal/yr}) \times (3.78\,\text{L/gal}) \times (20\,\text{mg/L}) \times \left(\frac{1\,\text{g}}{1{,}000\,\text{mg}}\right) \times \left(\frac{1\,\text{lb}}{454\,\text{g}}\right)$$

= 83.4 lb/yr

The amount of chromium sent to the POTW =

$$(500{,}000\,\text{gal/yr}) \times (3.78\,\text{L/gal}) \times (5\,\text{mg/L}) \times \left(\frac{1\,\text{g}}{1{,}000\,\text{mg}}\right) \times \left(\frac{1\,\text{lb}}{454\,\text{g}}\right)$$

= 20.8 lb/yr

### 4.2.4 Flash-Off and Curing

Flash-off and curing are typically two physically unique unit operations. However, for the purposes of EPCRA Section 313 reporting they are very similar. The sources, types, and release and other waste management activities are identical and these two operations are combined in this document.

Drying and curing are the last steps in the effort to produce a final coating with specific chemical and physical properties. A combination of time and temperature is used to drive off solvents and set the coating. The curing stage in the electrodeposition coating process, where the solvent is water, would not normally evolve any EPCRA Section 313 chemicals or chemical categories.

Several options for the process are available. There are air-dry applications, low temperature cures for woods, plastics and even electrocoated parts, and the more traditional higher temperatures for solids and powders. The equipment to dry and/or cure the coating includes infrared, radiant wall, and conventional and high-velocity convection ovens (Ref: Carl, D., "Design and Operation of Conventional Dyeing and Curing Ovens"; *Metal Finishing: Organics Finishing Guidebook and Directory*, May 1996, pages 308-312).

EPCRA Section 313 chemicals and chemical categories in the flash-off and curing operations, carrier solvents that evaporate, are considered otherwise used. They would therefore be subject to the 10,000-pound otherwise use threshold.

**Step 1: Prepare Process Flow Diagram**

A site-specific process flow diagram should be prepared to help identify all potential sources and types of chemical and chemical category release and other waste management activities. A typical flow diagram is presented in Figure 4-10.

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

The evaporation of volatile paint components, predominantly solvents, is a typical source of EPCRA Section 313 chemicals and chemical categories when spray application of the organic coating has been used. The potential exists for creation of EPCRA Section 313 chemicals or chemical categories if an incinerator is used as an air pollution control device for treatment of these vapors.

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

The release and other waste management activity types of EPCRA Section 313

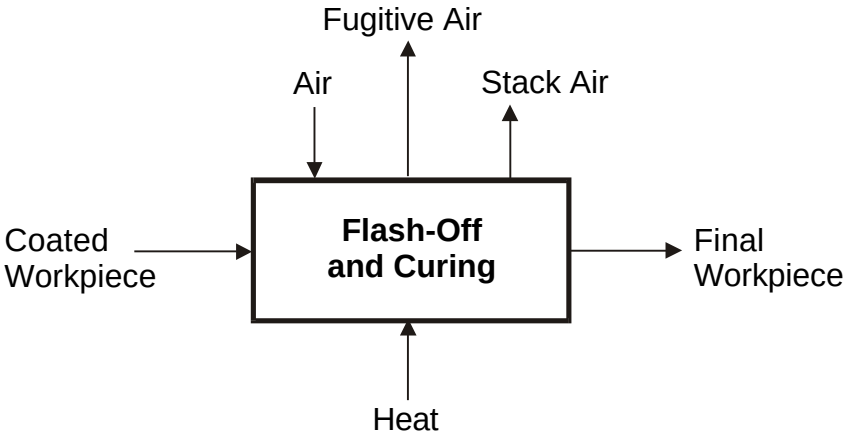


**Figure 4-10. Process Flow Diagram - Flash-Off and Curing**

chemicals and chemical categories from flash-off and curing operations are expected to be almost exclusively stack and fugitive air emissions. The type of chemical present may depend on the type of paint used in the coating process. Typical releases and the EPCRA Section 313 chemicals and chemical categories associated with each are shown in the following table.

| Typical Type of Release | Typical EPCRA Section 313 Chemicals and Chemical Categories |
|---|---|
| Fugitive Air | Methyl ethyl ketone, xylene, toluene |
| Stack Air | Methyl ethyl ketone, xylene, toluene - may also include some coincidentally manufactured EPCRA Section 313 chemicals if an incinerator is used as control equipment |

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

Total air releases can be estimated using a mass balance approach, assuming that 100% of the carrier fluid/solvent entering the flash-off and curing systems will be released during these two processes.

Once the total air release is determined, engineering judgement based on a knowledge of your facility should be used to partition the release between fugitive and stack emissions. Efficiencies of any vapor recovery systems and/or air pollution control devices should be considered in your calculations for emissions and on-site treatment, as appropriate. Typical efficiencies for control of bake oven emissions by a thermal incinerator is 96% and by a catalytic incinerator, 90%, for surface coating operations other than the metal furniture industry. (Ref: Air & Waste Management Association. *Air Pollution Engineering Manual*, (AP-40), 1992. Page 366.)

# APPENDIX A

# EPCRA Section 313 Guidance Resources

# Appendix A

# EPCRA SECTION 313 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.

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-97-004).

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/opptintr/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/opptintr/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.

National Technical Information Service (NTIS)
U.S. Department of Commerce
5285 Port Royal Road
Springfield, VA 22161
Call: (800) 553-6847; (703) 487-4650
Fax: (703) 321-8547
Publication Number PB97-502-587
E-mail: *info@ntis.fedworld.gov*

## 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.

Guidance for Chemical Distribution Facilities (Version 1.0), October 7, 1997

Guidance for Coal Mining Facilities (Version 1.0), September 26, 1997

Guidance for Electricity Generating Facilities (Version 1.0), September 15, 1997

Guidance for Metal Mining Facilities (Version 1.0), October 6, 1997

Guidance for Petroleum Bulk Storage Facilities (Version 1.0), September 15, 1997

Guidance for RCRA Subtitle C TSD Facilities and Solvent Recovery Facilities (Version 1.0)
October 6, 1997

Coincidental Manufacture/By-products

Estimating Releases and Waste Treatment Efficiencies

Formulation of Aqueous Solutions

Food Processors

Leather Tanning and Finishing Processes

Metal Fabrication and Electroplating

Monofilament Fiber Manufacture

Paper and Paperboard Production

Presswood & Laminated Wood Products Manufacturing

Printing Operations

Roller, Knife, and Gravure Coating Operations

Rubber and Plastics Manufacturing

Semiconductor Manufacture

Smelting Operations

Spray Application and Electrodeposition of Organic Coatings

Textile Dyeing

Welding Operations

Wood Preserving

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

Air & Waste Management Association. Air Pollution Engineering Manual, (AP-40). 1992. Van Nostrand Reinhold, New York.

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.

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.

Organic Finishing Guidebook and Directory Issue. Latest Edition. Annual issue of Metal Finishing magazine, Elsevier Science Inc., New York.

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

Salman, David, Transfer Efficiency and Regulatory Guidance for Spray Coating Operations, Presented at the National Air Pollution Control Technology Advisory Committee. November 19-21, 1991.

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

U.S. EPA. Pollution Prevention in the Paint and Coatings Industry, EPA 625-R-96-003. September 1996. Office of Research and Development.

# 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.

| |
|---|
| Volumetric flow = (gas velocity) × [(π) × (internal stack diameter)$^2$/4)] |

Volumetric flow = (8 m/s) × [(π) × (0.3 m)$^2$/4] = 0.57 m$^3$/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.)

Dry volumetric flow = (Volumetric flow) × (1-fraction water vapor)

Dry volumetric flow = ($0.57 m^3/s$) × (1-0.10) = 0.51 $m^3/s$

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 0°C and 760 mmHg is 22.4L/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 80°C (353 K) and atmospheric pressure (1 atm).

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

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

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:

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

Step 4. Calculate air releases.

Air releases are calculated as follows:

$$\text{Air Release} = (\text{volumetric flow, } m^3/s) \times (\text{concentration, } mg/m^3) \times (\text{operating time, s/yr})$$

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

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

$$\text{Air Release} = (0.51\ m^3/s) \times (0.3\ mg/m^3) \times \left(\frac{3{,}600\ s}{hr}\right) \times \left(\frac{2{,}080\ hr}{yr}\right) \times \left(\frac{lb}{454\ g}\right) \times \left(\frac{g}{1{,}000\ mg}\right)$$

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

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) Industrial Hygiene Data**

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:

$$\left(\frac{20{,}000\ \text{ft}^3}{\text{minute}}\right) \times \left(\frac{60\ \text{minutes}}{\text{hour}}\right) \times \left(\frac{24\ \text{hr}}{\text{day}}\right) \times \left(\frac{330\ \text{days}}{\text{year}}\right) \times \left(\frac{0.1\ \text{ft}^3\ \text{benzene}}{10^6\ \text{ft}^3\ \text{air}}\right) \times \left(\frac{0.2\ \text{lb}}{\text{ft}^3}\right)$$

$$= \underline{190\ \text{lb/yr of benzene}}$$

**(3) Raoult's Law**

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:

| | | |
|---|---|---|
| $P^\circ$ | = | 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.

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

Where:

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

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

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

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; |
| $P^\circ$ | = | 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.

$$\text{Emissions} = (0.001) \times \left(\frac{2.83\ m^3}{min}\right) \times \left(\frac{250\ day}{yr}\right) \times \left(\frac{24\ hr}{day}\right) \times \left(\frac{60\ min}{hr}\right) \times \left(\frac{mole}{22.4L}\right) \times \left(\frac{106.17g}{mole}\right) \times \left(\frac{L}{10^{-3}m^3}\right)$$

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

The emissions of o-xylene are calculated as shown below.

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

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.

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

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.

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

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

**(5) RCRA Waste Analysis**

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)

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

**(6) NPDES Data**

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.

| Quarter | 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)

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

= 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:

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

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 days/year) (0.03 lb/day) = 10.5 lb of silver/year

# Appendix C

# LIST OF TOXIC CHEMICALS WITHIN THE WATER DISSOCIABLE NITRATE COMPOUNDS CATEGORY AND GUIDANCE FOR REPORTING

United States Environmental Protection Agency
Office of Pollution Prevention and Toxics
Washington, DC 20460
Revised May 1996
EPA 745-R-96-004

# TOXICS RELEASE INVENTORY

**List of Toxic Chemicals Within the Water Dissociable Nitrate Compounds Category and Guidance for Reporting**

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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## Seciton 1. Introduction

On November 30, 1994 EPA added 286 chemicals and chemical categories, which include 39 chemicals as part of two delineated categories, to 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. These additions are described at 59 FR 61432, and are effective January 1, 1995 for reports due July 1, 1996. Six chemical categories (nicotine and salts, strychnine and salts, polycyclic aromatic compounds, water dissociable nitrate compounds, diisocyanates, and polychlorinated alkanes) are included in these additions. At the time of the addition, EPA indicated that the Agency would develop, as appropriate, interpretations and guidance that the Agency determines are necessary to facilitate accurate reporting for these categories. This document constitutes such guidance for the water dissociable nitrate compounds category.

### Section 1.1 Who Must Report

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

- It conducts manufacturing operations (is included in Standard Industrial Classification (SIC) codes 20 through 39); and
- It has 10 or more full-time employees (or the equivalent 20,000 hours per year); and
- 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 thresholds 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.

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.

## Section 1.3 Chemicals Within the Water Dissociable Nitrate Compounds Category

EPA is providing a list of CAS numbers and chemical names to aid the regulated community in determining whether they need to report for the water dissociable nitrate compounds category. The list includes individual chemicals within the water dissociable nitrate compounds category. If a facility is manufacturing, processing, or otherwise using a chemical which is on this list, they must report this chemical. However, this list is not exhaustive. If a facility is manufacturing, processing, or otherwise using a water dissociable nitrate compound, they must report the chemical, even if it does not appear on the list.

## Section 1.4 *De Minimis* Concentrations

The water dissociable nitrate compounds category is subject to the one percent *de minimis* concentration. Thus, mixtures that contain members of this category in excess of the *de minimis* should be factored into threshold and release determinations.

## Section 2. Guidance for Reporting Chemicals within the Water Dissociable Nitrate Compounds Category

Note: for the purposes of reporting under the nitrate compounds category, water dissociable means that the nitrate ion dissociates from its counterion when in solution.

### Section 2.1 Chemicals within the Water Dissociable Nitrate Compounds Category

Chemicals within the nitrate compounds category are only reportable when in aqueous solution. All water dissociable nitrate compounds are included in the nitrate compounds category, including ammonium nitrate. Specifically listed EPCRA Section 313 chemicals *are not* included in threshold determinations for chemical categories such as the water dissociable nitrate compounds category. Specifically listed toxic chemicals are subject to their own individual threshold determinations. As of December 1, 1994, ammonium nitrate (solution) is not an individually listed chemical on the EPCRA Section 313 list. However, ammonium nitrate is still subject to reporting under the nitrate compounds category. In addition, the aqueous ammonia from the dissociation of ammonium nitrate when in aqueous solution is subject to reporting under the ammonia listing.

### Section 2.2 Determining Threshold and Release Quantities for Nitrate Compounds

The total nitrate compound, including both the nitrate ion portion and the counterion, is included in the nitrate compounds category. When determining threshold amounts, the total weight of the nitrate compound is to be included in all calculations. However, only the nitrate ion portion is to be included when determining the amount of the chemicals within the nitrate compounds category that is released, transferred, or otherwise managed in wastes.

Example 1: In a calendar year, a facility processes 100,000 pounds of ammonium nitrate ($NH_4NO_3$), *in aqueous solution*, which is released to wastewater streams then transferred to a POTW. The quantity applied towards threshold calculations for the nitrate compounds category is the total quantity of the nitrate compound or 100,000 pounds. Since this quantity exceeds the 25,000 pound processing threshold, the facility is required to report for the nitrate compounds category. Under the nitrate compounds category, only the weight of the nitrate ion portion of ammonium nitrate is included in release transfer calculations. The molecular weight of the ammonium nitrate is 80.04 and the weight of the nitrate ion portion is 62.01 or 77.47 percent of the molecular weight of ammonium nitrate. Therefore, the amount of nitrate ion reported as transferred to the POTW is 77.47 percent of 100,000 pounds or 77,470 pounds (reported as 77,000 pounds). The aqueous ammonia from ammonium nitrate is reportable under the EPCRA Section 313 listing for ammonia. For determining thresholds and calculating releases under the ammonia listing, see the separate directive, *Guidance for Reporting Aqueous Ammonia* (EPA document #745-R-95-0003, July 1995).

Example 2: In a calendar year, a facility manufactures as by-products 20,000 pounds of sodium nitrate ($NaNO_3$) and 10,000 pounds of calcium nitrate ($Ca(NO_3)_2$), both in aqueous solutions, and releases these solutions to wastewater streams. The total quantity of nitrate compounds manufactured by the facility is the sum of the two chemicals, or 30,000 pounds, which exceeds the manufacturing threshold quantity of 25,000 pounds. The facility therefore is required to report for the nitrate compounds category. By weight, the nitrate ion portion is 72.96 percent of sodium nitrate and is 75.57 percent of calcium nitrate. Of the 20,000 pounds of the sodium nitrate in solution, 72.96 percent or 14,592 pounds is nitrate ion, and similarly, of the 10,000 pounds of the calcium nitrate in solution, 75.57 percent or 7,557 pounds is nitrate ion. The total nitrate ion in aqueous solution released by the facility is the sum of the nitrate ion in the two solutions or 22,149 pounds (reported as 22,000 pounds).

## Section 2.3 Reporting Nitrate Compounds Generated from the Partial or Complete Neutralization of Nitric Acid

Nitric acid is an individually listed chemical on the original EPCRA Section 313 list and is reported as a separate chemical if the manufacture, process, or otherwise use thresholds are exceeded. The partial or complete neutralization of nitric acid results in the formation of nitrate compounds which are reported as chemicals within the nitrate compounds category if their manufacture, process, or otherwise use thresholds are exceeded.

Mineral acids such as nitric acid may be present in aqueous waste streams that are sent to on-site neutralization or are discharged to a publicly owned treatment works (POTW) or other off-site treatment facility. As stated in the *Toxic Chemical Release Inventory Reporting Form R and Instructions* document (revised 1993 version, EPA 745-K-94-001), on-site acid neutralization and its efficiency must be reported in Part II, section 7A of Form R (waste treatment methods and efficiency section). For purposes of reporting on Form R, EPA considers a waste mineral acid at a pH 6 or higher to be 100 percent neutralized (water discharges to receiving streams or POTWs are reported as zero). The nitrate compounds produced from the complete neutralization (pH 6.0 or above) of nitric acid are reportable under the nitrate compounds category and should be included in all threshold and release calculations. Two Form R reports would be required if the manufacture, process or otherwise use thresholds are exceeded for nitric acid and for the nitrate compounds category.

If the nitric acid treatment efficiency is not equal to 100 percent (pH is less than 6), the amount of the acid remaining in the waste stream which is released to the environment on-site or off-site must be reported in Part II of Form R. The nitrate compounds produced from the partial neutralization of nitric acid are reportable under the nitrate compounds category and should be included in all threshold and release calculations. Two reports would again be required if the manufacture, process or otherwise use thresholds are exceeded for nitric acid and for the nitrate compounds category.

**Section 2.3.1 Estimating Nitric Acid Releases**

The pH of the waste stream can be used to calculate the amount of nitric acid in the stream and the efficiency of neutralization. The pH is a measure of the acidity or alkalinity of a waste stream and can be obtained readily using a pH meter or pH sensitive paper. The pH scale itself varies from 0 to 14.

The total nitric acid concentration (ionized and un-ionized) in pounds per gallon can be calculated by using the pH value of the solution, the molecular weight and ionization constant of the acid, and appropriate conversion factors. The total acid concentration for nitric acid for different pH values is listed in Table 1. The calculation of mineral acid concentrations and the derivation of Table 1 are discussed in a separate directive, *Estimating Releases for Mineral Acid Discharges Using pH Measurements*, and an addendum to this directive.

The procedure outlined in this guidance document for calculating the quantity of nitrate compounds formed from the complete or partial neutralization of nitric acid can be used if nitric acid is the only mineral acid in a solution. In addition, the calculation of nitric acid releases using only pH measurements is a rough estimate. The subsequent calculation of nitrate compound releases is therefore also only a rough estimate. The estimates can be made for a waste stream with a steady pH below 6 or for one whose pH temporarily drops to below pH 6. Facilities should use their best engineering judgement and knowledge of the solution to evaluate how reasonable the estimates are.

Example 3: In a calendar year, a facility transfers 1.0 million gallons of a solution containing nitric acid ($HNO_3$), at pH 4, to a POTW. Using Table 1 (next page), a pH of 4 corresponds to a concentration of 0.0000520 lbs $HNO_3$/gallon of solution. The weight of $HNO_3$ transferred can be estimated using the equation:

Transfer of $HNO_3$ = (Concentration of $HNO_3$) × (effluent flow rate)

Substituting the example values into the above equation yields:

Transfer of $HNO_3$ = 0.0000520 lbs/gal $HNO_3$ × 1,000,000 gal solution/year = 52 lbs/year

Example 4: A facility had an episodic release of nitric acid ($HNO_3$) in which the waste stream was temporarily below pH 6. During the episode, the wastewater (pH 2.0) was discharged to a river for 20 minutes at a rate of 100 gallons per minute. Using Table 1, a pH of 2.0 for $HNO_3$ represents a concentration of 0.0052000 lbs $HNO_3$/gallon of solution. The amount of the $HNO_3$ released can be estimated using the following equation:

Release of $HNO_3$ = (concentration of $HNO_3$) × (effluent flow rate)

Substituting the example values in the above equation:

Release of $HNO_3$ = 0.0052000 lbs/gal × 100 gal/min × 20 min
= 10 lbs

# Table C-1
# Nitric Acid Concentration Versus pH

| pH | Nitric Acid Concentration (lbs/gallon) | pH | Nitric Acid Concentration (lbs/gallon) |
|---|---|---|---|
| 0.0 | 0.5200000 | 3.0 | 0.0005200 |
| 0.2 | 0.3300000 | 3.2 | 0.0003300 |
| 0.4 | 0.2100000 | 3.4 | 0.0002100 |
| 0.6 | 0.1300000 | 3.6 | 0.0001300 |
| 0.8 | 0.0830000 | 3.8 | 0.0000830 |
| 1.0 | 0.0520000 | 4.0 | 0.0000520 |
| 1.2 | 0.0330000 | 4.2 | 0.0000330 |
| 1.4 | 0.0210000 | 4.4 | 0.0000210 |
| 1.6 | 0.0130000 | 4.6 | 0.0000130 |
| 1.8 | 0.0083000 | 4.8 | 0.0000083 |
| 2.0 | 0.0052000 | 5.0 | 0.0000052 |
| 2.2 | 0.0033000 | 5.2 | 0.0000033 |
| 2.4 | 0.0021000 | 5.4 | 0.0000021 |
| 2.6 | 0.0013000 | 5.6 | 0.0000013 |
| 2.8 | 0.0008300 | 5.8 | 0.0000008 |
| | | 6.0 | 0.0000005 |

## Section 2.3.2 Estimating Treatment Efficiencies for Nitric Acid Neutralization

Nitric acid solutions that are neutralized to a pH of 6 or above have a treatment efficiency of 100 percent. If nitric acid is neutralized to a pH less than 6, then the reportable treatment efficiency is somewhere between 0 and 100 percent. It is possible to estimate the neutralization treatment efficiency using nitric acid concentration values directly from Table 1 in the equation given below. The concentrations correspond to the pH values before and after treatment.

$$\text{Treatment efficiency} = \frac{(I - E)}{I} \times 100$$

where:

I = Acid concentration before treatment; and
E = Acid concentration after treatment.

Example 5: A nitric acid ($HNO_3$) waste stream of pH 2.4 is neutralized to pH 4.6. Using Table 1, the initial nitric acid concentration is 0.0021000 mol/liter and the final concentration is 0.0000130 mol/liter. Substituting these values into the equation for treatment efficiency:

$$\text{Treatment Efficiency} = \frac{(0.0021000 - 0.0000130)}{0.0021000} \times 100$$

$$= 99.4 \text{ percent}$$

For strong acids only (including nitric acid), the net difference in pH before and after treatment can be used to estimate the treatment efficiency since pH is directly proportional to the acid concentration. For example, a pH change of one unit results in a treatment efficiency of 90 percent, whether the pH change is from pH 1 to pH 2 or from pH 4 to pH 5. Table 2 summarizes treatment efficiencies for various pH changes (the pH change is the difference between the initial pH and the pH after neutralization). In the table, some pH changes result in the same treatment efficiency values due to rounding to one decimal place.

## Table C-2
## Nitric Acid Treatment Efficiencies for Various pH Changes

| pH Unit Change | Treatment Efficiency (%) | pH Unit Change | Treatment Efficiency (%) |
|---|---|---|---|
| 1.0 | 90.0 | 2.0 | 99.0 |
| 1.1 | 92.1 | 2.1 | 99.2 |
| 1.2 | 93.7 | 2.2 | 99.4 |
| 1.3 | 95.0 | 2.3 | 99.5 |
| 1.4 | 96.0 | 2.4 | 99.6 |
| 1.5 | 96.8 | 2.5 | 99.7 |
| 1.6 | 97.5 | 2.6 | 99.8 |
| 1.7 | 98.0 | 2.7 | 99.8 |
| 1.8 | 98.4 | 2.8 | 99.8 |
| 1.9 | 98.7 | 2.9 | 99.9 |
| | | 3.0 | 99.9 |

Example 6: If a nitric acid ($HNO_3$) waste stream of pH 2 is treated to pH 4, the pH change is 2 units. Using Table 2 above, the treatment efficiency is given as 99.0 percent.

### Section 2.3.3 Estimating Releases of Nitrate Compounds Generated from the Neutralization of Nitric Acid

The nitrate compounds produced from the complete neutralization (pH 6.0 or above) or partial neutralization (pH less than 6) or nitric acid are reportable under the nitrate compounds category if the appropriate threshold is met and should be included in all threshold and release calculations. In order to determine the quantity of a nitrate compound generated and released, the quantity of nitric acid released must be known (or calculated from the equations used in Examples 3 and 4 above) as well as the nitric acid treatment efficiency (calculated from the equations used in Examples 5 and 6 above).

The neutralization of nitric acid will most likely result in the generation of monovalent nitrate compounds (such as sodium nitrate and potassium nitrate). The quantity of these compounds formed in kilomoles will be equal to the quantity of the nitric acid neutralized in kilomoles. If divalent nitrate compounds are formed (such as calcium nitrate), the quantity of these compounds formed in kilomoles will be equal to one-half the quantity of the nitric acid neutralized in kilomoles. Similarly, if trivalent nitrate compounds are formed (such as iron (III) nitrate), the quantity formed of these compounds in kilomoles will be equal to one-third the quantity of the nitric acid neutralized in kilomoles. Note: to calculate the releases of nitrate compounds generated from the neutralization of nitric acid, the molecular weight of the nitrate

compound formed must be used. Molecular weights of some of the individual chemicals within the water dissociable nitrate compounds category are given in Table 3.

Example 7: In a calendar year, a facility transfers 50,000 pounds of nitric acid ($HNO_3$) to an on-site treatment facility. The nitric acid treatment efficiency is 95 percent, and the nitrate compound formed as a result of the treatment is sodium nitrate ($NaNO_3$). The quantity of nitric acid transferred that is neutralized (generating sodium nitrate) is 95 percent of 50,000 pounds or 47,500 pounds. The molecular weight of nitric acid is 63.01 kg/kmol, and the molecular weight of sodium nitrate is 84.99 kg/kmol. 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 example values into the above equation yields:

Kilograms $HNO_3$ neutralized = 47,500 lbs × 0.4536 kg/lb = 21.546 kg

Kilomoles $HNO_3$ neutralized = 21,546 kg ÷ 63.01 kg/kmol = 341.9 kmol

The quantity of sodium nitrate generated in kilomoles is equal to the quantity of nitric acid neutralized (341.9 kmol). The quantity of sodium nitrate generated in kilomoles is converted first to kilograms then to pounds using the following equations:

Kilograms $NaNO_3$ generated = (kmol $NaNO_3$) × (MW of $NaNO_3$ in kg/kmol)
Pounds $NaNO_3$ generated = (kg $NaNO_3$) × (2.205 lbs/kg)

Substituting the values into the above equation yields:

Kilograms $NaNO_3$ generated = 341.9 kmol × 84.99 kg/kmol = 29,058 kg
Pounds $NaNO_3$ generated = 29,058 kg × 2.205 lbs/kg = 64,073 pounds
(reported as 64,000 pounds)

The 64,000 pounds of sodium nitrate generated is the quantity used to determine whether thresholds have been met or exceeded. The quantity of nitrate ion released is calculated as in Example 1 above.

## Section 2.4 Generation of Nitrate Compounds from Biological Wastewater Treatment

If a facility treats wastewater on-site biologically, using the activated sludge process, for example, the facility may be generating nitrate compounds as by-products of this biological process. The nitrate ion generated from this process will be associated with various counterions (e.g., sodium ion, potassium ion). In the absence of information on the identity of the counterion, a facility should assume for the purposes of EPCRA Section 313 threshold determinations that the counterion is sodium ion.

## Section 3. CAS Number List of Some of the Individual Chemicals within the Water Dissociable Nitrate Compounds Category

EPA is providing the following table of CAS numbers and chemical names to aid the regulated community in determining whether they need to report for the water dissociable nitrate compounds category. If a facility is manufacturing, processing, or otherwise using a chemical which is listed below, they must report this chemical. However, this list is not exhaustive. If a facility is manufacturing, processing, or otherwise using a water dissociable nitrate compound, they must report this chemical, even if it does not appear on the following list.

### Table C-3
### Listing by CAS Number and Molecular Weight of Some of the Individual Chemicals within the Water Dissociable Nitrate Compounds Category

| Chemical Name | Molecular Weight* | CAS Number |
|---|---|---|
| Aluminum nitrate, nonahydrate | 213.00 | 7784-27-2 |
| Ammonium nitrate | 80.04 | 6484-52-2 |
| Cerium (III) ammonium nitrate, tetrahydrate | 486.22 | 13083-04-0 |
| Cerium (IV) ammonium nitrate | 548.23 | 10139-51-2 |
| Barium nitrate | 261.34 | 10022-31-8 |
| Beryllium nitrate, trihydrate | 133.02 | 7787-55-5 |
| Cadmium nitrate | 236.42 | 10325-94-7 |
| Cadmium nitrate, tetrahydrate | 236.42 | 10022-68-1 |
| Calcium nitrate | 164.09 | 10124-37-5 |
| Calcium nitrate, tetrahydrate | 164.09 | 13477-34-4 |
| Cerium (III) nitrate, hexahydrate | 326.13 | 10294-41-4 |
| Cesium nitrate | 194.91 | 7789-18-6 |
| Chromium (III) nitrate, nonahydrate | 238.01 | 7789-02-8 |
| Cobalt (II) nitrate, hexahydrate | 182.94 | 10026-22-9 |
| Copper (II) nitrate, trihydrate | 187.56 | 10031-43-3 |
| Copper (II) nitrate, hexahydrate | 187.56 | 13478-38-1 |
| Dysprosium (III) nitrate, pentahydrate | 348.51 | 10031-49-9 |
| Erbium (III) nitrate, pentahydrate | 353.27 | 10031-51-3 |
| Gadolinium (III) nitrate, hexahydrate | 343.26 | 19598-90-4 |
| Gallium nitrate, hydrate | 255.73 | 69365-72-6 |
| Iron (III) nitrate, hexahydrate | 241.86 | 13476-08-9 |
| Iron (III) nitrate, nonahydrate | 241.86 | 7782-61-8 |

# Table C-3 (Continued)

| Chemical Name | Molecular Weight* | CAS Number |
|---|---|---|
| Lanthanum (III) nitrate, hexahydrate | 324.92 | 10277-43-7 |
| Lead (II) nitrate | 331.21 | 10099-74-8 |
| Lithium nitrate | 68.95 | 7790-69-4 |
| Lithium nitrate, trihydrate | 68.95 | 13453-76-4 |
| Magnesium nitrate, dihydrate | 148.31 | 15750-45-5 |
| Magnesium nitrate, hexahydrate | 148.31 | 13446-18-9 |
| Manganese (II) nitrate, tetrahydrate | 178.95 | 20694-39-7 |
| Neodymium (III) nitrate, hexahydrate | 330.25 | 16454-60-7 |
| Nickel (II) nitrate, hexahydrate | 182.70 | 13478-00-7 |
| Potassium nitrate | 101.10 | 7757-79-1 |
| Rhodium (III) nitrate, dihydrate | 288.92 | 13465-43-5 |
| Rubidium nitrate | 147.47 | 13126-12-0 |
| Samarium (III) nitrate, hexahydrate | 336.37 | 13759-83-6 |
| Scandium (III) nitrate | 230.97 | 13465-60-6 |
| Scandium (III) nitrate, tetrahydrate | 230.97 | 16999-44-3 |
| Silver nitrate | 169.87 | 7761-88-8 |
| Sodium nitrate | 84.99 | 7631-99-4 |
| Strontium nitrate | 211.63 | 10042-76-9 |
| Strontium nitrate, tetrahydrate | 211.63 | 13470-05-8 |
| Terbium (III) nitrate, hexahydrate | 344.94 | 13451-19-9 |
| Thorium (IV) nitrate | 480.06 | 13823-29-5 |
| Thorium (IV) nitrate, tetrahydrate | 480.06 | 13470-07-0 |
| Yttrium (III) nitrate, hexahydrate | 274.92 | 13494-98-9 |
| Yttrium (III) nitrate, tetrahydrate | 274.92 | 13773-69-8 |
| Zinc nitrate, trihydrate | 189.39 | 131446-84-9 |
| Zinc nitrate, hexahydrate | 189.39 | 10196-18-6 |
| Zirconium (IV) nitrate, pentahydrate | 339.24 | 13986-27-1 |

*For hydrated compounds, e.g., aluminum nitrate, nonahydrate, the molecular weight excludes the weight of the hydrate portion. For example, the same molecular weight is provided for aluminum nitrate, nonahydrate and aluminum nitrate.

# Appendix D

# EPCRA SECTION 313, 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 all three of the following criteria:

- It conducts manufacturing operations (is included in Standard Industrial Classification (SIC) codes 20 through 39); and
- It has 10 or more full-time employees (or the equivalent 20,000 hours per year); and
- 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:

$$NH_3 \text{ equivalent wt\%} = (NH_3 \text{ equivalent weight})/(\text{MW ammonium salt}) \times 100$$

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.

Example 3:

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.

Example 4: 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 D-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<br>(Ammonium aluminum disulfate) | 237.14 | 7.181 | 7784-25-0 |
| Ammonium antimony fluoride<br>(Diammonium pentafluoroantimonate) | 252.82 | 13.47 | 32516-50-0 |
| Ammonium arsenate<br>(Ammonium arsenate, hydrogen)<br>(Ammonium arsenate, dihydrogen) | 158.97 | 10.71 | 13462-93-6 |
| Ammonium arsenate<br>(Diammonium arsenate)<br>(Diammonium arsenate, hydrogen)<br>(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<br>(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 |

# Table D-1 (Continued)

| Chemical Name | Molecular Weight* | $NH_3$ Equivalent Wt% | CAS Number |
|---|---|---|---|
| Ammonium carbonate<br>(Diammonium carbonate) | 96.09 | 35.45 | 506-87-3 |
| Ammonium carbonate, hydrogen<br>(Ammonium bicarbonate) | 79.06 | 21.54 | 1066-33-7 |
| Ammonium cerium nitrate<br>(Ammonium hexanitratocerate)<br>(Ammonium hexanitratocerate (IV))<br>(Diammonium cerium hexanitrate) | 548.23 | 6.213 | 16774-21-3 |
| Ammonium cerous nitrate<br>(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<br>(Ammonium chromate (VI))<br>(Diammonium chromate) | 152.07 | 22.40 | 7788-98-9 |
| Ammonium chromate<br>(Ammonium dichromate)<br>(Ammonium dichromate (VI))<br>(Ammonium bichromate)<br>(Diammonium dichromate) | 252.06 | 13.51 | 7789-09-5 |
| Ammonium chromium sulfate<br>(Ammonium chromic sulfate) | 265.17 | 6.422 | 13548-43-1 |
| Ammonium citrate<br>(Ammonium citrate, monohydrogen)<br>(Ammonium citrate, dibasic)<br>(Diammonium citrate)<br>(Diammonium citrate, hydrogen) | 226.19 | 15.06 | 3012-65-5 |
| Ammonium citrate<br>(Ammonium citrate, tribasic)<br>(Triammonium citrate) | 243.22 | 21.01 | 3458-72-8 |
| Ammonium cobalt sulfate<br>(Ammonium cobaltous sulfate) | 289.14 | 11.78 | 13596-46-8 |
| Ammonium cupric chloride<br>(Ammonium chlorocuprate (II))<br>(Diammonium copper tetrachloride)<br>(Diammonium tetrachlorocuprate) | 241.43 | 14.11 | 15610-76-1 |
| Ammonium cyanate<br>(Ammonium isocyanate) | 60.06 | 28.35 | 22981-32-4 |

# Table D-1 (Continued)

| Chemical Name | Molecular Weight* | $NH_3$ Equivalent Wt% | CAS Number |
|---|---|---|---|
| Ammonium cyanide | 44.06 | 38.65 | 12211-52-8 |
| Ammonium cyanoaurate, monohydrate<br>(Ammonium tetracyanoaurate, monohydrate) | 319.07 | 5.337 | 14323-26-3 |
| Ammonium cyanoaurate<br>(Ammonium dicyanoaurate) | 267.04 | 6.377 | 31096-40-9 |
| Ammonium ferricyanide<br>(Ammonium hexacyanoferrate (III))<br>(Triammonium hexacyanoferrate) | 266.07 | 19.20 | 14221-48-8 |
| Ammonium ferrocyanide<br>(Ammonium hexacyanoferrate (II))<br>(Tetraammonium ferrocyanide)<br>(Tetraammonium hexacyanoferrate) | 284.11 | 23.98 | 14481-29-9 |
| Ammonium fluoride | 37.04 | 45.98 | 12125-01-8 |
| Ammonium fluoride<br>(Ammonium difluoride)<br>(Ammonium bifluoride)<br>(Ammonium fluoride, hydrogen)<br>(Ammonium difluoride, hydrogen)<br>(Ammonium bifluoride, hydrogen) | 57.04 | 29.86 | 1341-49-7 |
| Ammonium fluoroborate<br>(Ammonium tetrafluoroborate) | 104.84 | 16.24 | 13826-83-0 |
| Ammonium fluorogermanate (IV)<br>(Ammonium hexafluorogermanate (IV))<br>(Diammonium hexafluorogermanate) | 222.66 | 15.30 | 16962-47-3 |
| Ammonium fluorophosphate<br>(Ammonium hexafluorophosphate) | 163.00 | 10.45 | 16941-11-0 |
| Ammonium fluorosulfate<br>(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<br>(Ammonium chloroiridate (III))<br>(Ammonium hexachloroiridate)<br>(Triammonium hexachloroiridate) | 459.05 | 11.13 | 15752-05-3 |
| Ammonium iron sulfate<br>(Ammonium ferric sulfate)<br>(Ammonium iron disulfate) | 269.02 | 6.330 | 10138-04-2 |

# Table D-1 (Continued)

| Chemical Name | Molecular Weight* | $NH_3$ Equivalent Wt% | CAS Number |
|---|---|---|---|
| Ammonium iron sulfate<br>(Ammonium ferrous sulfate)<br>(Diammonium iron disulfate)<br>(Diammonium ferrous disulfate) | 286.05 | 11.91 | 10045-89-3 |
| Ammonium lactate<br>(Ammonium 2-hydroxypropionate) | 107.11 | 15.90 | 515-98-0 |
| Ammonium laurate<br>(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<br>(Ammonium bimalate) | 151.12 | 11.27 | 5972-71-4 |
| Ammonium molybdate<br>(Diammonium molybdate) | 196.01 | 17.38 | 13106-76-8 |
| Ammonium molybdate<br>(Ammonium heptamolybdate)<br>(Ammonium molybdate, hydrate)<br>(Ammonium molybdate, tetrahydrate)<br>(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<br>(Ammonium nickel sulfate, hexahydrate)<br>(Ammonium nickel disulfate, hexahydrate)<br>(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<br>(Ammonium chloropalladate (II))<br>(Ammonium tetrachloropalladte (II))<br>(Diammonium tetrachloropalladate) | 284.31 | 11.98 | 13820-40-1 |
| Ammonium phosphate<br>(Ammonium orthophosphate) | 149.09 | 34.27 | 10124-31-9 |

# Table D-1 (Continued)

| Chemical Name | Molecular Weight* | $NH_3$ Equivalent Wt% | CAS Number |
|---|---|---|---|
| Ammonium phosphate<br>(Ammonium biphosphate)<br>(Ammonium phosphate, hydrogen)<br>(Ammonium phosphate, dihydrogen)<br>(Ammonium orthophosphate, dihydrogen)<br>(Ammonium phosphate, monobasic) | 115.03 | 14.80 | 7722-76-1 |
| Ammonium phosphate<br>(Ammonium phosphate, hydrogen)<br>(Ammonium orthophosphate, monohydrogen)<br>(Ammonium phosphate, dibasic)<br>(Ammonium orthophosphate, dibasic)<br>(Diammonium phosphate)<br>(Diammonium orthophosphate)<br>(Diammonium phosphate, hydrogen)<br>(Diammonium phosphate, monohydrogen)<br>(Diammonium orthophosphate, hydrogen) | 132.06 | 25.79 | 7783-28-0 |
| Ammonium phosphinate<br>(Ammonium hypophosphite) | 83.03 | 20.51 | 7803-65-8 |
| Ammonium phosphite<br>(Ammonium biphosphite)<br>(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<br>(Ammonium chlororhodate (III))<br>(Ammonium hexachlororhodate (III))<br>(Triammonium rhodium hexachloride)<br>(Triammonium hexachlororhodate) | 369.74 | 13.82 | 15336-18-2 |
| Ammonium salicylate<br>(Ammonium 2-hydroxybenzoate) | 155.15 | 10.98 | 528-94-9 |
| Ammonium selenide | 115.04 | 29.61 | 66455-76-3 |
| Ammonium silicon fluoride<br>(Ammonium fluorosilicate)<br>(Ammonium hexafluorosilicate)<br>(Diammonium silicon hexafluoride)<br>(Diammonium fluorosilicate)<br>(Diammonium hexafluorosilicate) | 178.15 | 19.12 | 16919-19-0 |
| Ammonium stearate<br>(Ammonium octadecanoate) | 301.51 | 5.648 | 1002-89-7 |
| Ammonium succinate<br>(Diammonium succinate) | 152.15 | 22.39 | 2226-88-2 |

# Table D-1 (Continued)

| Chemical Name | Molecular Weight* | $NH_3$ Equivalent Wt% | CAS Number |
|---|---|---|---|
| Ammonium sulfamate<br>(Ammonium amidosulfate)<br>(Ammonium amidosulfonate) | 114.12 | 14.92 | 7773-06-0 |
| Ammonium sulfate<br>(Diammonium sulfate) | 132.13 | 25.78 | 7783-20-2 |
| Ammonium sulfate<br>(Ammonium bisulfate)<br>(Ammonium sulfate, hydrogen)<br>(Ammonium sulfate, monohydrogen) | 115.10 | 14.80 | 7803-63-6 |
| Ammonium *per*sulfate<br>(Ammonium peroxysulfate)<br>(Ammonium peroxydisulfate)<br>(Diammonium persulfate)<br>(Diammonium peroxydifulsite) | 228.19 | 14.93 | 7727-54-0 |
| Ammonium sulfide<br>(Ammonium bisulfide)<br>(Ammonium sulfide, hydrogen) | 51.11 | 33.32 | 12124-99-1 |
| Ammonium sulfide<br>(Ammonium monosulfide)<br>(Diammonium sulfide) | 68.14 | 49.99 | 12135-76-1 |
| Ammonium sulfide<br>(Diammonium pentasulfide) | 196.39 | 17.34 | 12135-77-2 |
| Ammonium sulfite, monohydrate<br>(Diammonium sulfite, monohydrate) | 116.13 | 29.33 | 7783-11-1 |
| Ammonium sulfite<br>(Ammonium bisulfite)<br>(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<br>(Diammonium trithiocarbonate) | 144.27 | 23.61 | 13453-08-2 |
| Ammonium thiocyanate<br>(Ammonium isothiocyanate)<br>(Ammonium sulfocyanate)<br>(Ammonium rhodanate)<br>(Rhodanid) | 76.12 | 22.37 | 1762-95-4 |
| Ammonium dithionate | 196.19 | 17.36 | 60816-52-6 |
| Ammonium thiosulfate<br>(Ammonium hyposulfite)<br>(Diammonium thiosulfate) | 148.20 | 22.98 | 7783-18-8 |

| Chemical Name | Molecular Weight* | $NH_3$ Equivalent Wt% | CAS Number |
|---|---|---|---|
| Ammonium tin bromide<br>(Ammonium bromostannate (IV))<br>(Ammonium hexabromostannate (IV))<br>(Diammonium hexabromostannate) | 634.19 | 5.371 | 16925-34-1 |
| Ammonium tin chloride<br>(Ammonium chlorostannate (IV))<br>(Ammonium hexachlorostannate (IV))<br>(Diammonium tin hexachloride)<br>(Diammonium hexachlorostannate) | 367.48 | 9.269 | 16960-53-5 |
| Ammonium titanium fluoride<br>(Ammonium fluorotitanate (IV))<br>(Ammonium hexafluorotitanate (IV))<br>(Diammonium titanium hexafluoride)<br>(Diammonium hexafluorotitanate) | 197.95 | 17.21 | 16962-40-6 |
| Ammonium titanium oxalate, monohydrate<br>(Diammonium dioxalatooxotitanate, monohydrate) | 276.00 | 12.34 | 10580-03-7 |
| Ammonium tungstate<br>(Ammonium tungstate (VI))<br>(Ammonium *para*tungstate)<br>(Hexaammonium tungstate) | 1,779.2 | 5.743 | 12028-06-7 |
| Ammonium tungstate<br>(Ammonium tungstate (VI))<br>(Ammonium *para*tungstate)<br>(Decaammonium tungstate) | 3,058.6 | 5.568 | 11120-25-5 |
| Ammonium valerate<br>(Ammonium pentoate) | 119.16 | 14.29 | 42739-38-8 |
| Ammonium zinc chloride<br>(Ammonium chlorozincate)<br>(Ammonium tetrachlorozincate)<br>(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.

# INDEX

The pages listed in bold text in the index correspond to the primary uses or definitions of the associated term. Additionally, this index includes a list of primary purposes for examples and common errors that are presented throughout the document.

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## INDEX (Continued)