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EMERGENCY PLANNING AND COMMUNITY RIGHT-TO-KNOW ACT SECTION 313

GUIDANCE FOR ELECTRICITY GENERATING FACILITIES

(Version 1.0)

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SECTION 1
INTRODUCTION

This guidance document has been prepared to assist coal and oil-fired electricity generating facilities in complying with the reporting requirements of Section 313 of the Emergency Planning and Community Right-to-Know Act (EPCRA, Public Law 99-499, Title III of the Superfund Amendments and Reauthorization Act of 1986, hereafter EPCRA Section 313) and Section 6607 of the Pollution Prevention Act (PPA). This guidance document is intended for use along with the Toxic Chemical Release Inventory Reporting Form R and Instructions document published annually by the U.S. Environmental Protection Agency (EPA). For further assistance and to obtain copies of the latest version of this instruction document, contact the EPCRA Hotline at 1-800-535-0202. The other EPCRA reporting programs are summarized at the end of this section.

One of the primary goals of the EPCRA program 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 and other waste management activities of toxic chemicals into the environment. Since 1987, certain facilities in the manufacturing sector have been reporting information on releases and other waste management activities of Section 313 chemicals to EPA and states throughout the United States. As a result of an EPA rulemaking (62 FR 23834, May 1, 1997), certain additional industry groups, including electricity generating facilities (Standard Industrial Classification (SIC) codes 4911, 4931 and 4939 (limited to facilities that combust coal and/or oil for the purpose of generating electricity for distribution in commerce) are now required to evaluate their chemical use and management activities to determine potential reporting responsibilities under EPCRA Section 313. Combustion of coal or oil for on-site support purposes (such as heating the facility), for testing or operation of emergency backup power systems (meaning systems designed to supply power to the facility itself in the event of an emergency), or for start-up purposes (i.e., to heat the boiler to an operational temperature prior to switching to the primary fuel) will not subject facilities to the EPCRA Section 313 reporting requirements, provided such combustion of coal or oil does not itself generate power for distribution in commerce.

Section 313 establishes annual reporting requirements for Section 313 chemicals provided that certain activity thresholds are met. Section 313 includes a list of over 650 chemicals and chemical categories. These chemicals and chemical categories were either originally selected by Congress or were added by EPA through rulemaking.

The Section 313 reporting requirements apply to owners or operators of facilities which meet all of the following three criteria:

- The facility must be in SIC code 10 (except 1011, 1081, and 1094), or 12 (except 1241), or 20-39 (manufacturing facilities), or **4911 (limited to facilities that combust coal and/or oil for the purpose of generating power for distribution in commerce), 4931 (limited to facilities that combust coal and/or oil for the purpose of generating power for distribution in commerce)** and **4939 (limited to facilities that combust coal and/or oil for the purpose of generating power for distribution in commerce)**, or 4953 (limited to facilities regulated under RCRA subtitle C), or 5169, or 5171, or 7389 (limited to facilities primarily engaged in solvent recovery services on a contract or fee basis); and,

- The facility must have 10 or more full-time employees (or the total hours worked by all employees is greater than 20,000 hours), and

- The facility manufactures (defined to include importing), processes, or otherwise uses any Section 313 chemical in quantities greater than the established threshold in the course of a calendar year.

For each Section 313 chemical or chemical category, covered facilities must report the total annual releases, both routine and accidental, to all environmental media; and other on-site waste management activities, including quantities recycled, combusted for energy recovery and treated for destruction, and off-site transfers for disposal, waste treatment, energy recovery and recycling. This information is submitted on the Toxic Chemical Release Inventory (TRI) Reporting Form, which is called the "Form R." (As discussed in the following chapter, facilities meeting certain conditions are eligible to report using an abbreviated Form A.)

The annual Form R or Form A reports are submitted to EPA headquarters and to a state designated agency, usually a State Emergency Response Commission (SERC) buy may be a Tribal Emergency Response Commission (TERC), annually on or before July 1st for activities occurring during the previous calendar year (e.g., July 1, 1999, for activities during the period from January 1 to December 31, 1998).

EPCRA mandated that EPA establish and maintain a national TRI database to assist in research and the development of regulations, guidelines, and standards related to Section 313 chemicals and to make the TRI data available to the general public and any interested parties. The TRI database is computer-accessible to anyone with a modem via the National Library of Medicine's TOXNET on-line system. The TRI data are also available through many other sources, including EPA's Internet Web site; public libraries on microfiche; the Government Printing Office on CD-ROM; and the National Technical Information Service on magnetic tape and individual state diskettes.

Facility owners or operators who violate the Section 313 reporting provisions may be assessed civil penalties of up to $25,000 per day for each violation. In addition, state enforcement provisions may also be applicable depending on the state's EPCRA Section 313 reporting regulations.

This document is organized into several sections to provide quick reference. Section 2 presents an overview of the Section 313 reporting requirements. Section 3 provides a detailed discussion of how to make threshold determinations regarding the manufacture, processing, and otherwise use of Section 313 chemicals. Section 4 covers general concepts relating to reporting and release estimating, and provides potential data sources for determining releases at coal and oil-fired electricity generating facilities and other amounts managed. Section 5 presents a detailed discussion of EPCRA Section 313 release and other waste management scenarios in the coal and oil-fired electricity generating industry and covers developing estimates of releases and other waste management activities for several types of operations commonly encountered by the coal and oil-fired electricity generating industry. Finally, Appendix A provides an alphabetical listing of the Section 313 chemicals and chemical categories subject to EPCRA Section 313, the *de minimis* concentrations for each Section 313 chemical, and the RCRA status of the chemical. Appendix B provides a bibliography of relevant EPA documents used to help electricity generating facilities in complying with EPCRA Section 313. Appendix C provides relevant online information sources.

Table 1-1. Summary of Reporting Requirements Under EPCRA

EPCRA Section	Reporting Requirements
Sections 302 - 303 Presence of Extremely Hazardous Substances (40 CFR §355.30)	If a facility has one or more "extremely hazardous substances" present on site in quantities greater than Threshold Planning Quantities (TPQs) established by EPA, it must notify its State Emergency Response Commission (SERC) and Local Emergency Planning Committee (LEPC) that it is subject to the emergency planning requirements of these sections. A facility representative must be designated to participate in the local emergency planning process. The facility also must provide any information deemed necessary for development or implementation of a local emergency plan.
Section 304 Emergency Notification (40 CFR §355.40)	A facility must notify the LEPC and SERC immediately of the release of any "extremely hazardous substance" (listed in 40 CFR Part 355, Appendices A and B) or any hazardous substance under CERCLA (listed in 40 CFR 302.4), in amounts at or above the specified Reportable Quantities that EPA establishes for each substance. The facility must follow up this initial notification with a written statement providing details of the incident.
Section 311 Material Safety Data Sheet (MSDS) Reporting (40 CFR §370.21)	A facility must submit to the LEPC, SERC, and local fire department a list of Material Safety Data Sheets (MSDSs), or copies of MSDSs, for any "hazardous chemicals" (as defined under the Occupational Safety and Health Administration (OSHA) Hazard Communication Standard) that are present on site in quantities greater than 10,000 pounds. A facility also must report any "extremely hazardous substances" (EHS) (as defined under Section 302) that are present on site in quantities at or above the TPQ or 500 pounds, whichever is less. Submissions are required within 90 days of the date when new chemicals are first present at or above specified thresholds or if new information on previously reported chemicals becomes available. Some states have established lower activity thresholds.
Section 312 Hazardous Chemical Inventory (40 CFR §370.25)	A facility must submit to the LEPC, SERC, and local fire department certain information for any "hazardous chemical" or EHS reportable under Section 311. This information is most commonly submitted on a Tier I or Tier II Form and includes a description of any type of hazard the material may pose, the quantities stored, general storage locations, and type of storage. The reports for each calendar year are due on or before March 1 of the following year. Most states require or request that facilities submit the more detailed Tier II reporting form or a state-issued version of that form. In addition, some states have established lower activity thresholds and require more detailed or additional information.

EPCRA Section	Reporting Requirements
Section 313: Toxic Chemical Release Inventory Reporting (Form R) (40 CFR §372)	A facility in certain SIC codes meeting threshold requirements is required to report annually amounts of listed Section 313 chemicals released or otherwise managed to EPA and designated state agencies. Section 313 includes a list of over 650 chemicals and chemical categories. Release reporting information is submitted on the Toxic Chemical Release Inventory (TRI) Reporting Form, Form R. The Section 313 reporting requirements apply to owners or operators of facilities which meet <u>all</u> of the following three criteria: ■ Facility must be in SIC code 10 (except 1011, 1081, and 1094), or 12 (except 1241), or 20-39 (manufacturing facilities), or 4911 (limited to facilities that combust coal and/or oil for the purpose of generating power for distribution in commerce), 4931 (limited to facilities that combust coal and/or oil for the purpose of generating power for distribution in commerce) and 4939 (limited to facilities that combust coal and/or oil for the purpose of generating power for distribution in commerce), or 4953 (limited to facilities regulated under RCRA subtitle C), or 5169, or 5171, or 7389 (limited to facilities primarily engaged in solvent recovery services on a contract or fee basis); <u>and</u>, ■ Facility must have 10 or more full-time employees (or the total hours worked by all employees is greater than 20,000 hours), <u>and</u> ■ Facility must manufacture (including importation), process, or otherwise use a listed Section 313 chemical in excess of specific threshold quantities. The threshold quantities for reporting under Section 313 are based on the amount of the Section 313 chemical manufactured, processed, or otherwise used during the calendar year. Specifically, the thresholds are greater than 25,000 pounds if manufactured, or 25,000 pounds if processed, or 10,000 pounds if otherwise used. EPCRA mandated that EPA establish and maintain a national TRI database to assist in research and the development of regulations, guidelines, and standards related to Section 313 chemicals and to make the TRI data available to the general public and any interested parties. The TRI database is computer-accessible to anyone with a modem via the Internet or the National Library of Medicine's TOXNET on-line system.

SECTION 2
SECTION 313 REPORTING REQUIREMENTS

WHO MUST REPORT?

A facility is subject to the provisions of the Section 313 reporting requirements if it meets all three of the following criteria:

- The facility must be in SIC code 10 (except 1011, 1081, and 1094), or 12 (except 1241), or 20-39 (manufacturing facilities), or 4911 (limited to facilities that combust coal and/or oil for the purpose of generating power for distribution in commerce), 4931 (limited to facilities that combust coal and/or oil for the purpose of generating power for distribution in commerce) and 4939 (limited to facilities that combust coal and/or oil for the purpose of generating power for distribution in commerce), or 4953 (limited to facilities regulated under RCRA subtitle C), or 5169, or 5171, or 7389 (limited to facilities primarily engaged in solvent recovery services on a contract or fee basis) hereafter "covered SIC codes"; and,

- Facility must have 10 or more full-time employees (or the total hours worked by all employees is greater than 20,000 hours), and

- The facility manufactures (defined to include importation), or processes, or otherwise uses any Section 313 chemical in quantities greater than the established threshold in the course of a calendar year.

Instructions regarding how to determine the facility SIC code, employee threshold, or activity follows; for additional detail please consult the *Toxic Chemical Release Inventory Reporting Form R and Instructions*, a document published annually by EPA.

In addition, pursuant to Executive Order (EO) 12856 signed by the President on August 3, 1993, Federal facilities are required to determine the applicability of the EPCRA Section 313 reporting requirements regardless of the facility's SIC codes. Federal facilities that have 10 or more full time employees or the equivalent and manufacture, process, or otherwise use listed Section 313 chemicals at or above established thresholds are subject to EPCRA Section 313 reporting. Federal facilities were required to begin reporting no later than reporting year 1994; their first Form R or Form A reports were due by July 1, 1995.

The amount of the chemical released to the environment does not affect the need to report. Even if there are no releases of a listed Section 313 chemical, a facility must report if it meets the

requirements regarding SIC code, number of employees, and activity threshold. A threshold determination must be made individually for each Section 313 chemical.

Thresholds are based on operation year, this includes partial year reporting and reporting by a facility that is going through closure. The facilities should consider the portion of the year for which they operated to determine the actual employee hours worked as well as threshold determination and release reporting.

Reduced Reporting

On November 30, 1994, EPA published a final rule (59 FR 61488) that provides an alternative reporting option to qualifying facilities. Eligible facilities wishing to take advantage of this alternative reporting option may report on a simplified two page form referred to as Form A and do not have to use Form R. The rule entitled "TRI Alternate Threshold for Facilities with Low Annual Reportable Amounts," provides facilities that otherwise meet EPCRA Section 313 activity thresholds the option of reporting on Form A, provided that they do not exceed 500 pounds for the total annual reportable amount (defined below) for that chemical, and that the amounts manufactured, processed or otherwise used do not exceed 1 million pounds. As with determining an activity threshold to determine if the chemical activity has been exceeded, facilities must evaluate each activity threshold separately; for example, a facility that manufactures 900,000 pounds per year of a Section 313 chemical and processes 150,000 pounds per year of a Section 313 chemical would still be eligible to use the Form A.

For the purpose of reporting on Form A, the annual reportable amount is equal to the combined total quantities released (including disposed) at the facility, treated at the facility (as represented by amounts destroyed or converted by treatment processes), recycled at the facility, combusted for the purpose of energy recovery at the facility, and amounts transferred from the facility to off-site locations for the purpose of recycling, energy recovery, treatment, and/or disposal. These quantities do not include amounts of the chemical accidentally released. These volumes correspond to the sum of amounts reported on Form R, as Part II column B of section 8, data elements 8.1 (quantity released), 8.2 (quantity used for energy recovery on-site), 8.3 (quantity used for energy recovery off-site), 8.4 (quantity recycled on-site), 8.5 (quantity recycled off-site), 8.6 (quantity treated on-site), and 8.7 (quantity treated off-site). See Section 4 of this document for more guidance on completing Part II, Section 8 of Form R.

What is a Facility?

Under EPCRA, a "facility" is defined as all buildings, equipment, structures, and other stationary items which are located on a single site or contiguous or adjacent sites and which are owned or operated by the same person (or by any person which controls, is controlled by, or under common control with such person). An "establishment" is generally a single physical location, where

business is conducted or where services or industrial operations are performed. A facility may contain more than one establishment. For example, a coal/oil-fired electricity generating establishment, a hydroelectric generating station and a co-generation plant would be one facility if all three units were owned and operated by the same company, and are located on the same contiguous or adjacent properties. A single facility therefore can be a multi-establishment complex. Such a facility may submit reports that cover all its establishments, or the individual establishments may report separately. However, for the purposes of determining thresholds, all chemical activities for the entire facility must be considered.

How to Determine Your SIC Code*

Standard Industrial Classification (SIC) codes 10 (except 1011, 1081, and 1094), 12 (except 1241), 20-39 (manufacturing facilities), 4911, 4931 and 4939 (limited to facilities that combust coal and/or oil for the purpose of generating power for distribution in commerce), 4953 (limited to facilities regulated under RCRA subtitle C), 5169, 5171, and 7389 (limited to facilities primarily engaged in solvent recovery services on a contract or fee basis) are covered under section 313 of EPCRA. The first two digits of a 4-digit SIC code define a major business sector, while the last two digits denote a facility's specialty within the major sector. A facility should determine its own SIC code(s), based on its activities on-site and the "Standard Industrial Classification Manual 1987." In some cases, a state agency or other organization may have assigned SIC codes on a different basis than the one used in the SIC Manual. For the purposes of TRI reporting, state assigned codes should not be used if they differ from ones assigned using the SIC Manual.

Your facility may include multiple establishments that have different SIC codes. In order to determine which SIC code best represents the facility, the facility should calculate the value of the products or services produced or provided at/by or shipped from each establishment within the facility and then use the following rule to determine if your facility comes within the covered SIC codes, and the SIC code criterion is met.

- If the total value of the products or services shipped, produced or provided at establishments in "covered" SIC codes is greater than 50 percent of the value of the entire facility's products and services, the entire facility comes within the covered SIC codes, and the SIC code criterion is met.

*Please note: The North American Industrial Classification System that appeared in the *Federal Register* on April 9, 1997 will replace the 1987 Standard Industrial Classification System (SIC). Regulatory entities, including EPA, will take steps to adopt the new classification system over the next few years. In the meantime, facilities should consider their activities in relation to the 1987 SIC code system.

- If any one establishment in the specified set of SIC codes produces, provides or ships products or service whose value exceeds the value of products and services produced or shipped by all other establishments within the facility, the facility comes within the covered SIC codes, and the SIC code criterion is met.

The value of production or service attributable to a particular establishment may be isolated by subtracting the product or service value obtained from other establishments within the same facility from the total product or service value of the facility. This procedure eliminates the potential for "double counting" production or service in situations where establishments are engaged in sequential production activities at a single facility.

How to Determine Your Number of Employees

A "full time employee," for the purpose of Section 313 reporting, is defined as 2,000 work hours per year. The number of full time employees is dependent only upon the total number of hours worked by all employees during the calendar year for that facility and not the number of persons working. To determine the number of full time employees working for your facility, add up the hours worked by all employees during the calendar year including contract employees and sales and support staff, and divide the total by 2,000 hours. In other words, if the total number of hours worked by all employees is 20,000 hours or more, your facility meets the ten employee threshold.

Facilities may have contract workers present at times to conduct maintenance and service operations, including equipment, motor vehicle, and building maintenance, construction, and operating processes and waste management activities (e.g., remediation). The hours of all these contract workers count toward the employee threshold for reporting under Section 313. In addition, the hours worked by professionals (e.g., those on salary, that do not clock in or out) also count towards the facility's employee threshold. Employees that perform activities which routinely occur off-site such as truck drivers, but who are based at the facility are also counted towards the employee threshold. Routine activities performed at the facility by outside personnel such as contract drivers that are not based at the facility are not counted towards the employee threshold.

CHEMICAL ACTIVITY THRESHOLDS

Section 313 requires a facility that meets the SIC code and employee criteria to submit Form R reports for any listed Section 313 chemical or chemical category that it manufactures in annual quantities greater than 25,000 pounds, processes in annual quantities greater than 25,000 pounds, or otherwise uses in annual quantities greater than 10,000 pounds (40 CFR §372.3). These thresholds (manufacture, process, or otherwise use) will be referenced throughout this document as "activity thresholds." Chemicals must be evaluated in association with one or more of these

three categories when determining whether an activity threshold has been exceeded. These categories are:

- **Manufacture** - "Manufacture" means to produce, prepare, compound, or import a listed Section 313 chemical. Import is defined as causing the Section 313 chemical to be imported into the customs territory of the United States. If you order a listed Section 313 chemical (or a mixture containing the chemical) from a foreign supplier, then you have imported the chemical when that shipment arrives at your facility directly from a source outside of the United States. By ordering the chemical, you have "caused it to be imported," even though you may have used an import brokerage firm as an agent to obtain the Section 313 chemical. If the importation was directed by the parent company, then the facility receiving the chemical is not considered to have imported the chemical.

  The term manufacture also includes coincidental production of a listed chemical (e.g., as a byproduct or impurity) as a result of the manufacture, processing, otherwise use, or waste management of other chemical substances. The fact that the coincidental manufacturing of these byproducts is not the primary purpose of coal mining is irrelevant. Listed EPCRA Section 313 chemicals coincidentally manufactured by a facility must be factored into threshold determinations and release calculations.

- **Manufactured Activities and Definitions**

  - Produced or imported for on-site use/processing
    A chemical that is produced or imported and then further processed or otherwise used at the same facility.
  - Produced or imported for sale/distribution
    A chemical that is produced or imported specifically for sale or distribution outside the facility.
  - Produced as a by-product
    A chemical that is produced coincidentally during the production, processing, otherwise use, or disposal of another chemical substance or mixture and, following its production, is separated from that other chemical substance or mixture. Section 313 chemicals produced and released as a result of waste treatment for disposal are also considered byproducts.

- Produced as an impurity

  A chemical that is produced coincidentally as a result of the manufacture, processing, or otherwise use of another chemical but is not separated and remains primarily in the mixture or product with that other chemical.

- **Process** - "Process" means the preparation of a listed Section 313 chemical, after its manufacture, for distribution in commerce. Processing is usually the intentional incorporation of a Section 313 chemical into a product. Processing includes preparation of the Section 313 chemical in the same physical state or chemical form as that received by your facility, or preparation that produces a change in physical state or chemical form. The term also applies to the processing of a mixture or other trade name product that contains a listed Section 313 chemical as one component. Processing activities include use of Section 313 chemicals as reactants, in formulations, and as article components, and repackaging. Processing may also include the recycling of a Section 313 chemical for distribution in commerce. For example, if a facility receives a waste containing a Section 313 chemical from off-site, stabilizes, and repackages the waste in one calendar year and then distributes the repackaged waste into commerce in the following year. The facility would count the amount of the Section 313 chemical stabilized as being processed in the year it was treated.

  Relabeling or redistributing of the Section 313 chemical where no repackaging of the Section 313 chemical occurs does not constitute processing of the Section 313 chemical.

- **Processed Activities and Definitions**

  - As a reactant

    A natural or synthetic chemical used in chemical reactions for the manufacture of another chemical substance or product. This includes, but is not limited to, feedstocks, raw materials, intermediates, and initiators.

  - As a formulation component

    A chemical added to a product (or product mixture) prior to further distribution of the product that acts as a performance enhancer during use of the product. Examples of Section 313 chemicals used in this capacity include, but are not limited to, additives, dyes, reaction diluents, initiators, solvents, inhibitors, emulsifiers, surfactants, lubricants, flame retardants, and rheological modifiers.

- As an article component
  A chemical that becomes an integral component of an article distributed for industrial, trade, or consumer use.
- Repackaging
  Processing or preparation of a Section 313 chemical (or product mixture) for distribution in commerce in a different form, state, or quantity. This includes, 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.

- **Otherwise use** - Any use involving a listed Section 313 chemical at a facility that does not fall under the definitions of 'manufacture" or "process" is an otherwise use of that chemical. A chemical that is otherwise used by a facility is not incorporated into a product distributed in commerce and includes use of the Section 313 chemical as a chemical processing aid or as a manufacturing aid or for ancillary uses such as treating wastes. Otherwise use of a Section 313 chemical does not include disposal, stabilization (without subsequent distribution in commerce), or treatment for destruction unless:

  (1) The Section 313 chemical that was disposed, stabilized, or treated for destruction was received from off-site for the purposes of further waste management, or

  (2) The Section 313 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 purpose of further waste management.

  Relabeling or redistributing of the Section 313 chemical where no repackaging of the Section 313 chemical occurs does not constitute the otherwise use of the Section 313 chemical.

- **Otherwise Used Activities and Definitions**

  - As a chemical processing aid

    A chemical 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 of such Section 313 chemicals include, but are not limited to, process solvents, catalysts, inhibitors, initiators, reaction terminators, and solution buffers.

  - As a manufacturing aid

    A chemical that aids the manufacturing process that 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, but are not limited to, process lubricants, metalworking fluids, coolants, refrigerants, and hydraulic fluids.

  - Ancillary or other use

    A chemical that is used at a facility for purposes other than aiding chemical processing or manufacturing as described above. Examples of such Section 313 chemicals include, but are not limited to, cleaners, degreasers, lubricants, fuels, and chemicals used for treating wastes.

For purposes of the otherwise use definition, EPA interprets ***waste management*** activities to include recycling, combustion for energy recovery, treatment for destruction, waste stabilization, and release, including disposal. Waste management does not include the storage, container transfer, or tank transfer of a Section 313 chemical if no recycling, combustion for energy, treatment for destruction, waste stabilization, or release of the chemical occurs at the facility. (See 62 FR 23850)

Recycling for the purposes of EPCRA Section 313 means the following: (1) the recovery for reuse of a Section 313 chemical from a gaseous, aerosol, aqueous, liquid, or solid stream; or (2) the reuse or the recovery for use of a Section 313 chemical that is a RCRA hazardous waste as defined in 40 CFR Part 261. Recovery is the act of extracting or removing the Section 313 chemical from a waste stream and includes: (1) the reclamation of the Section 313 chemical from a stream that entered a waste treatment or pollution control device or process where destruction of the stream or destruction or removal of certain constituents of the stream occurs (including air pollution control devices or processes, wastewater treatment or control devices or processes, Federal or state permitted treatment or control devices or processes, and

other types of treatment or control devices or processes); and (2) the reclamation for reuse of an "otherwise used" Section 313 chemical that is spent or contaminated and that must be recovered for further use in either the original or any other operations. (See EPA document, *Interpretations of Waste Management Activities: Recycling, Combustion for Energy Recovery, Waste Stabilization and Release.)*

Combustion for energy recovery is interpreted by EPA to include the combustion of a Section 313 chemical that is (1) (a) a RCRA hazardous waste or waste fuel, (b) a constituent of a RCRA hazardous waste or waste fuel, or (c) a spent or contaminated "otherwise used" material; and that (2) has a heating value greater than or equal to 5,000 British thermal units (BTU) per pound in an energy or materials recovery device. Energy or materials recovery devices are boilers and industrial furnaces as defined in 40 CFR §372.3 (See 62 FR 23891). In determining whether an EPCRA Section 313 listed chemical is combusted for energy recovery, the facility should consider the BTU value of the Section 313 chemical and not of the chemical stream. If the heating value of the Section 313 chemical is below 5,000 BTU/lb., the chemical is being treated for destruction. A facility that blends and subsequently distributes in commerce a waste-derived fuel "processes" EPCRA Section 313 listed chemicals that are constituents of that waste-derived fuel. In contrast, if subsequent to blending the waste-derived fuel, that same facility combusts on-site the waste-derived fuel in an energy recovery unit, the facility "otherwise uses" EPCRA Section 313 listed chemicals that are constituents of that waste-derived fuel. An EPCRA Section 313 listed chemical that has a heat value of less than 5,000 BTU/lb. and that is a constituent of a waste-derived fuel is "otherwise used" if that fuel is combusted in an on-site energy recovery unit (62 FR 23851).

EPA defines ***Treatment for destruction*** to mean the destruction of a Section 313 chemical in waste such that the substance is no longer the Section 313 chemical subject to reporting under EPCRA Section 313. Treatment for destruction does not include the destruction of a Section 313 chemical in waste where the Section 313 chemical has a heat value greater than 5,000 British Thermal Units (BTU) and is combusted in any device that is an industrial boiler or furnace. (See 40 CFR §372.3.) "Treatment for destruction" includes acid or alkaline neutralization if the Section 313 chemical is the entity that reacts with the acid or base. "Treatment for destruction" does not include: (1) neutralization of a waste stream containing Section 313 chemicals if the Section 313 chemicals themselves do not react with the acid or base (See 40 CFR §372.3), (2) preparation of a Section 313 chemical for disposal, (3) removal of Section 313 chemicals from waste streams, and (4) activities intended to render a waste stream more suitable for further use or processing, such as distillation or sedimentation. For example, neutralization of pure nitric acid is considered treatment for destruction. In contrast, neutralization of nitric acid containing three percent lead is not considered treatment for

percent lead is not considered treatment for destruction of the lead component, because the lead has not reacted with the neutralizing agent (See 62 FR 23852).

EPA defines ***Waste stabilization*** to mean any physical or chemical process used to either reduce the mobility of hazardous constituents in a hazardous waste or eliminate free liquid as determined by a RCRA approved test method (e.g., Test Method 9095). A waste stabilization process includes mixing the hazardous waste with binders or other materials and curing the resulting hazardous waste and binder mixture. Other synonymous terms used to refer to this process are "stabilization," "waste fixation," or "waste solidification." (See 40 CFR §372.3.)

Release is defined by EPCRA Section 329(8) to mean any spilling, leaking, pumping, pouring, emitting, emptying, discharging, injecting, escaping, leaching, dumping, or disposing into the environment (including the abandonment or discarding of barrels, containers, and other closed receptacles) of any Section 313 chemical. (See 40 CFR §372.3.)

Disposal is defined by EPCRA to mean any underground injection, placement in landfills/surface impoundments, land treatment, or other intentional land disposal. (See 40 CFR §372.3.)

Based on EPA's evaluation of the electricity generating industry, the Agency believes electricity generating activities routinely involve or result in the manufacturing, processing, or otherwise use of EPCRA Section 313 chemicals (62 FR 23834, May 1, 1997). The term manufacture includes the coincidental manufacture of a chemical, such as a byproduct or impurity, from the manufacturing, processing, otherwise use or waste management of another chemical substance or mixture. Thresholds must be calculated separately for manufacture, process, or otherwise use of the same chemical. If any single threshold is exceeded for a listed Section 313 chemical, the facility must submit a Form R covering all nonexempt activities. Facilities generating electricity via the combustion of coal or oil will be required to factor into their threshold determinations and reporting calculations the quantities of EPCRA Section 313 chemicals used in support activities such as tank or boiler cleaning, non-motor vehicle equipment maintenance, and purification. Chemicals involved in these support activities are classified under the otherwise use category.

EXEMPTIONS

Section 313 provides for exemptions from reporting for specific "processing" or "otherwise use" activities. The instructions provided in *Toxic Chemical Release Inventory Reporting Form R and Instructions* should be reviewed carefully before proceeding. The following discussion summarizes the exemption instructions. A facility does not have to consider amounts of listed Section 313 chemicals involved in any of these processing or otherwise use activities when determining if activity thresholds have been exceeded or when estimating environmental releases. Limited exemptions apply to manufacturing activities. For example, manufacturing a Section 313 chemical for research and development purposes and manufacturing as an impurity below a specified level in a product distributed beyond the facility both can be exempt. The EPA's *Toxic Chemical Release Inventory Questions and Answers, Revised 1990 Version* [EPA 560/4/91-003 (will be revised in near future)] and the *Toxic Release Inventory Reporting Form R and Instructions* also contain information about these exemptions. (See Appendix B for ordering information.)

- The ***de minimis*** exemption allows facilities to disregard certain minimal concentrations of chemicals in mixtures or trade name products they "process" or "otherwise use" in making threshold determinations and release and other waste management determinations. The *de minimis* exemption does not apply to the "manufacture" of a Section 313 chemical except if that Section 313 chemical is "manufactured" as an impurity and remains in the product distributed in commerce below the appropriate *de minimis* level. The *de minimis* exemption does not apply to a byproduct "manufactured" coincidentally as a result of "manufacturing," "processing," "otherwise use," or any waste management activities.

  This *de minimis* exemption applies solely to "mixtures" and trade name products. EPA's long-standing interpretation has been that "mixture" does not include waste. Therefore, the *de minimis* exemption cannot be applied to Section 313 chemicals in a waste even if the waste is being "processed" or "otherwise used."

  When determining whether the *de minimis* exemption applies to a listed Section 313 chemical, the owner or operator should only consider the concentration of the Section 313 chemical in mixtures and trade name products in process streams in which the Section 313 chemical is undergoing a reportable activity. If the Section 313 chemical in a process stream is "manufactured" as an impurity, "processed," or "otherwise used" and is below the appropriate *de minimis* concentration level, then the quantity of the Section 313 chemical in that process stream does not have to be applied to threshold determinations nor included in release or other waste management determinations. If a Section 313 chemical in a process stream meets the *de minimis* exemption, all releases and other waste management activities associated with

the Section 313 chemical in that stream are exempt from EPCRA section 313 reporting. It is possible to meet an activity (e.g., processing) threshold for a Section 313 chemical on a facility-wide basis, but not be required to calculate releases or other waste management quantities associated with a particular process because that process involves only mixtures or trade name products containing the Section 313 chemical below the *de minimis* level.

Once a Section 313 chemical concentration is above the appropriate *de minimis* concentration, threshold determinations and release and other waste management determinations must be made, even if the chemical later falls below *de minimis* level in the same process stream. Thus, all releases and other quantities managed as waste which occur after the *de minimis* level has been exceeded are then subject to reporting. If a Section 313 chemical in a mixture or trade name product above *de minimis* is brought on-site, the *de minimis* exemption never applies.

The *de minimis* concentration level is consistent with the OSHA Hazard Communication Standard requirements for development of Material Safety Data Sheets (MSDSs). The *de minimis* level is 1.0 percent except if the Section 313 chemical is an OSHA-defined carcinogen. The *de minimis* level for OSHA-defined carcinogens is 0.1 percent. For mixtures or other trade name products that contain one or more members of a listed Section 313 chemical category, the *de minimis* level applies to the aggregate concentration of all such members and not to each individually. The list of Section 313 chemicals in the publication *Toxic Chemical Release Inventory Reporting Form R and Instructions* for the current reporting year contains the *de minimis* values for each of the Section 313 chemicals and chemical categories.

- **Materials that are processed or used as articles** - Quantities of a listed Section 313 chemical contained in an article do not have to be factored into threshold or release determinations when that article is processed or otherwise used at your facility. An article is defined as a manufactured item that is formed to a specific shape or design during manufacture, that has end-use functions dependent in whole or in part upon its shape or design during end-use, <u>and</u> that does not release a Section 313 chemical under the normal conditions of the processing or use of that item at the facility.

  If the processing or otherwise use of like articles results in a total release of less than 0.5 pounds of a Section 313 chemical in a calendar year to all environmental media, EPA will allow this release quantity to be rounded to zero, and the manufactured items remain exempt as articles. EPA requires facilities to round off and report all estimates to the nearest whole number. The 0.5-pound limit does not apply to each individual article, but applies to the sum of all releases from processing or otherwise use of like articles.

The article exemption applies to the normal processing or otherwise use of an article. It does not apply to the manufacture of an article. Thus, Section 313 chemicals processed into articles manufactured at a facility must be factored into threshold and release determinations.

A closed item containing Section 313 chemicals (e.g., a transformer containing PCBs) that does not release the Section 313 chemicals during normal use is considered an article if a facility uses the item as intended and the Section 313 chemicals are not released. If a facility services the closed item (e.g., a transformer) by replacing the Section 313 chemicals, the Section 313 chemicals added during the reporting year must counted in threshold determinations.

- **Materials that are structural components of the facility** - Chemicals present in materials used to construct, repair, or maintain a plant building are exempt from the activity thresholds. For example, solvents and pigments present in paint used to coat the structural components of a building would be exempt from threshold determinations.

- **Materials used for janitorial or facility grounds maintenance** - Chemicals present in materials used for routine or facility grounds maintenance are exempt from the activity thresholds. Examples include bathroom cleaners, fertilizers, and garden pesticides in the same form and concentration commonly distributed to consumers. Chemicals used for equipment maintenance, such as the use of oil or cleaning solvents, are not exempt.

- **Materials used with facility motor vehicles** - Chemicals present in materials used for operating and maintaining motor vehicles operated by the facility are exempt from the activity thresholds. Examples include gasoline, radiator coolant, and windshield wiper fluid used in equipment such as cars, trucks, forklifts, and tow motors.

- **Personal items** - Chemicals present in materials such as foods, drugs, cosmetics, or other personal items are exempt from the activity thresholds. Examples include materials used in the facility cafeteria and infirmary. Chemicals used for heating and air conditioning solely to provide comfort to personnel are also exempt from reporting. If a building's temperature is regulated to facilitate a process or treatment operation, the Section 313 chemicals used to heat or cool the building are not exempt. Units that supply both personal comfort and operational needs may be apportioned, if it is possible to separate them.

- **Laboratory materials** - Chemicals used in certain laboratory activities that are conducted under the supervision of a technically qualified individual (as defined under 40 CFR §720.3(ee)) are exempt from the activity thresholds. The laboratory activities exemption

applies only to sampling and analysis, research and development, and quality assurance and quality control activities. The exemption does not apply to the use or production of listed Section 313 chemicals in pilot-plant operations and laboratories for distribution in commerce (e.g., specialty chemicals) and laboratory support services.

- **Materials as they are drawn from the environment or municipal sources -** Chemicals contained in intake water (used for processing or non-contact cooling) or in intake air (used either as compressed air or for combustion) are exempt from the activity thresholds.

- **Property owners -** Property owners that merely own real estate on which a facility covered by Section 313 is located and have no business interest in the operation of that facility (e.g., a company owns an industrial park) are exempt for Section 313 reporting. The operator of that facility, however, is subject to reporting requirements.

SUPPLIER NOTIFICATION REQUIREMENTS

Because manufacturers reporting under Section 313 must know the Section 313 chemical composition of the products they use to be able to accurately calculate releases, EPA requires some suppliers of mixtures or trade name products containing one or more of the listed Section 313 chemicals to notify their customers of the identity of the chemical in the mixture or the trade name product. This requirement has been in effect since January 1, 1989.

A facility must comply with the Section 313 supplier notification requirements if it owns or operates a facility which meets all of the following criteria.

- The facility is in SIC codes 20-39,

- The facility manufactures, imports, or processes a Section 313 chemical, and

- The facility sells or otherwise distributes in commerce a mixture or trade name product containing the Section 313 chemical to either:
    - A facility described in 40 CFR §372.22 (covered facility group), or

    - A facility that then sells the same mixture or trade name product to a facility described in 40 CFR §372.22 (covered facility group).

The supplier notification requirements do not apply to TRI chemicals that are themselves wastestreams or are constituents of wastestreams.

LISTED SECTION 313 CHEMICALS

Appendix A to this document contains an alphabetical listing of the chemicals subject to Section 313 reporting at the time of publication of this document, including their *de minimis* concentrations. EPA publications *Common Synonyms for Section 313 Chemicals* (EPA 745-R-95-008) and *Consolidated List of Chemicals Subject to Reporting Under the Act (Title III List of Lists)* (EPA-550-B-96-015) may also be useful references when reviewing the chemicals at your facility for Section 313 coverage.

The list of Section 313 chemicals is amended frequently. Users of this guidance document or other documents listing Section 313 chemicals are cautioned that changes may have occurred to the list of Section 313 chemicals since publication of the original list or addition of the chemical through administrative action. The list of Section 313 chemicals presented in the *Toxic Chemical Release Inventory Reporting Form R and Instructions* for the current reporting year should always be consulted as the most up-to-date source of currently listed Section 313 chemicals. For the latest information on Section 313 chemical listings, contact the EPCRA Hotline at 1-800-535-0202.

Some of the Section 313 chemicals have qualifiers included with their names. Reporting on these chemicals are determined by the conditions specified in the qualifiers. Chemicals that are listed without parenthetic qualifiers are subject to reporting in <u>all forms</u> in which they are manufactured, processed, or otherwise used. Descriptions of the qualifiers are as follows:

- **Fume or dust** - Three of the metals on the list of Section 313 chemicals (aluminum, vanadium, and zinc) contain the qualifier "fume or dust." Fume or dust refers to dry forms of these metals, not to "wet" forms such as solutions or slurries. Thus, a facility should determine if, for example, it generated more than 25,000 pounds of "aluminum (fume or dust)." Similarly, there may be certain technologies in which one of these metals is processed in the form of a fume or dust to make other Section 313 chemicals or other products for distribution in commerce. In reporting releases, the facility would report only releases of the fume or dusts.

  EPA considers dusts to consist of solid particles generated by any mechanical processing of materials including crushing, grinding, rapid impact, handling, detonation, and decrepitation of organic and inorganic materials such as rock, ore, and metal. Dusts do not tend to flocculate,

except under electrostatic forces. A fume is an airborne dispersion consisting of small solid particles created by condensation from a gaseous state, in distinction to a gas or vapor. Fumes arise from the heating of solids such as aluminum. The condensation is often accompanied by a chemical reaction such as oxidation. Fumes flocculate and sometimes coalesce. Other metals, (e.g., such as lead or copper) are not limited by this qualifier and are subject to reporting in all forms (fume, dust, and wet).

- **Manufacturing qualifiers -**Two of the entries in the Section 313 chemical list contain a qualifier relating to manufacture. For isopropyl alcohol, the qualifier is "manufacturing - strong acid process". For saccharin the qualifier simply is "manufacturing." For isopropyl alcohol, the qualifier means that only facilities manufacturing isopropyl alcohol by the strong acid process are required to report. In the case of saccharin, only manufacturers of the Section 313 chemical are subject to the reporting requirements. A facility that processes or otherwise uses either Section 313 chemical would not be required to report for those chemicals. In both cases, the facility is not required to provide supplier notification because only the manufacturer, not the user, of the Section 313 chemical must report.

- **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)** - The qualifier for ammonia means that anhydrous forms of ammonia are 100 percent reportable and aqueous forms are limited to 10 percent of total aqueous ammonia. Therefore, when determining thresholds, releases, and other waste management quantities all anhydrous ammonia is included but only 10 percent of total aqueous ammonia is included. Any evaporation of ammonia from aqueous ammonia solutions is considered anhydrous ammonia and should be included in the appropriate threshold and release determinations.

- **Phosphorus (yellow or white)** - The listing for phosphorus is qualified by the term "yellow or white" This means that only manufacturing, processing, or otherwise use of phosphorus in the yellow or white chemical forms require reporting. Conversely, manufacturing, processing, or otherwise use of "black" or "red" phosphorus does not trigger reporting.

- **Asbestos (friable)** - The listing for asbestos is qualified by the term "friable," referring to the physical characteristic of being able to be crumbled, pulverized, or reducible to a powder with hand pressure. Only manufacturing, processing, or otherwise use of asbestos in the friable form triggers reporting.

- **Aluminum oxide (fibrous forms)** - The listing for aluminum oxide is qualified by the term "fibrous forms." Fibrous refers to a man-made form of aluminum oxide that is processed to

produce strands or filaments which can be cut to various lengths depending on the application. Only manufacturing, processing, or otherwise use of aluminum oxide in the fibrous form triggers reporting.

- **Hydrochloric acid and sulfuric acid (acid aerosols including mists, vapors, gas, fog, and other airborne forms of any particle size)** - The qualifier for hydrochloric acid and sulfuric acid means that only aerosol forms of this chemical are reportable. Aqueous solutions are not covered by this listing, but airborne forms generated from aqueous solutions are covered.

- **Nitrate compounds (water dissociable; reportable only when in an aqueous solution)** - The qualifier for the nitrate compounds category limits the reporting to nitrate compounds that dissociate in water, and thereby generate nitrate ions. For the purposes of threshold determinations, the entire weight of the nitrate compound must be included in all calculations. For the purposes of reporting releases and other waste management quantities, only the weight of the nitrate ion should be included in the calculations of these quantities.

WHAT MUST BE REPORTED?

If your facility is included in the specified set of SIC codes, has ten or more full-time employees or the equivalent, and manufactures, processes, or otherwise uses one of the listed Section 313 chemicals in amounts greater than the appropriate thresholds, you must report the following information on Form R:

- Name and location of your facility;

- Identity of the listed Section 313 chemical (unless you claim its identity to be a trade secret);
- Whether you manufacture, process, or otherwise use the chemical any other way;

- Maximum quantity of the chemical on-site at any time during the year;

- Quantities of the chemical released during the year to environmental media, including both accidental spills and routine emissions;

- Quantities of the chemical subject to on site waste management actions, including recycling, energy recovery, or waste treatment;

- Off-site locations to which you shipped wastes containing the chemical and the quantities of the chemical sent to those locations;

- Information on source reduction activities; and

- Treatment methods used for wastes containing the chemical and estimates of their efficiency for the reportable Section 313 chemical.

A release is defined under EPCRA Section 329(8) as any spilling, leaking, pumping, pouring, emitting, emptying, discharging, injecting, escaping, leaching, dumping, or disposing into the environment of any listed Section 313 chemical. The definition of release includes the abandonment or discarding of barrels, containers, and other closed receptacles. Separate release estimates must be provided for releases to air, water, and land (e.g., deep well injection, surface impoundment, permitted landfill).

DOCUMENTING REPORTING EFFORTS

Sound recordkeeping practices are essential for accurate and efficient TRI reporting. EPA requires that facilities keep a copy of each Form R or Form A report filed for at least three years from the date of submission (40 CFR §372.10). These reports will also be of use to facilities in subsequent years when completing future Form R or Form A reports. EPA also requires that facilities maintain those documents, calculations, worksheets, and other forms upon which they relied to file Form R or Form A reports. EPA may request this supporting documentation from the facility, for example, to conduct data quality reviews of present or past Form R or Form A submissions.

Supporting documentation, organized by year, that a facility should maintain may include, if applicable:

- Previous years' Forms Rs and Form As;
- Section 313 Reporting Threshold Worksheets (a sample worksheet is given in the *Toxic Chemical Release Inventory Reporting Form R and Instructions* document;
- Engineering calculations and other notes;
- Purchase records from suppliers;
- Inventory data;
- EPA (NPDES) permits and monitoring reports;
- EPCRA Section 312, Tier II Reports;

- Monitoring records;
- Flowmeter data;
- RCRA Hazardous Waste Generator's Report;
- Pretreatment reports filed by the facility with the local government;
- Invoices from waste management companies;
- Manufacturer's estimates of treatment efficiencies;
- RCRA Manifests; and
- Process diagrams.

SECTION 3
MAKING THE THRESHOLD DETERMINATION

A separate Toxic Chemical Release Inventory Reporting Form must be submitted for each listed chemical that is "manufactured," "processed," or "otherwise used" above an activity threshold at your facility, assuming the SIC code and employee criteria are met. See Table 3-1 for illustrative examples of these threshold activities.

Table 3-1 Examples of Manufactured, Processed, and Otherwise Used Chemicals at Coal and Oil-fired Electricity Generating Facilities *

Manufactured Chemicals
The coincidental manufacturing of EPCRA Section 313 reportable chemicals that directly result from the combustion of coal and oil are subject to the **manufacturing** activity threshold. All chemicals that are manufactured during the combustion process are byproducts separate from the product (power generation). Because the *de minimis* exemption does not apply to a Section 313 chemical manufactured at the facility as a byproduct that does not remain in the primary product distributed by the facility, metal compounds which were manufactured during combustion are not subject to the *de minimis* exemption. The entire weight of a metal compound manufactured during combustion must be applied toward the 25,000 pound threshold, not just the weight of the parent metal.
During combustion, if an elemental metal is converted to a metal compound; if a metal compound is converted to an elemental metal; or if one metal compound is converted to another metal compound (even if it is within the same Section 313 metal compound category); then **manufacturing** has occurred. The quantity of the Section 313 metal or metal compound manufactured must be counted towards the 25,000 pound threshold. The question is not whether a metal's valence state has changed, but whether a new metal or metal compound was created. In these circumstances, the *de minimis* exemption does not apply because a Section 313 chemical was manufactured as a byproduct of the combustion process. There may be cases in which a metal compound is not changed at all during combustion. For example, if beryllium oxide in coal remains as beryllium oxide after combustion, a metal compound has not been manufactured. In this example, the *de minimis* exemption could be used, because the Section 313 chemical was otherwise used.

Activity	Examples
Produced or imported for on-site use/processing	Maintenance chemicals, coal or limestone containing Section 313 chemicals imported into the customs territory of the United States.
Produced or imported for sale/distribution	May not occur in the electricity generating industry.
Produced as a by-product	Hydrogen fluoride or hydrochloric acid or sulfuric acid aerosol emissions in the stream leaving the boiler and in the stack gas during the combustion of feed coal. The coincidental manufacturing of metal compounds during the combustion of coal and oil, such as, oxides of copper and manganese.
Produced as an impurity	May not occur in the electricity generating industry.
Processed Chemicals	
The recovery of a listed Section 313 chemical from a mixture for further distribution in commerce is processing of that chemical. Solvent recovery, metal recovery, and other reclamation of Section 313 chemicals manufactured as a byproduct or otherwise used by the facility (e.g., flue gas desulfurization byproducts used to produce gypsum), that result in a product that is further distributed beyond the facility should be considered in your threshold determination for **processing** activities.	
Activity	**Examples**
As a reactant	May not occur in the electricity generating industry.
As a formulation component	May not occur in the electricity generating industry.
As an article component	May not occur in the electricity generating industry.
Repackaging	Facilities may repackage and process fly ash resulting from combustion, for purposes of distribution in commerce.

Otherwise Used Chemicals	
When combusted for energy production, all constituents of coal and oil are subject to the **otherwise use** activity threshold because the constituents are not incorporated into the product (the energy produced) and, therefore, the *de minimis* exemption applies for this activity. Hence, chemicals present in coal and oil below *de minimis* levels would not be subject to reporting under the otherwise use activity.	
The use of EPCRA Section 313 Section 313 chemicals in support activities such as cleaning, maintenance, and purification constitutes **otherwise use** of that chemical.	
The use of a Section 313 chemical to treat another chemical constitutes **otherwise use.**	
Activity	**Examples**
As a chemical processing aid	May not occur in the electricity generating industry.
As a manufacturing aid	Metal used to maintain power lines within the facility.
Ancillary or other use	Combustion of coal or oil containing Section 313 chemicals above the *de minimis* level. Ethylene glycol sprayed on coal to prevent freezing. Thiourea used as an inhibitor in cleaning solution for removal of scale deposits and metals from tube walls.

* More complete discussions of the industry-specific examples can be found in Section 5 of this guidance manual.

CONDUCTING THE THRESHOLD DETERMINATION

STEP ONE
Identify Section 313 chemicals that are manufactured, processed or otherwise used.

An activity threshold determination must be made individually for each Section 313 chemical by each activity in which the chemical is manufactured, processed, or otherwise used at your facility. The threshold determination is one criterion used to ascertain whether a Form R or Form A is required to be submitted.

The primary function of coal and oil-fired electricity generating facilities is to generate electricity for distribution in commerce. Most activities performed by electricity generating facilities may involve Section 313 Section 313 chemicals that are "manufactured" (such as the coincidental manufacture of metal compounds during combustion activities), or "otherwise used" (such as the use of chemicals for intake water treatment, neutralization of waste stream, or in equipment cleaning). Aside from coincidental manufacturing, the combustion of coal or oil constitutes otherwise use.

STEP TWO
Identify "processing" and "otherwise use" activities that are subject to exemptions. Exclude chemicals associated with these activities from your threshold determination.

Any chemical purchased by facilities for use as processing or manufacturing aids or for treating waste are considered "otherwise used". In addition, EPCRA Section 313 chemicals in materials purchased to be used as fuel or for maintaining equipment operations, other than for maintaining motor vehicles, should be included in the threshold determination for "otherwise use" activities. Any EPCRA Section 313 chemicals in materials purchased to be used in the waste management processes should also be included in the threshold determination for "otherwise use" activities.

When performing your threshold determinations, it is important to remember that exemptions apply to certain facility-related activities. These exemptions were discussed in Section 2 of this guidance document and may apply only to certain "manufacturing," "processing," or "otherwise use" activities. For the purposes of an activity threshold analysis, the following areas should be examined closely to determine whether the TRI chemicals subject to certain activities should be included in the activity threshold and reporting calculations:

- **Laboratories:** Sampling and analysis, research and development (R&D), and QA/QC activities undertaken in laboratories are exempt if conducted under the supervision of a technically qualified individual. Pilot plants and support services, such as photo processing, waste water treatment, and instrument sterilization are not exempt. Wastes generated during sampling and analysis, R&D, and QA/QC activities in an on-site laboratory are exempt.

- **Motor vehicles:** Use of products containing Section 313 chemicals for the purpose of most motor vehicle maintenance activities are exempt, as well as fuel used in those vehicles.

- **Routine janitorial or facility grounds maintenance:** The routine maintenance exemption is intended to cover janitorial or other custodial or plant grounds maintenance activities using such substances as bathroom cleaners, or fertilizers and pesticides used to maintain lawns, in the same form and concentration commonly distributed to consumers. Equipment maintenance such as the use of oil or grease is not exempt.

- **Structural component of the facility:** This exemption covers Section 313 chemicals that are incorporated into the structural components of the facility (e.g., metal in pipes) or that are used to ensure or improve the structural integrity of a structure (e.g., paint). The facility is not required to report the releases of Section 313 chemicals that result from

"passive" degradation (degradation or corrosion that occurs naturally in structural components of facilities).

- **Materials as they are drawn from the environment or municipal sources-** Chemicals contained in intake water (used for processing or non-contact cooling) or in intake air (used either as compressed air or for combustion) are exempt from the activity thresholds. However, EPCRA Section 313 chemicals manufactured from use of the air or water are not exempt and must be considered for the threshold determination.

A *de minimis* exemption applies only to Section 313 chemicals in mixtures or trade name products manufactured as impurities or processed or otherwise used in mixtures or trade name products. This exemption does not apply to chemicals that are manufactured as byproducts nor does it apply to chemicals in wastes that are processed or otherwise used.

STEP THREE

Determine whether TRI chemicals are present in mixtures or trade name products that are processed or otherwise used below the *de minimis* concentration threshold and eliminate from further consideration in your processing and otherwise use threshold determination those chemicals below *de minimis*, unless those chemicals are later concentrated. Also determine whether chemicals are present as impurities below the *de minimis* concentration threshold in manufactured products and eliminate from further consideration in your manufacturing threshold determination those chemicals below *de minimis*.

To perform a comprehensive and accurate activity threshold analysis, the facility should first determine what Section 313 chemicals (such as metals and metal compounds) are present in the fuel (coal or oil) and then identify and quantify the metal compounds that are produced during and after the combustion process. As to the latter analysis, the facility need to determine which of the chemicals are present below *de minimis*, because none of the chemicals manufactured remain in the primary product (i.e. thermally generated electricity) as impurities and therefore are not eligible for the *de minimis* exemption (an impurity is the residual amount of chemical remaining in a final product for distribution in commerce). Next, the facility should determine what other Section 313 chemicals are otherwise used, such as chemicals used in water treatment, waste management and plant maintenance. Section 313 chemicals above *de minimis* levels in coal or oil must be included in the otherwise use threshold determination.

Section 313 chemicals present at less than 1 percent (<10,000 ppm) for chemicals that do not meet the OSHA carcinogen standard or less than 0.1 percent (<1,000 ppm) for chemicals that do meet the OSHA carcinogen standard do not have to be considered when making your threshold

determinations for processing or otherwise use. Appendix A to this document contains the list of Section 313 chemicals subject to reporting, along with the *de minimis* concentration associated with the chemical. The list of Section 313 chemicals in the publication *Toxic Chemical Release Inventory Reporting Form R and Instructions* for the current reporting year should also be checked to determine whether the list of chemicals has been updated (e.g., changes in listed chemicals and chemical categories, and *de minimis* levels).

The combustion process involves the coincidental manufacturing of Section 313 reportable chemicals (metals, metal compounds, and formaldehyde), usually as a result of oxidation. Electricity generating facilities should closely examine what metals and metal compounds are manufactured during combustion.

The elemental metals aluminum, vanadium, and zinc (with the qualifier "fume or dust") are considered manufactured when they are converted from a non-fume or non-dust form to a fume or dust form. This may occur during the combustion of fuel. Notice that this qualifier of fume or dust applies only to the elemental form of aluminum, vanadium, and zinc.

If the Section 313 chemicals were manufactured as a result of the combustion process, determine if the 25,000 pounds threshold for "manufacturing" activities is met. For threshold determinations for Section 313 metal compound categories, the entire weight of the metal compound must be applied towards the threshold, not just the weight of the metal itself. However, only the quantity of the parent metal released or otherwise managed is reported.

Finally, some waste treatment activities will involve the conversion or reaction of chemicals to produce a new Section 313 chemical, such as occurs with chemical oxidation or chemical precipitation.

Threshold determinations are made based on the best available information in your possession. However, if a facility is aware that a chemical is probably present in a mixture, but has no information on its concentration in the mixture, then they are not required to consider that chemical in its threshold determinations. Though, in general, the following methods should be employed to determine the appropriate concentrations to use in threshold determinations:

STEP FOUR

Gather data needed for calculations of threshold determination, including:

- **Inventory Data**
- **Consumption Information**
- **Supplier Notification**
- **Ore Sampling and Analysis Data**
- **MSDS**
- **Analysis of Waste Products**
- **Permits**

- If the exact concentration is known (e.g., 33.0% toluene), use it.
- If only the upper bound is known (e.g., <5% toluene), use it (e.g., 5% toluene).
- If only the concentration range is known (e.g., 10-30% toluene), then use the midpoint (e.g., 20% toluene).
- If only the lower bound is known, assume the upper bound is 100%. Factor out other known constituents (e.g., 10% water and >60%toluene), create a range (e.g., 60-90% toluene) and then use the midpoint (e.g., 75% toluene).

In cases where certain materials that have broad ranges or high upper bounds for multiple constituents (e.g., %x+%y+%z=110% of mixture), the total components of a mixture should not exceed 100%. In these instances, the best available information should be used to estimate the approximate concentration of the chemicals in the material. However, if a facility is aware that a chemical is probably present in a mixture, but has no information on its concentration in the mixture, then they are not required to consider that chemical in its threshold determinations.

STEP FIVE

Calculate the quantity of each chemical manufactured, processed and otherwise used, in pounds, to determine whether the activity threshold has been exceeded. The Form R must be completed for each chemical otherwise used in excess of 10,000 pounds and for each chemical processed in excess of 25,000 pounds, for each chemical manufactured in excess of 25,000 pounds.

In determining threshold quantities and release and other waste management quantities of Section 313 reportable metals and metal compounds coincidentally manufactured from the combustion of coal and oil or from treatment to remove sulfates and ash-forming materials, it is not necessary to measure the change in valence state of the metals. These determinations can be performed by either estimating or measuring the metal compounds that are created after the combustion process. Calculations are to be based on readily available data. These data may include monitoring data collected pursuant to other laws and regulations, and, if no such data exist, then calculations should be based on reasonable estimates. Data on what occurs to metal constituents in coal during the combustion process suggest that most, if not all metals, are present as some form of metal compound that does not usually survive combustion. Therefore, if no data are available which identify specific metal compounds being produced, a facility may assume that the metals in the coal are converted to the lowest weight metal oxide possible. This engineering assumption can be used in determining the threshold quantities of all metals in coal or

fuel oil. It is unlikely that using this estimation method would cause any facility that is not exceeding thresholds to report because at least some, if not many, of the metal compounds manufactured as a result of combustion will be heavier than the lowest weight metal oxide.

The best available information should be used to estimate the approximate concentration of the chemical in the coal or fuel oil. If you have data regarding chemical concentrations in the coal or fuel oil, use the data. If specific concentration data of Section 313 chemicals in coal or fuel oil are not available, your facility may use the default values provided in Tables 3-2, 3-3, and 3-4. Table 3-2 lists concentrations of Section 313 metals typically found in different types of coal. Unless the facility has information to support use of the low or mid concentration values, the facility should calculate threshold determinations using the highest concentration values in Table 3-2, Tables 3-3, and 3-4 list concentrations of metals and metal compounds typically found in coal and No. 6 fuel oil, and based on these concentrations, the amount of coal or oil one needs to consume to manufacture 25,000 pounds of the metal compound. To calculate the amount of Section 313 metal compounds manufactured during combustion using the assumption that metals will be converted to the lowest weight metal oxide possible, facilities must know the amount of elemental metal in the coal. The one exception to using metal oxides for determining threshold quantities may be mercury. Data indicate that most mercury remains volatilized as elemental mercury after combustion rather than converted to a metal compound. Therefore, the weight of the metal, rather than that of the metal oxide, can be used in threshold determinations, and this amount then applied towards the manufacture activity threshold for mercury.

Unlike metals that can form new compounds subject to the activity threshold for manufacturing, chemical components of fuel oil that are burned for combustion are subject to the activity threshold for otherwise use. Benzo(a)anthracene, a member of the polycyclic aromatic compound chemical category, is found in No. 6 fuel oil at a concentration of 1.13 weight percent, which is above the *de minimis* concentration. Thus, approximately 110,619 gallons of No. 6 fuel oil are needed to exceed the 10,000 pound threshold for otherwise use. 1,2,4 Trimethylbenzene is found in No. 2 fuel oil and diesel oil at a concentration of 1.0 weight percent. Thus, approximately 142,857 gallons of No. 2 Fuel Oil or Diesel Oil are needed to exceed the otherwise use threshold for 1,2,4 Trimethylbenzene. Other organics are not expected to be present at or above *de minimis* concentrations.

Combustion of coal and fuel oil may result in emissions of hydrochloric acid (HCl) in aerosol form, hydrogen fluoride (HF), sulfuric acid, and/or formaldehyde. If aerosol forms of hydrochloric or sulfuric acid are produced during or after combustion and are present in the flue gas, the amount produced must be applied to the manufacturing threshold. In the absence of better data, facilities can use the HCl and HF emission factors presented in Table 3-5. Use the emission factor that corresponds to the type of coal being combusted. If a facility combusts a

mixture of coal types, and knows the mixture ratio, it may apply this ratio to the emission factors in Table 3-5. Facilities that do not know the type of coal they use should assume the coal is bituminous or subbituminous, since these types are commonly used. The factors in Table 3-5 are more appropriate than AP-42 factors, which are averages of factors for each type of coal. Table 3-6 lists emission factors of formaldehyde produced during the combustion of coal and No. 6 fuel oil, and based on these emission factors, the amount of coal or fuel oil one needs to consume to manufacture 25,000 pounds of the chemical. In the absence of better information, the emission factors in these tables can be used to calculate threshold determinations. For guidance on calculating the amount of sulfuric acid manufactured during combustion, refer to: *Emergency Planning and Community Right-to-Know Act--Section 313: Guidance for Reporting Sulfuric Acid (acid aerosols including mists, vapors, gas, fog, and other airborne forms of any particle size)*, EPA, August 1997.

An example of how to determine the quantities of Section 313 chemicals manufactured is given in the box on the following page.

Calculating Thresholds for Hydrochloric Acid and Selenium

A facility combusts 1 million tons of subbituminous coal in the reporting year. What quantity of selenium compounds and HCl (aerosol) are manufactured?

Hydrochloric Acid:
The HCl emission factor for subbituminous coal is 1.9 lb/ton coal (see Table 3-5).

1.9 lb HCl/ton coal x 1,000,000 tons coal = 1,900,000 pounds HCl

Therefore, 1.9 million pounds of HCl are manufactured and the 25,000 pound threshold has been exceeded. Form R reporting for HCl (aerosol) is required.

Selenium Compounds:
Based on the high-end concentration of selenium in Table 3-2, the emission factor for selenium oxide (SeO_2) is 11.2 μg/g (see Table 3-3), or 2.24×10^{-2} lb SeO_2/ton coal.

2.24×10^{-2} lb SeO_2/ton coal x 1,000,000 tons of coal = 22,400 pounds of SeO_2 emitted.

Therefore, 22,400 pounds of selenium compounds are manufactured and the 25,000 pound threshold was not exceeded. Form R reporting for selenium compounds is not required.

Table 3-2. Total Constituent Concentrations of Section 313 Chemicals in Coal			
Element Concentrations in Different Types of Coal (micrograms/gram of coal)			
Element	Low	Mid	High
Antimony	0.2	7.1	14
Arsenic	0.5	53.25	106
Barium	150	200	250
Cadmium	0	3.25	6.5
Chromium	0	305	610
Copper	1.8	93.4	185
Lead	4	111	218
Manganese	6	93.5	181
Mercury	0.01	0.81	1.6
Nickel	0.4	52.2	104
Selenium	0.4	4.2	8
Silver	0.04	0.06	0.08
Vanadium	0	640.5	1,281
Zinc	0	2,800	5,600

Note: The mid range value is the average of low and high estimates provided in Table VIII.2 from U.S. EPA, SIC Code Profile 49: Electric, Gas, and Sanitary Services. Report Prepared by Science Applications International Corporation. June 1996.

Note: The metals and concentrations in Table 3-2 are provided for elemental metal. In actuality, metals are expected to be present in coal as metal compounds, and consequently, are expected to be at higher concentrations than reported in the table. See Table 3-3 for these metal compound values.

Table 3-3 Chemical Concentrations of Select Section 313 Metal Compound Constituents of Coal and Tons of Coal Needed to Manufacture 25,000 Lbs. of the Metal Compound			
Section 313 Metal/Metal Compound (oxide) That May Be Manufactured	Metal Concentration (micrograms/gram) in Coal	Metal Compound Concentration (micrograms/gram) in Coal	Approximate Tons of Coal Needed To Be Consumed to Manufacture 25,000 Lbs. of the Metal Compound
Zinc/ZnO	5,600	6971	1,800
Chromium/CrO_3	610	1,173	10,700
Barium/BaO_2	250	308.3	40,500
Manganese/MnO_2	181	286.4	43,600
Lead/PbO_2	218	251.7	49,700
Copper/CuO	185	231.6	54,000
Arsenic/As_2O_5	106	162.6	76,900
Nickel/NiO	104	132.3	94,500
Antimony/Sb_2O_5	14	18.6	670,000
Selenium/SeO_2	8	11.2	1,116,100
Beryllium/BeO	1.7	4.72	2,647,500
Cadmium/CdO	6.5	7.43	1,682,400
Mercury/HgO	1.6	1.73	7,225,400
Cobalt/CoO	0.15	0.19	65,791,000
Silver/AgO	0.08	0.09	138,888,900

Source: Adapted from *Economic Analysis of the Final Rule to Add Certain Industry Groups to EPCRA Section 313*, Appendix D, Table D-2 (based on high-end concentration values) and Appendix E, Table E-3.

Table 3-4 Concentrations of Section 313 Constituents and their Compounds Found In No. 6 Fuel Oil and Tons of Oil Needed To Manufacture 25,000 Lbs. of the Chemical

Fuel Oil Constituents	Concentration (micrograms/gram)	Compound Concentration (micrograms/gram)	Approximate Tons of Fuel Oil Needed To Be Consumed to Manufacture 25,000 Lbs. of the Metal Compound (assuming 8 lbs./gallon density for No. 6 Fuel Oil)
Manganese/MnO_2	50.0	79.1	158,000
Nickel/NiO	37.5	47.7	262,000
Lead/PbO_2	1.0	1.2	10,831,000
Cadmium/CdO	0.3	0.3	36,500,000
Copper/CuO	0.3	0.4	33,291,000
Cobalt/CoO	0.15	0.19	65,790,000
Selenium/SeO_2	0.09	0.13	98,870,000
Beryllium	0.08	0.22	56,277,000
Antimony	0.01	0.01	944,149,000
Arsenic/As_2O_5	0.058	0.088	140,503,000
Mercury/HgO	0.005	0.005	2,301,136,000
Chromium/CrO_3	0.0045	0.009	1,444,539,000
Silver/AgO	0.0002	0.0002	53,571,429,000

Source: *Economic Analysis of the Final Rule to Add Certain Industry Groups to EPCRA Section 313*, Appendix E, Table E-6.

Table 3-5 Emission Factors For HCl and HF Manufactured During Combustion of Coal			
Source	SCC	Emission factor[a]	
		HF	HCl
Anthracite Coal			
pulverized coal	1-01-001-01	0.18	0.91
traveling grate stokers	1-01-001-02	0.18	0.91
Bituminous Coal			
pulverized coal: wet bottom	1-01-002-01	0.23	1.9
pulverized coal: dry bottom	1-01-002-02	02.3	1.9
cyclone	1-01-002-03	0.23	1.9
spreader stoker	1-01-002-04	0.23	1.9
traveling grate (overfeed) stoker	1-01-002-05	0.23	1.9
pulverized coal: dry bottoom (tangential firing)	1-01-002-12	0.23	1.9
atmospheric fluidized bed	1-01-002-17	0.23	1.9
Subbituminous coal			
pulverized coal: wet bottom	1-01-002-21	0.23	1.9
pulverized coal: dry bottom	1-01-002-22	0.23	1.9
cyclone	1-01-002-23	0.23	1.9
spreader stoker	1-01-002-24	0.23	1.9
traveling grate (overfeed) stoker	1-01-002-25	0.23	1.9
pulverized coal: dry bottoom (tangential firing)	1-01-002-26	0.23	1.9
Lignite			
pulverized coal	1-01-003-01	0.01	0.01
pulverized coal: tangential firing	1-01-003-02	0.01	0.01
cyclone	1-01-003-03	0.01	0.01

Table 3-5 Emission Factors For HCl and HF Manufactured During Combustion of Coal			
Source	SCC	Emission factor[a]	
		HF	HCl
traveling grate (overfeed) stoker	1-01-003-04	0.01	0.01
spreader stoker	1-01-003-06	0.01	0.01

Source: *Hydrogen Chloride and Hydrogen Fluoride Emission Factors for the NAPAP Emission Inventory; 1985*

Table 3-6 Emission Factors and Triggering Thresholds For Formaldehyde Manufactured During Combustion of Coal and No. 6 Fuel Oil		
Chemical	Emission Factor (lbs./ton)	Approx. Tons of Fuel Oil Combusted to Manufacture 25,000 lbs. of Formaldehyde
Formaldehyde	170.5 lbs./10^{12} BTU	na[b]
Formaldehyde	0.00075[a]	33,333,000

Source: *Economic Analysis of the Final Rule to Add Certain Industry Groups to EPCRA Section 313*, Appendix E, Table E-10.

[a] Emission factor is an average range of data for industrial oil-fired boilers and furnaces. Note that the document cautions that "Since formaldehyde is a product of incomplete combustion, it is likely that modern units, particularly for utilities, would have lower emissions than those in these tests which date to the mid-1960's. Additional emissions testing is clearly needed to establish reliable boiler emission factors for formaldehyde.

[b] Reporting estimates for formaldehyde relied on coal BTU values in Utility Data Institute data for each plant. Approximate tons of coal needed to trigger reporting was therefore not determined.

SECTION 4
OVERVIEW OF SECTION 313 RELEASE ESTIMATION

This section presents general guidelines for preparing Section 313 release estimates. It begins with a discussion of general ideas on estimating chemical releases. A section-by-section discussion of release and waste management reporting requirements follows.

GENERAL CONCEPTS

Release Estimation

A Form R or Form A must be completed for each Section 313 chemical that meets the applicable activity thresholds. Each form requests facility specific information and identifies the chemical for which thresholds were exceeded. Form A (the abbreviated report) includes a statement that the facility did not exceed specified amounts while, the main components of Form R are environmental release estimates to all media for the reportable chemical during the preceding calendar year. This includes all wastes containing the reportable Section 313 chemical that are sent off-site from the facility for further waste management. Specifically, facility release estimates must be made for the following release sources:

- Releases to air from fugitive or non-point sources (Section 5.1)
- Releases to air from stack or point sources (Section 5.2)
- Releases to water directly discharged to a receiving stream (Section 5.3)
- Releases in wastes that are injected underground (Section 5.4)
- Releases to land on-site (Section 5.5)
- Releases to water discharged to a publicly owned treatment works (POTW) (Section 6.1)
- Wastes transferred off-site for recycling, energy recovery, waste treatment, or disposal (Section 6.2).

Development of accurate and comprehensive release estimates requires consideration of all possible release pathways. The threshold determination provides valuable information when beginning the release estimation process for a Section 313 chemical: each material containing a Section 313 chemical is identified. For each of these materials, the facility should identify all potential release sources. A useful way to do this is to draw a process flow diagram that traces the material's path through the plant. The process flow diagram should identify each major piece of equipment (including pollution control devices) through which the material passes, from its initial entry into the facility to its final disposition. The diagram should also identify all potential release sources and pollution control equipment for the chemical.

After you have identified all the potential release sources for a chemical, you can estimate releases for each source. Often, the starting point for a release estimate is chemical throughput data, which are typically available from threshold determination calculations.

Given the chemical throughput quantities for a process, you must apply other data and assumptions to complete the estimates. This information includes process-specific data (e.g., scrubber efficiency) and any data developed for other environmentally oriented purposes (e.g., air and wastewater monitoring data, air and water permits and permit applications, RCRA manifest data, monitoring data).

Section 313 does not require any new monitoring to be performed. Facilities should use existing data to calculate release estimates. The accuracy of a release estimate is proportional to the quantity and quality of the data used in its preparation. Situations may arise where estimates based on one set of data contradict estimates based on another. In such cases, the facility should document the rationale for using one data set (or method) versus another. If a facility is aware that a chemical is probably present but has no method to estimate releases or quantities on site, then they are not required to report on that chemical.

Release estimates can be developed by combining all available data with assumptions concerning the fate of each chemical in the process. There are four general methods for developing a release estimate. These methods may be used together or in sequence in developing release estimates.

- **Direct measurement** (basis of estimate code = M; entered in Part II Sections 5 and 6) - These are estimates based on actual monitoring of the concentration of a chemical. The chemical's concentration in the waste stream multiplied by the flow rate or volume of the waste stream and its density yields the mass of the chemical released. Direct measurement is typically used to estimate releases via wastewater, solid waste, and hazardous waste, in part, to ensure compliance with applicable environmental regulations. Although this estimation method should yield the most accurate results, only rarely are sufficient data available for

direct measurement data to be applied without also resorting to other techniques (e.g., engineering calculations, mass balance). The frequency of the direct measurements should be taken into account when determining if monitoring data alone are sufficient for making a reasonable estimate. For example, if a facility has only gathered monitoring data once throughout the year, other methods may provide a more accurate estimate.

Note an indication that reportable chemical is below detection is not equivalent to stating that the chemical is not present. If the reportable Section 313 chemical is known to be present, a concentration equivalent to half the detection limit should be used in subsequent calculations of release estimate quantities (i.e., if the limit of detection is 10 mg/l, release calculations should be performed using a concentration of 5 mg/l). If the reportable Section 313 chemical is not known to be present in the waste, then 0 percent can be assumed.

- **Mass balance** (basis of estimate code = C entered in Part II, Sections 5 and 6) - These are estimates based on a knowledge of the quantity of a chemical entering and leaving a process. An imaginary boundary is first drawn around the process, and all streams entering or leaving the boundary are identified. Assuming the amount of the chemical in the process input streams is known, a facility could calculate the quantity in waste streams by difference. A facility would need to account for any accumulation or depletion of the chemical within the mass balance boundary. The equation for mass balance is:

$$\textit{Input} + \textit{Generation} = \textit{Output} + \textit{Amount Reacted} + \textit{Accumulation}$$

Using a mass balance to estimate a relatively small release of a chemical with a large throughput can lead to inaccurate, or even negative release estimates. Even a small percentage error in a large throughput could amount to a greater quantity than the release calculated. When several large values each with their respective errors are used to calculate a small release, propagation of errors occurs which could yield a highly inaccurate value. Other techniques should be considered in these situations.

Mass balance estimates usually require engineering calculations or assumptions to be made (e.g., all usage results in air or water releases). These assumptions should be explicitly stated in the documentation and should be checked for reasonableness.

- **Emission factors** (basis of estimate code = E entered in Part II, Sections 5 and 6) - Release information derived from facilities or processes similar to yours can be used to estimate releases. Emission factors come in two forms. The first expresses releases as a ratio of the

amount of chemical released to facility throughput or production (e.g., 0.5 pound of Chemical X released per every pound of Material Y used). The second provides a typical concentration of a chemical in a waste stream (e.g., 0.1 mg/L of Chemical Z in wastewater from scrubbers). These factors, combined with process throughput or waste stream flow data, can be used as a basis for the release estimate. Many emission factors are available in *Compilation of Air Pollutant Emission Factors* (AP-42). AP-42 can be accessed via the world wide web at www.epa.gov/ttn/chief/ap42etc.html. The basis of estimate code "E" can only be used for published Section 313 chemical-specific emission factors.

The reliability of emission factors depends on the quality and quantity of data used in their derivation, plus the similarity of the process to which they are applied and the quality of raw materials for the process.

- **Engineering calculations and assumptions** (basis of estimate code = O entered in Part II, Sections 5 and 6) - Estimates that do not fall into any of the above categories are considered engineering calculations. Typically, these estimates are based on standard engineering principles using properties of the chemicals involved, process data, or process knowledge. Example chemical properties include vapor pressure, solubility in water, and density. Example process parameters include temperature, pressure, and material flow rate. Other examples of engineering calculations would be the use of general equipment emissions factors or non-published, facility-developed emissions factors.

Reasonable Estimates: Significant Figures and Use of Range Codes

EPA recommends that two significant figures be used when reporting release and off-site transfer quantities in Part II, Sections 5 and 6 of Form R. Use of two significant figures may prevent errors from being reported on Form R, because a small calculating error may not impact the final reported quantity if the quantity is rounded to two significant figures. If you have reason to believe that your best estimate of a release quantity is particularly imprecise, you could use one significant figure or one of the range codes in reporting releases in Part II, Sections 5 and 6 of the Form R, if applicable:

Range Code A = 1 to 10 pounds
Range Code B = 11 to 499 pounds
Range Code C = 500 to 999 pounds

"NA" versus "0"

If you have no releases of a Section 313 chemical to a particular medium, report either "NA," not applicable, or "0," as appropriate. Report "NA" only when there is no possibility a release could have occurred to a specific medium or off-site location. If a release to a specific medium or off-site location could have occurred, but either did not occur or the annual aggre-gate release was less than 0.5 pounds, report zero. However, if you report zero releases, a basis of estimate must be provided. If use of the Section 313 chemical began in the reporting year, enter "NA" as the production ratio or activity index (Part II, Section 8.9 of the Form R).

For example, if nitric acid is involved in the facility's processing activities but the facility neutralizes the wastes to a pH of 6 or above, then the facility reports a "0" release for the Section 313 chemical. If the facility has no underground injection well, "NA" would be written in Part I, Section 4.10 and checked in Part II, Section 5.4.1 and 5.4.2 of Form R. Also, if the facility did not use the Section 313 chemical in the previous year, the facility would have no basis to develop a production ratio or activity index, "NA" would be checked in Part II, Section 8.9 of Form R.

REPORTING RELEASES IN FORM R, PART II

The following sections discuss the types of release reporting required on the Form R. Releases must be partitioned into land and air releases and should not be inadvertently "double counted." For example, a single wastewater discharge should not be listed as both a release to water (on-site) and a discharge to a POTW (off-site), nor should a release to land be listed as a release to both land (on-site) and a transfer to an off-site landfill. Also, subsequent releases from land (such as a leak from an impoundment) to groundwater is included as a land release in the year the leakage occurred. No reporting is required past the year in which it occurred. Even if it leaches out to ground water in the next year.

It is important to note that historical releases are not included in release reporting. For example, contamination around an underground storage tank (UST) is discovered, but there is no active leak from the tank. If you know that the contamination occurred during the reporting year (RY), then report the leak as a release to land. However, if the leak did not occur during the RY, it should not be included in release reporting.

Finally, the amount of leaks or spills onto pads or containment areas should not automatically be reported as released to land. The amount should be considered as treated or disposed depending on type of management activity. After releases to air, amounts cleaned up and disposed of off-site, amounts recycled, and amounts released to water are considered, then the amount remaining

on the pad is considered to be released to land. Amounts spilled into containment that are directly reused within the same reporting year without requiring treatment prior to reuse are not subject to release reporting.

Fugitive or Non-Point Emissions (Part II, Section 5.1 of Form R)

Fugitive emissions can occur from almost any part of a facility's operation. Potential sources include the following:

- Normal leakage of valves, pump seals, flanges, connectors, and other devices
- Sampling, packaging, loading, and unloading of chemicals
- Cleaning and maintenance activities such as blowing out pipes
- Containers of raw materials, intermediates, or wastes
- Storage piles and spills
- Evaporation from cooling towers, ponds, surface impoundments, and on-site wastewater management systems (including on-site sewers)
- Drum residues.

Where actual monitoring or measurement data are not available, data sources and calculation methods that could be employed in estimating fugitive emissions include the following:

- Industrial Hygiene monitoring data
- AP-42 emissions factors (listed in Tables 5-2, 5-3, and 5-4)
- SOCMI emission factors (listed in Table 4-1)
- Facility-specific emission factors
- Mass balance (for volatile solvents)
- EPA models such as WATER8 for wastewater management systems
- Data from a leak detection and repair (LDAR) program
- Engineering calculations
- CHEMDAT8 and TANKS.

CHEMDAT8

Analytical models have been developed to estimate emissions of organic compounds via various pathways from wastewater and waste management units. Some of these models have been assembled into a spreadsheet called CHEMDAT8 for use on a PC. A user's guide for CHEMDAT8 is also available. Area emission sources for which models are included in the spreadsheet are as follows: nonaerated impoundments, which include surface impoundments and open top wastewater treatment tanks; aerated impoundments, which include aerated surface impoundments and aerated WWT tanks; disposal impoundments, which include nonaerated disposal impoundments; land treatment; and landfills. These models can be used to estimate the magnitude of site air emissions for regulatory purposes. The CHEMDAT8 program and manual can be downloaded from the world wide web at http://www.epa.gov/ttn/chief/software.html#water8.

Table 4-1. SOCMI AVERAGE EMISSION FACTORS*

Equipment type	Service[c]	Emission factors[a] (lbs/hr/source)
Valves	Gas Light liquid Heavy liquid	0.0131 0.00887 0.00051
Pump seals[b]	Light liquid Heavy liquid	0.0438 0.0190
Compressor seals	Gas	0.502
Pressure relief valves	Gas	0.229
Connectors	All	0.00403
Open-ended lines	All	0.0037
Sampling connections	All	0.033

*Protocol for Equipment Leak Emission Estimates (EPA, EPA-453/R-95-017)

a These factors are for total organic compound emissions.

b The light liquid pump seal factor can be used to estimate the leak rate from agitator seals.

c "Gas" is material in a gaseous state at operating conditions, "Light liquid" is material in a liquid state in which the sum of the concentration of individual constituents with a vapor pressure over 0.3 kilopascals (kPa) at 20 °C is greater than or equal to 20 weight percent, and "Heavy liquid" is material that is not defined as a gas or light liquid.

Example Fugitive Emission Calculation Using SOCMI Emission Factors

A process has 100 flanges (connectors) which are in contact with a mixture containing 50% benzene (by weight) during 8000 hours of the year. What are the fugitive emissions of benzene from this process?

Emission = emission factor x # of valves x concentration of chemical x # of hours

Emission = 0.00403 lb/hr/source x 100 sources x 50% benzene x 8000 hours

Emission = 1612 pounds of benzene

Stack or Point-Source Air Emissions (Part II, Section 5.2 of Form R)

Point-source air emissions can occur from numerous pieces of process equipment throughout a facility. Potential sources include the following:

- Air pollution control devices such as scrubbers, condensers, baghouses
- Storage tanks, process tanks, and waste tanks
- Process vessels such as reactors and distillation columns.

Where actual monitoring or measurement data are not available, data sources and calculation methods that could be employed in estimating stack or point source emissions include the following:

- Air emission inventories
- Air permit applications
- Process and production data
- Emission factors from EPA and commercial models
- Engineering calculations.

TANKS

The TANKS program is designed to estimate emissions of organic chemicals from several types of storage tanks. The calculations are performed according to EPA's AP-42, Chapter 12. After the user provides specific information concerning a storage tank and its liquid contents, the system produces a report which estimates the chemical emissions for the tank on an annual or partial year basis. The user can also determine individual component losses by using one of the specification options available in the program.

The TANKS program relies on a chemical database of over 100 organic liquids and a meteorological database which includes over 250 cities in the United States; users may add new chemicals and cities to these databases by providing specific information through system utilities. On-line help provides documentation and user assistance for each screen of the program. The TANKS program and manual can be downloaded from the world wide web at http://www.epa.gov/ttn/chief/tanks.html.

Wastewater Discharges (Part II, Section 5.3 and 6.1 of Form R)

Discharges to a stream or water body are reported in Part II, Section 5.3 of Form R, while transfers to Publicly Owned Treatment Works (POTWs) are reported in Part II, Section 6.1 of Form R. Because the release estimation approach is similar for both types of wastewater discharges, they are discussed here together.

WATER8

A computer program, WATER8, is available for estimating the fate of organic compounds in various wastewater treatment units, including collection systems, aerated basins, and other units. WATER8 is written to run under DOS without the need to purchase other programs. WATER8 contains useful features such as the ability to link treatment units to form a treatment system, the ability for recycle among units, and the ability to generate and save site-specific compound properties. The WATER8 program and users manual can be downloaded from the world wide web at http://www.epa.gov/ttn/chief/software.htmlwater#8.

A facility that discharges or has the potential to discharge water containing regulated wastes must operate under the terms of Federal, State, and/or local permits, such as a NPDES direct discharge permit, or a POTW indirect discharge agreement. The permit(s) or agreement usually require measurements of the water volume and monitoring and analyses of some generalized wastewater parameters including concentrations of various constituents. In some cases, the constituent analyses required for permit compliance includes Section 313 chemicals. In these instances, releases can be calculated by multiplying the volume of wastewater released by the concentration of the chemical released. Releases discharged to a POTW should be reported as off-site transfers on Part II, Section 6.1 of Form R.

Based on the concentration and wastewater flow data available, an estimate of discharges to water can be calculated. Facilities should calculate the daily average discharges of a reportable Section 313 chemical in pounds and must use those estimates to determine the annual discharge in pounds per year. Using the daily concentration data available for the reportable chemical combined with the wastewater flow data for each of the sampling dates, calculate an estimate of pounds per day for each sampling date. After the calculations are made for each monitoring point (e.g., daily, monthly), the pounds discharged are averaged to determine an average daily discharge amount which would be multiplied by the number of days discharges were possible (e.g., 365 days a year).

If no monitoring data exist, NPDES permit applications or POTW agreements may provide information useful to estimating releases. Otherwise, process knowledge (or in some cases, mass balance) needs to be utilized to develop an estimate.

Discharges of listed acids may be reported as zero if all discharges have been neutralized to pH 6 or above. If wastewater containing a listed acid is discharged below pH 6, then releases of the acid must be calculated and reported. For more information on calculating such discharges of acids, see EPA's *Estimating Releases of Mineral Acid Discharges Using pH Measurements* (EPA745/F-97-003, June 1991).

Example Calculation of Yearly Wastewater Discharge

A facility has monitoring data on discharges to water of xylene, a listed Section 313 chemical, and a Form R report is required. In this example, monitoring data on this chemical are only available for two days in the year. The daily quantities of pounds of xylene released for those two dates would then be divided by the number of sample dates to determine the daily average for the whole reporting year, which would be used to estimate the annual discharge of xylene in wastewater:

Date	Concentration (mg/l)	Flow (MGD)	Daily Discharge
3/1/96	1.0	1.0	8.33 lbs.
9/8/96	0.2	0.2	0.332 lbs.

Annual Calculation:
(8.33 lbs. + 0.332 lbs.)/2 days x 365 days/year = 1580.82 lbs/yr

Underground Injection On-Site (Part II, Section 5.4 of Form R)

A facility that has an underground injection well for waste disposal is regulated by Safe Drinking Water Act (SDWA) permits. The permit(s) usually require measurements of the waste volume and analyses of some generalized waste parameters including concentrations of various constituents. When the constituents for which the permit requires analyses include reportable Section 313 chemicals, releases via underground injection can be calculated by multiplying the volume of waste injected by the concentration of the chemical in the waste. Facilities must report amounts of Section 313 chemicals injected into Class I wells (Part II, Section 5.4.1 of Form R) and amounts injected into Class II-V (Part II, Section 5.4.2 of Form R).

Release to Land On-Site (Part II, Section 5.5 of Form R)

In most circumstances involving the disposal of many Section 313 chemicals, land disposal is regulated by RCRA and state regulations. In part II, Section 5.5, TRI is concerned with the total amount of the specified reportable Section 313 chemical released to land, regardless of the potential for the chemical to leach from the disposed waste.

On-site disposal includes disposal in an on-site RCRA Subtitle C landfill (Part II, Section 5.5.1A of Form R), disposal in other on-site landfills (Part II, Section 5.5.1B of Form R), disposal in a land treatment/application farming unit (Part II, Section 5.5.2 of Form R), and disposal in a surface impoundment (Part II, Section 5.5.3 of Form R). Data concerning these types of "intentional" on-site disposal are usually readily available because facilities are required to monitor the quantity of waste and will have a waste profile that describes typical concentration ranges for waste constituents. In some cases, concentrations of constituents in the waste have been measured. If on-site waste treatment occurs prior to on-site land disposal, the treatment efficiency and a mass balance can be conducted to determine the quantity of a chemical that is land disposed. For example, a facility can determine the amount of the chemical present in the untreated waste, determine the efficiency of treatment in removing or destroying the chemical in the waste, account for other releases (i.e., fugitive emissions, leaks, spills, accidental releases, losses to air pollution control devices, etc.), and determine that the remainder is the quantity of the chemical land disposed.

Releases to land on-site/other disposal (Part II, Section 5.5.4 of Form R) include the amount of chemical released to land on site not covered by any of the above categories. Releases to land on-site/other disposal includes spills, leaks, or "unintentional" disposal, such as metal dust that is deposited onto soil. Incident logs or spill reports can provide useful information.

Transfers in Wastes to Other Off-site Locations (Part II, Section 6.2 of Form R)

Similar to on-site disposal, data concerning off-site waste transfers are usually readily available because facilities are required to monitor the quantity of waste and either measure concentrations of chemicals or develop a waste profile that describes typical concentration ranges. Under Section 313, off-site transfer estimates are based on the final, known disposition of the reportable Section 313 chemical in the waste sent off-site for further waste management. For example, a reportable Section 313 metal is contained in a waste solvent sent off-site for energy recovery purposes. Even though the waste stream as a whole has a sufficient heat value to warrant energy recovery, metals do not have a significant heat value and, therefore, cannot be combusted for energy recovery. Unless the facility had additional information on the fate of the reportable Section 313 metal in this waste, the facility must assume the metal is being disposed and should report the quantity sent off-site accordingly in Part II, Sections 6.2 and 8.1 of Form R.

Even wastes that were minimally processed, such as wastes that were repackaged, such as small containers removed from a lab pack that were not otherwise opened or managed, may need to be reported if the article exemption (as discussed in Section 2) is not applicable.

Estimating Releases for Accidental Losses

Leaks, spills, and drips from the loading and transfer of chemicals received at the facility should be considered and reported in your release estimates. Data concerning specific incidents (such as notification reports or incident logs) should be used to estimate releases. Equations found in Section 6 of EPA's *Estimating Releases and Waste Treatment Efficiencies for the Toxic Chemical Release Inventory Form* (EPA 560/4-88-002, December 1987), provides guidance on calculating releases from chemical spills or leaks, including liquid discharges, fraction of discharge flashed, vaporization, two-phase discharges, and gas discharges.

EXAMPLE: A facility uses more than 10,000 pounds of ethylene glycol during the year to prevent freezing of coal piles. While unloading on a windless overcast day, a malfunction occurs and onsite personnel visually estimate that 50 gallons of ethylene glycol are spilled. Most of the spill remains on the pad, however, an estimated ten percent flows off the pad and onto the soil. Absorbent material used to remove the ethylene glycol from the concrete pad is transferred offsite for disposal. How would these releases be reported on the Form R? The density of ethylene glycol is 9.3 pounds per gallon, and the vapor pressure is 0.06 mm Hg at 68° F.

Quantity spilled = 50 gal x 9.3 lbs./gal = 465 lbs.
Amount spilled onto pad = 465 x 90% = 418.5 lbs.
Amount spilled onto soil = 465 x 10% = 46.6 lbs.

Air emissions of ethylene glycol are expected to be negligible due to the low vapor pressure and environmental conditions, provided response and cleanup are immediate. Therefore, the total amount spilled onto the concrete pad (418.5 pounds) is transferred offsite and should be reported in Sections 6.2, and the total amount spilled onto the soil (46.6 pounds) should be reported in Section 5.5.4, other disposal.

On-site Waste Treatment Methods and Efficiency (Part II, Section 7A of Form R)

In Section 7A, the following information must be reported:

- General waste stream types containing the Section 313 chemical being reported;
- Waste treatment methods or sequence used on all waste streams containing the Section 313 chemical;
- Range of concentration of the Section 313 chemical in the influent at the first step in a waste treatment system;
- Efficiency of the waste treatment method or sequence in destroying or removing the Section 313 chemical; and
- Indication of whether the efficiency estimate was based on actual operating data.

Report any waste treatment step through which the reportable Section 313 chemical passes regardless of treatment efficiency. Report all non-identical parallel steps and all sequential steps.

Waste treatment for the purpose of Section 7A is defined as removal of the Section 313 chemical from the waste through destruction, biological degradation, chemical conversion, or physical removal. Note that this definition of waste treatment is broader than the definition used in Part II, Section 8 of Form R (discussed later). Section 7A treatment efficiency is calculated as follows:

$$\textit{percent efficiency} = \frac{(\textit{input} - \textit{output})}{\textit{input}} \times 100\%$$

If your facility has a measurement of the pollutant concentration of input and output at the treatment unit, these data should be used to calculate the treatment efficiency. If these measurements are not available, data from literature or the equipment manufacturer can be used for estimation purposes. Equipment manufacturer data on treatment efficiencies often represent ideal operating conditions with an ideal waste matrix. Thus, you may want to adjust such data to account for downtime, process upsets, and other less than optimum conditions during the year that would result in lower efficiencies.

Estimates of treatment efficiencies by process for EPCRA Section 313 chemicals are available from the ATTIC database via modem from ATTIC by calling data number (513) 569-7610. Additional information can be obtained by calling the ATTIC Hotline at (513) 569-7272.

On-site Energy Recovery Processes (Part II, Section 7B of Form R)

In Section 7B, methods used to combust the Section 313 chemical in wastes for energy recovery are reported. Two conditions need to be met to report the combustion of a Section 313 chemical as energy recovery: (1) the chemical must have a heat of combustion high enough to support combustion (e.g., 5,000 BTU per pound or greater), and (2) must be combusted in a unit equipped with an energy recovery device, such as a waste heat boiler.

On-site Recycling Processes (Part II, Section 7C of Form R)

In Section 7C, methods used to recycle the Section 313 chemical in wastes are reported.

Source Reduction and Recycling Activities (Part II, Section 8 of Form R)

The following discussion for Sections 8.1 through 8.7 applies to the current reporting year (i.e., column B of Section 8 of the Form R).

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 reported as sent off-site for disposal in Section 6.2 minus the quantity reported in Section 8.8 that was released or transferred off site for disposal:

§8.1 = §5 + §6.2 (disposal only) - §8.8 (release or off-site disposal only)

Section 6.2 disposal codes are M10, M71, M72, M73, M79, M90, M94, and M99. In addition, EPCRA Section 313 listed metals in waste streams sent off-site to POTWs or other off-site locations for treatment for destruction should be reported in Section 8.1, unless the facility has knowledge that the metal is being recovered.

Quantity Used for Energy Recovery On-site (Part II, Section 8.2 of Form R)

Estimate a quantity of the Section 313 chemical in wastes combusted for energy recovery on-site. This estimate should be the quantity of the chemical 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 Section 313 chemical combusted for energy recovery purposes. If monitoring data are not available, vendor specifications regarding combustion efficiency may be

used as they relate to the reportable Section 313 chemical. 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 a Section 313 chemical as energy recovery: the chemical (1) must have a heat of combustion high enough to support combustion (e.g., 5,000 BTU per pound or greater), and (2) must be combusted in a unit equipped with an energy recovery device, such as a waste heat boiler. Note that "NA" should be reported for Section 313 chemicals which are Halons (e.g., CFCs) and metals that do not have a heat of combustion sufficient to sustain combustion.

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. Section 6.2 energy recovery codes are M56 and M92. 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)

Quantity Recycled On-site (Part II, Section 8.4 of Form R)

Estimate a quantity of the Section 313 chemical recycled in wastes on-site. This estimate should be the quantity of the chemical 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 which indicate a recovery efficiency and use that efficiency value combined with throughput data to calculate an estimate. If operating data are unavailable, use available vendor specifications.

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. Section 6.2 recycling codes are M20, M24, M28, and M93. 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)

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 Section 313 chemical. The quantities reported in Section 8.6 will be those treated in a subset of the processes for which codes were reported in Section 7A, where treatment includes physical removal from a waste stream. To estimate this quantity, you should determine if operating data exist which indicate a treatment (e.g., destruction or chemical conversion of Section 313 chemical) efficiency and use that efficiency value combined with throughput data to calculate an estimate. If operating data are unavailable, use available vendor specifications. Section 7A must be completed if a quantity is entered in Section 8.6.

Quantity Treated Off-site (Part II, Section 8.7 of Form R)

The quantity reported in Section 8.7 must be the sum of the quantities reported in Section 6.2, for which treatment codes are reported, and the quantities reported in Section 6.1, which were sent to a POTW. Section 6.2 waste treatment codes are M40, M50, M54, M61, M69, and M95. If a quantity is reported in Section 8.8, subtract any associated off-site transfers for treatment:

§8.7 = §6.1 + §6.2 (treatment) - §8.8 (off-site treatment).

Because metals cannot be destroyed or chemically converted, metals cannot be reported as treated in Section 8. Quantities of metals reported in Section 6.1 and 6.2 as being treated should be reported in Section 8.1 (Quantity released), unless the facility has knowledge that the metal is being recovered.

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 quantity reported in Section 8.8 is the quantity of the Section 313 chemical released directly into the environment or sent off-site for recycling, waste treatment, energy recovery, or disposal during the reporting year due to any of the following events:

(1) Remedial actions
(2) Catastrophic events such as earthquakes, fires, or floods
(3) 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. Releases and off-site transfers from remediation of a Section 313 chemical or an unpreventable accident unrelated to production (such as a hurricane) that cause a reportable Section 313 chemical to be released are reportable in Section 8.8.

On-site treatment, energy recovery, or recycling of Section 313 chemicals 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 Sections 8.1 through 8.7 of Form R.

SECTION 5
CALCULATING RELEASE ESTIMATION AT ELECTRICITY GENERATING FACILITIES

In Section 4, the tools and techniques available for estimating releases to the environment and reporting of disposition of wastes (including transfers off-site, land disposal, underground injection, and wastewater discharges) were discussed. This section provides guidance on how electricity generating facilities report these releases and waste dispositions on the Form R. Typical operations and the resulting wastes and releases are discussed.

Electricity generating facilities should evaluate their activities on a site-specific basis. This guidance is a starting point for considering possible releases and evaluating estimation methods. Developing accurate and comprehensive release estimates requires the consideration of all possible release pathways.

While differing in some important respects, all conventional steam electricity generating stations rely on the same basic mechanism, as presented in Figure 5-1. Fuel is ignited and burned within a boiler chamber composed of thousands of feet of water-filled tubes. The heat of combustion heats the water in the boiler tubes, creating high temperature and high pressure steam The steam passes through turbines causing the turbine blades to rotate and a shaft connected to the turbine blades drives electric generators, yielding electric power. In this fashion, the chemical energy of the fossil fuel is converted to heat energy through combustion, then to mechanical energy in the turbines, and finally to electrical energy in the generators. Transmission lines, substations, and switching stations channel generated electricity to various customers.

This section discusses certain operations, common to many electric power generating stations, which may result in releases containing Section 313 chemicals. These operations are: fuel storage and preparation, water treatment, combustion waste management, flue gas desulfurization, and plant maintenance.

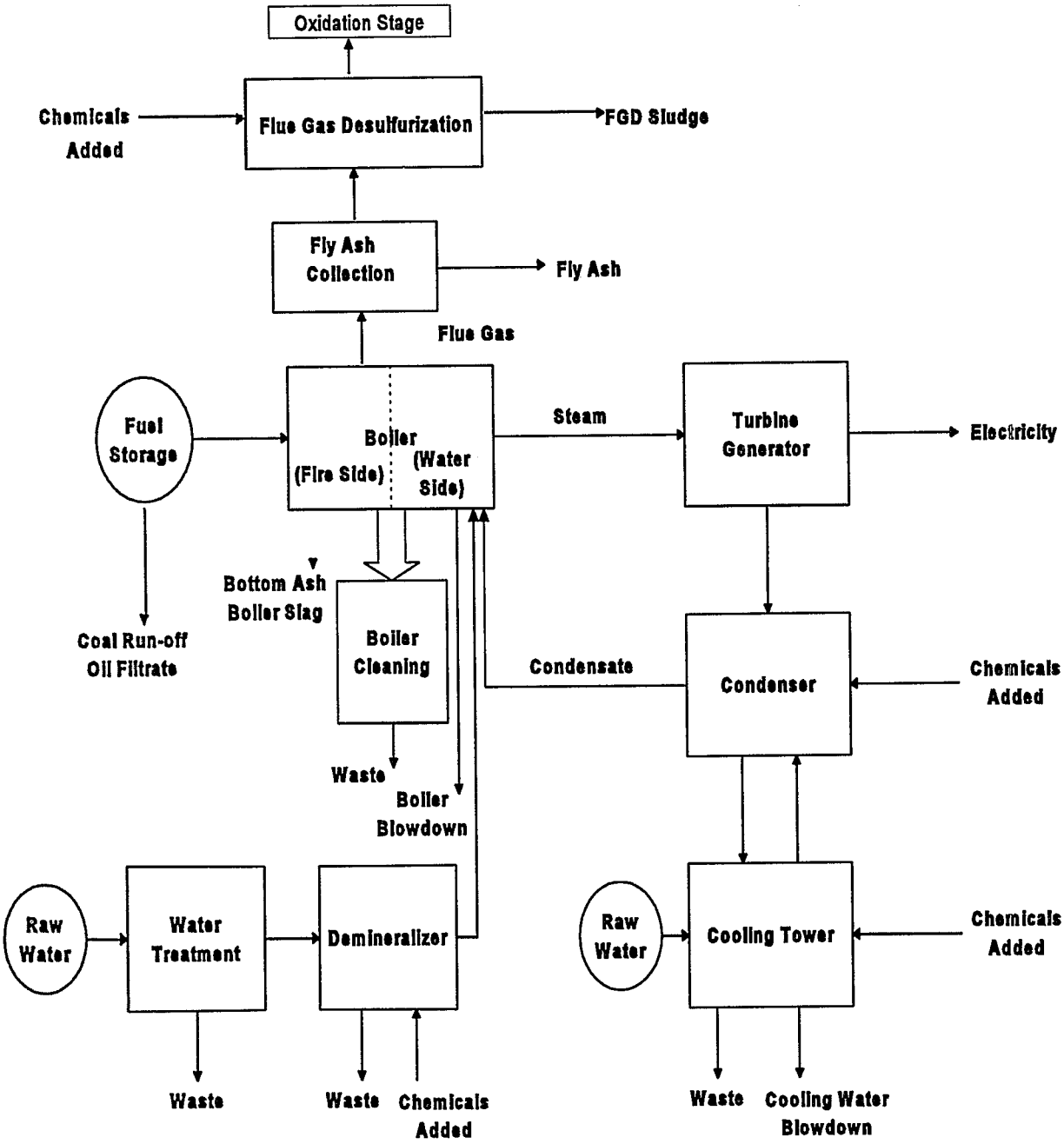


Figure 5-1 Process for Generating Electricity at Electricity Generating Facilities

Fuel Storage and Preparation

Examples of Potential Section 313 Chemicals Involved in Fuel Storage and Preparation	Source
Compounds of: antimony, arsenic, beryllium, cadmium, chromium, copper, lead, manganese, mercury, nickel, selenium, silver, thallium	Coal pile
Ethylene glycol	Prevention of coal pile freezing
Section 313 chemicals in oil	Filtration

Coal

Electricity generating facilities typically store large quantities of coal onsite. Many tons of coal are commonly stored onsite at coal-fired generating plants to maintain up to 90 days worth of coal. Releases, for example air emissions from fuels in storage, must be considered for reporting.

Coal stored in exposed piles may be subject to rainfall, snowfall, spraying for dust control, and underground streams that surface under the piles. Thus, on-site storage may result in-coal pile run-off. Moisture and air may react with metallic sulfides in the coal to produce sulfuric acid, which dissolves inorganic salts in the coal pile. Depending on a variety of factors, various amounts of metals and metal compounds may be present in the resulting coal pile runoff. Metal compounds that form during reactions in the coal pile are considered "manufactured" and are not eligible for the *de minimis* exemption. Therefore, quantities of metal compounds or other Section 313 chemicals manufactured in the coal pile must be counted towards the manufacturing threshold of 25,000 pounds. (For a complete discussion on the manufacture of metal compounds, refer to the discussion in Section 3 of this document). If two or more different compounds within the same metal compound category are manufactured, the total weight of all these compounds must be counted towards the threshold determination for that metal compound category.

Arsenic, chromium, copper, manganese, and nickel are commonly found in coal pile runoff. In addition low concentrations of antimony, cadmium, beryllium, lead, selenium, and thallium may

also be present. All of these Section 313 metals could be present in elemental and/or compound form. Traces of mercury and silver also may be found in the runoff.

Some potential releases or waste generation sources associated with coal storage and preparation are:

- Fugitive emissions during transfer of coal to boiler (§5.1)
- Fugitive emissions of ethylene glycol from coal pile (§5.1)
- Spills or leaks of ethylene glycol (§5.5)
- Stormwater runoff (§5.3)
- Coal pile runoff (§5.3 or §6.1)
- Disposal of material settled from coal pile runoff, on-site (§5.5), or transferred off-site (§6.2).

Oil

Oil-fired facilities often maintain storage capacity for 60 to 120 days worth of oil to ensure continuous operation of the boiler. Oil is stored in large tanks and delivered under pressure to the boiler's burners after filtration of sediment and contaminants. The filtered material may contain Section 313 chemicals and be disposed on or off-site.

Some potential releases or waste generation sources associated with oil storage and preparation are:

- Fugitive and/or point source emissions from storage and transfers of lighter oils (§5.1 or §5.2)
- Accidental releases due to tank failure (§5.1, §5.3, and/or §5.5.4)
- Leaks and drips (§5.5)
- Disposal of solids (residuals, sediments) from oil, on-site (§5.5) or transferred off-site (§6.2).

Water Treatment

Examples of Potential Section 313 Chemicals Involved in Water Treatment	Source
Bromine, chlorine, chlorine dioxide	Anti-biofouling agents in boilers and cooling towers
Bromoform, chloroform	Manufactured from reactions with biofouling agents and intake water
Ammonia, chromium compounds, hydroquinone, hydrazine, and zinc	Anti-corrosion agents in boilers and cooling towers
Nitrate compounds	Manufactured in cooling tower
Copper, manganese, zinc	Demineralizer regenerant

Electricity generating facilities use large amounts of water for two separate purposes. First, boiler water is used to generate steam which will drive the blades of a turbine. This water must be treated prior to entering the boiler to prevent fouling and scaling within the boiler. Once it has passed through the turbine, the "dead" steam is sent to a condenser, where large volumes of cooling water are used to remove heat from the steam, condense it, and pump it back into the boiler. Chemicals used for treatment of cooling water may be different from those used to treat steam generation water. Similarly, the resulting wastes differ, and therefore cooling water treatment and boiler water treatment are discussed separately.

Boiler Water Treatment

Water used to produce steam is drawn from municipal or other sources and treated to remove dissolved gases, suspended solids, and dissolved chemical salts prior to placement in the boiler. These materials can cause corrosion, erosion, and scaling of boiler components. Clarification and filtration are common methods of removing suspended solids in the feedwater. The filter media is periodically backwashed to remove the solids that have accumulated, producing a sludge that is typically disposed in onsite landfills, or codisposed in ash ponds. Section 313 chemicals present in water drawn from the environment or from municipal sources are exempt from both threshold determinations and release reporting. Therefore, sludges from clarification and filtration are only reportable if Section 313 chemicals were used (e.g., coagulants) to treat the boiler water.

After clarification and filtration, boilers with high drum pressures typically require demineralization of the water to remove any dissolved solids. Demineralization is commonly accomplished with ion exchange resins that replace dissolved cations with hydrogen ions, and anions with hydroxide ions. Demineralization may be repeated until the ion exchange resins are saturated with removed material and must be regenerated by passing a strong acid (commonly sulfuric acid) or a strong base (caustic) over the resin beds. Regeneration produces a potentially corrosive waste stream containing mineral salts, excess regenerant chemicals (e.g., sulfuric acid in solution), copper, zinc, manganese, and other chemicals. Chemicals originating from municipal sources that are present in demineralization wastes are exempt from reporting.

The demineralization waste stream may be neutralized in tanks and discharged along with other liquid waste streams, or co-disposed with ash in on-site ponds or surface impoundments, from which wastewaters may be discharged to a POTW or water body . Alternatively, facilities may send this waste stream offsite for treatment and disposal.

Condensate and make-up water may also be polished in fixed bed or powdered resin polishers. Fixed bed polishers are regenerated in the same manner as demineralizers, while powdered resin polishers are not regenerated and the resin is discarded as a slurry wastestream. Electricity generating facilities may also use reverse osmosis to treat boiler water. These facilities may dispose of the resulting brine on or off-site, or discharge it to a POTW or water body.

Water condensate exiting the condensers may also be treated by passing it through a deaerator heater before it is directed to feed pumps and returned to the boiler. The deaerator adds heat to the water, and removes dissolved oxygen and other noncondensable gases, by scrubbing the condensate with steam, thereby improving the water quality. The resulting gases exit through a vent line.

After passing through the deaerator, Section 313 chemicals such as hydrazine and hydroquinone may be added to the water to remove any remaining oxygen. Quantities of chemicals used for treatment must be applied to the otherwise use threshold. Regardless of how boiler feedwater is purified, some impurities remain. As water is recirculated through the steam cycle, these impurities begin to concentrate in the boiler. Also, the added Section 313 chemicals may undergo decomposition or react with other chemicals in the boiler. To prevent excessive concentration of corrosion or scaling agents within the boiler, a portion of the boiler water, called blowdown, must periodically be removed and replaced with make-up water. The blowdown may contain Section 313 chemicals added to the feedwater and boiler (such as hydrazine, hydroquinone, zinc and chromium compounds, and ammonia), their reaction products, and traces of copper, nickel and other metals. Metals or other Section 313 chemicals in blowdown that originated from municipal water sources are exempt for release reporting. Blowdown may be reused to sluice (transport)

ash to a disposal or treatment site, or as cooling water in cooling towers, vented to the atmosphere, or sent to ash ponds where it may be discharged after materials have settled out.

Some potential releases or waste generation sources associated with boiler water treatment are:

- Chemical and waste holding tanks (fugitive and/or point source emissions, §5.1 and/or §5.2)
- Deaerator vents (point-source air emissions, §5.2)
- Demineralizer regenerant wastes directed into on-site ash impoundments for disposal (§5.5)
- Demineralizer regenerant wastes directed to a settling pond then discharged (§5.3 or §6.1)
- Boiler blowdown co-disposed in surface impoundment (5.5)
- Condensate polisher wastewater discharge (§5.3 or §6.1)
- Boiler blowdown water discharge (§5.3 or §6.1)
- Sludges generated from coagulation and filtration of feedwater co-disposed in ash ponds or landfills on-site (§5.5) or transferred offsite (§6.2)

Cooling Water Treatment

The expansion of high pressure steam drives the blades of a turbine, and a generator then converts the turbine's mechanical energy into electrical energy. This creates a large volume of low pressure "dead" steam, which must be condensed to allow the efficient pumping of the resultant water back into the high-pressure boiler. It is condensed by transferring heat to cooling water in a heat exchanger called the condenser. This cooling water required to discard waste heat creates the largest volume waste stream of this industry.

Shell and tube condensers are typically used to cool the steam. Large amounts of cooling water circulate through the inside of thousands of condenser tubes, and steam passing over the tubes condenses and is collected for recycling. Cooling water passing through the tubes of the condenser is heated as it condenses the steam, and a constant flow of chilled water is required to maintain the efficiency of the condenser. The chilled cooling water is supplied in either one of two ways: once through or recirculated. Once-through cooling water is withdrawn from the water body source, passed through the condenser, and returned to its source. Following the condenser, once-through cooling water is sometimes passed through a pond or canal in order to lower its temperature before final discharge. A recirculated cooling water system is used when the water supply is inadequate to support a once-through cooling system, when there may be undesirable thermal effects in the receiving water, or when regulations so dictate. After cooling water has been passed through the condenser, the heat picked up is transferred to the atmosphere

by means of cooling towers, cooling ponds, or spray canals, and is then recirculated back to the condenser. Wastes produced in once-through cooling systems differ from those produced in recirculating systems and are discussed separately.

Once-through recirculating systems draw water from large or rapid rivers, oceans, bays and large lakes. In saltwater applications (or other situations where the total dissolved solids content of cooling water is high), anticorrosion agents such as zinc compounds may also be added to the intake stream to prevent damage to the cooling system. Unless the intake water has high concentrations of suspended solids, low temperatures, or other characteristics that limit biofouling, biocides (such as chlorine, bromine, or chlorine dioxide) may be injected into the cooling system or added to cooling ponds to prevent biofouling of equipment. Reactions between these chemical additives and the intake water may result in the formation of Section 313 compounds, including chlorinated organics such as chloroform or bromoform. Once it has passed through the condenser, the cooling water may be pre-cooled in a pond or canal prior to final discharge to a receiving water body.

Recirculating cooling water systems use cooling towers to remove heat via evaporation, leaving a liquid with concentrated impurities, which may deposit scale on tower basins or condenser tubes, reducing heat transfer efficiency. As a result of these impurities, the need for anti-corrosion and anti-biofouling agents discussed above is even more important than in once-through cooling systems. To prevent scaling, some of the impurity-filled water is periodically removed and fresh water is pumped in. The discharged water, or blowdown, may contain nitrate compounds, biofouling agents and anti-corrosion agents and their reaction products. Contaminants originating from intake water or ambient air are exempt from both threshold determinations and release reporting; therefore, facilities need only report releases of Section 313 chemicals in blowdown that were added to, or manufactured as byproducts in cooling water. Blowdown may be placed in a surface impoundment where much of the liquid evaporates or is discharged, and the remaining sludge is dredged and co-disposed in an on-site landfill or sent off-site for disposal. The blowdown may also be used to sluice ash for disposal in on-site landfills or surface impoundments. Solid precipitates which accumulate at the base of cooling towers must also be periodically be removed for disposal in onsite landfills. This material may reflect treatment chemicals discussed above.

Some potential releases or waste generation sources associated with cooling water treatment are:

- Chemical and waste holding tanks emissions (fugitive and/or point source emissions, §5.1, and/or §5.2)
- Blowdown wastewater discharge (§5.3 or §6.1)

- Cooling tower blowdown water used to sluice ash to on-site surface impoundment (5.5)
- Cooling tower sludge land disposed on-site (§.5.5).

Combustion Waste

Examples of Potential Section 313 Chemicals in Combustion Wastes	Source
Compounds or elemental forms of antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, copper, lead, manganese, mercury, nickel, selenium, silver, zinc	Coincidentally manufactured during combustion

Fly Ash, Bottom Ash, and Boiler Slag

Coal combustion and to a much lesser extent, oil combustion, generates considerable amounts of both fly ash and bottom ash. Bottom ash is unburned matter that collects at the bottom of the boiler, and is present mainly at facilities combusting coal. Very little bottom ash is produced from oil combustion. Fly ash is a fine, light ash borne in flue gas, collected by mechanical ash collectors and particulate control devices such as electrostatic precipitators, baghouses, or wet scrubbers. Fly ash is produced in both oil and coal combustion. Some facilities may produce boiler slag, bottom ash particles in a molten state.

Facility specific information (e.g., from suppliers or testing) can be used to estimate amounts of Section 313 metals in combustion wastes, provided the source of the information is documented. The best available information should be used to estimate the approximate concentration of the metal in ash byproduct. Typical concentrations of metals in ash byproducts from the combustion of coal are presented in Table 5-1. In the absence of better information, these values can be used as a basis for estimating quantities released during coal combustion.

Table 5-1 Total Constituent Concentrations of Elements in Coal Combustion Residuals		
Element Concentrations in Different Materials (ppm)		
Element (units)	Fly Ash	Bottom Ash
Antimony	131	10
Arsenic	6,300	168
Barium	13,800	9,360

Table 5-1 Total Constituent Concentrations of Elements in Coal Combustion Residuals		
Element Concentrations in Different Materials (ppm)		
Element (units)	Fly Ash	Bottom Ash
Cadmium	130	10
Chromium	900	5,820
Copper	2,200	932
Lead	2,120	1,082
Manganese	3,000	1,940
Mercury	12	4.2
Nickel	4,300	2,939
Selenium	134	14
Silver	36	9.9
Vanadium	1,180	537
Zinc	3,500	1,796

Source: *EPRI, Inorganic and Organic Constituents in Fossil Fuel Combustion Residues.*

Fly and bottom ash may be managed separately or together in landfills or wet surface impoundments. If managed wet, both fly and bottom ash may be sluiced and sent to one or more impoundments for temporary storage or permanent disposal. Bottom ash may be periodically dredged from a pond and dewatered prior to sale. Bottom or fly ash may also be sold for use in the construction industry (e.g., as concrete stabilizers or roadfill) or for metals recovery (e.g., vanadium recovery from oil combustion ash). Ash ponds may discharge to a treatment basin for settling and/or pH control prior to permitted discharge. Many operators recycle ash pond water back to the ash transport/sluice system.

If managed dry, fly ash may be pneumatically transferred to ash storage silos. From here, the ash may be conditioned with water prior to landfill disposal, or loaded on trucks for use elsewhere at the facility, or for sale (e.g., concrete stabilizer for on-site construction).

Because the *de minimis* exemption does not apply to a Section 313 chemical manufactured at the facility that does not remain in a product distributed by the facility, metal compounds in ash which were manufactured during combustion are not eligible for the *de minimis* exemption if the ash is managed as a waste. If a Form R is required for a metal compound category, then all non-

exempt releases must be reported on Form R. However, only the weight of the EPCRA Section 313 metal itself, not the weight of the entire metal compound, is used to report quantities released and transferred off-site for waste management.

If the ash is distributed in commerce to be used as a raw material by an off-site entity, the amounts of Section 313 chemicals contained in the ash "product" are considered "processed". In this case, the amounts of Section 313 chemicals distributed in commerce do not need to be reported on the Form R. Furthermore, the *de minimis* exemption applies to amounts processed. Therefore, releases and other waste management of reportable Section 313 chemicals present at concentrations below *de minimis* and generated from processing ash are exempt.

Off-Site Transfers of Wastes to A Facility Owned and Operated By The Electricity Generating Facility

Some electricity generating facilities dispose of solid wastes that the facility generated at off-site disposal facilities that the generating facility owns and operates. The generating facility is required to report the quantities of reportable Section 313 chemicals in the wastes sent for off-site disposal in Part II, Section 6.2 and Section 8.1. The generating facility is not required to report on releases that occur at any off-

Applicable codes for treatment of ash are P13 (Sludge Dewatering), P11 (Settling/Clarification), F83 (Thermal Drying/Dewatering) (Part II, Section 7A). The quantity of a Section 313 chemical (except for metals and metal compounds) destroyed or chemically converted would be reported in Part II, Section 8.6, Quantity treated on-site, of Form R.

Some potential releases or waste generation sources associated with ash waste management are:

- Dust and particulate fugitive emissions from dry ash management (§5.1)
- Discharge of water used to transport ash (§5.3 or §6.1)
- Disposal of ash solids and slag in on-site landfills, or surface impoundments (§5.5) or off-site mines, quarries, or waste management facilities (§6.2)

Note: Amounts of Section 313 chemicals in fly ash and bottom ash should be considered in addition to amounts of the same chemicals released to the air (discussed in the following section). The facility should consider amounts of metals managed as waste and potentially distributed in product as a mass balance compared to amounts of the metal originally contained in the fuel.

Air Emissions

Examples of Potential Section 313 Chemicals Released to the Air	Source
Compounds of metals such as arsenic, beryllium, cadmium, chromium, lead, manganese, mercury, nickel, selenium, and other TRI metals	Fuel combustion
Organic compounds such as formaldehyde, methanol, polycyclic aromatics (e.g., naphthalene)	Fuel combustion
Hydrogen fluoride, hydrochloric acid (aerosol), sulfuric acid (aerosol)	Fuel combustion

The combustion of coal and oil at electricity generating facilities may result in the volatilization of various Section 313 chemicals which become part of the flue gas. Amounts of these chemicals not caught in particulate control devices or in flue gas desulfurization (FGD) systems (discussed later) may result in stack emissions of antimony, arsenic, barium, beryllium, cobalt, cadmium, chromium, lead, manganese, mercury, nickel, selenium, zinc, formaldehyde, methanol, polycyclic aromatics (such as naphthalene), and other Section 313 chemicals. Lead and lead compounds are often emitted from boilers that are fired with used oil. To calculate the amount of metals emitted to the air, only the weight of the parent metal must be considered. Section 313 chemicals which form during combustion are considered "manufactured" and releases of these chemicals are not subject to the *de minimis* exemption. For a complete discussion on the formation of metal compounds during combustion, refer to Section 3 of this document. Combustion of coal may also result in emissions of hydrochloric acid (HCl) in aerosol form, hydrogen fluoride (HF), chlorine, and fluorine. If aerosol forms of hydrochloric acid are produced during or after combustion and are present in the flue gas, the amount produced must be applied to the manufacturing threshold.

Releases of Section 313 chemicals to the air may be calculated using information from monitoring data, air permits, and air permit applications. Emissions information from equipment vendors, particularly emission performance guarantees or actual test data from similar equipment is another potential source of information for release calculations.

In the absence of facility-specific data, emission factors can be used to estimate emissions of Section 313 chemicals. AP-42 emission for metals and organic compounds are given in Tables 5-2, and 5-3 respectively. These tables are specific to certain conditions (e.g., fuel type). To estimate releases of HCl and HF when no better data are available, assume the amount released is the amount manufactured (calculated using the factors presented in Table 3-5, Section 3 of this document) minus amounts removed by air control devices. Emission estimates will vary,

Acid Aerosols

Both hydrochloric acid and sulfuric acid appear on the Section 313 list of chemicals with the following qualifier: "(acid aerosols including mists, vapors, gas, fog, and other airborne forms of any particle size)." This definition is broader than just "aerosol" but the term "aerosol" is used as shorthand for the lengthy definition.

Sulfuric acid (aerosol) is manufactured from the combustion of coal and oil. For EPCRA Section 313, facilities are only required to account for manufacture of chemicals that occurs at the facility. Sulfur trioxide produced from combustion reacts with water to form sulfuric acid (aerosol). The quantity of sulfuric acid (aerosol) manufactured before the exhaust gas leaves the stack must be included in threshold and release calculations.

EPA will issue guidance concerning sulfuric acid (aerosol) in the near future. This guidance will include information to assist facilities in determining the quantity of sulfuric acid (aerosol), if any, manufactured on site.

depending on the efficiency of the air control device (e.g., electrostatic precipitator, baghouse, scrubber). Emission factors for other Section 313 chemicals and other conditions are also available, and can be found on the word wide web, as detailed in Section 4 of this document. The fly ash handling operations in most modern electricity generating facilities consist of pneumatic systems or enclosed and hooded systems which are vented through small fabric filters or other dust control devices. Therefore, the fugitive particulate matter emissions from these systems are anticipated to be minimal.

Fugitive emissions and stack emissions are reported in Sections 5.1 and 5.2, respectively, in Part II of Form R.

Per AP-42, the Emission Factor Quality Ratings for Tables 5-2, and 5-3 are as follows:

A Excellent. Factor is developed from A- and B-rated source test data taken from many randomly chosen facilities in the industry population. The source category population is sufficiently specific to minimize variability.

B Above average. Factor is developed from A- or B-rated test data from a "reasonable number" of facilities. Although no specific bias is evident, it is not clear if the facilities tested represent a random sample of the industry. As with an A rating, the source category population is sufficiently specific to minimize variability.

C Average. Factor is developed from A-, B-, and/or C-rated test data from a "reasonable number" of facilities. Although no specific bias is evident, it is not clear if the facilities tested represent a random sample of the industry. As with the A rating, the source category population is sufficiently specific to minimize variability.

D Below average. Factor is developed from A-, B- and/or C-rated test data from a small number of facilities, and there may be reason to suspect that these facilities do not represent a random sample of the industry. There also may be evidence of variability within the source population.

E Poor. Factor is developed from C- and D-rated test data, and there may be reason to suspect that the facilities tested do not represent a random sample of the industry. There also may be evidence of variability within the source category population.

Use of AP-42 Emission Factors

The general equation for emission estimation is:

$$E = A \times EF \times (1-ER/100)$$

where:

E = emissions,
A = activity rate,
EF = emission factor, and
ER= overall emission reduction efficiency, %.

ER is further defined as the product of the control device destruction or removal efficiency and the capture efficiency of the control system. When estimating emissions for a long time period (e. g., one year), both the device and the capture efficiency terms should account for upset periods as well as routine operations. Note that some emission factors already incoporate a removal efficiency term.

Table 5-2 Section 313 Metal Emission Factors for Fuel Combustion

CONTROLLED COAL COMBUSTION[a]			NO. 6 FUEL OIL COMBUSTION[c]	
Metal	Emission Factor (lb/ton)[b]	Emission Factor Rating	Average Emission Factor[d] (lb/10^3 Gal)	Emission Factor Rating
Antimony	1.8E-05	A	5.25E-03	E
Arsenic	4.1E-04	A	1.32E-03	C
Barium	N/A*	N/A*	2.57E-03	D
Beryllium	2.1E-05	A	2.78E-05	C
Cadmium	5.1E-05	A	3.98E-04	C
Chromium	2.6E-04	A	8.45E-04	C
Chromium (VI)	7.9E-05	D	2.48E-04	C
Cobalt	1.0E-04	A	6.02E-03	D
Copper	N/A*	N/A*	1.76E-03	C
Lead	4.2E-04	A	1.51E-03	C
Manganese	4.9E-04	A	3.00E-03	C
Mercury	8.3E-05	A	1.13E-04	C
Nickel	2.8E-04	A	8.45E-02	C
Selenium	1.3E-03	A	6.83E-04	D

Source: AP-42 Chapter 1, External Combustion Sources.

[a]The emission factors were developed from emissions data at eleven facilities firing bituminous coal, fifteen facilities firing subbituminous coal, and from two facilities firing lignite. The factors apply to boilers utilizing either venturi scrubbers, spray dryer absorbers, or wet limestone scrubbers with an electrostatic precipitator (ESP) or Fabric Filter (FF). In addition, the factors apply to boilers using only an ESP, FF, or venturi scrubber. SCCs = pulverized coal-fired, dry bottom boilers, 1-01-002-02/22, 1-02-002-02/22, 1-03-002-06/22; pulverized coal, dry bottom, tangentially-fired boilers, 1-01-002-12/26, 1-02-002-12/26, 1-03-002-16/26; cyclone boilers, 1-01-002-03/23, 1-02-002-03/23, 1-03-002-03/23; and, atmospheric fluidized bed combustors, circulating bed, 1-01-002-18/38, 1-02-002-18, and 1-03-002-18.

[b]Emission factor should be applied to coal feed, as fired. To convert from lb/ton to kg/Mg, multiply by 0.5.

[c]Data are for residual oil fired boilers, Source Classification Codes (SCCs) 1-01-004-01/04.

[d]To convert from lb/10^3 gal to kg/10^3 L, multiply by 0.12.

*N/A - data not available for this metal

Table 5-3 Emission Factors for Various Organic Compounds from Controlled Coal Combustion

Pollutant[b]	Emission Factor[c] (lb/ton)	Emission Factor Rating
Acetaldehyde	5.7E-04	C
Acetophenone	1.5E-05	D
Acrolein	2.9E-04	D
Benzene	1.3E-03	A
Benzyl chloride	7.0E-04	D
Bromoform	3.9E-05	E
Carbon disulfide	1.3E-04	D
2-Chloroacetophenone	7.0E-06	E
Chlorobenzene	2.2E-05	D
Chloroform	5.9E-05	D
Cumene	5.3E-06	E
2,4-Dinitrotoluene	2.8E-07	D
Dimethyl sulfate	4.8E-05	E
Ethyl benzene	9.4E-05	D
Formaldehyde	2.4E-04	A
Hexane	6.7E-05	D
Methyl ethyl ketone	3.9E-04	D
Methyl hydrazine	1.7E-04	E
Methyl methacrylate	2.0E-05	E
Methylene chloride	2.9E-04	D
Phenol	1.6E-05	D
Propionaldehyde	3.8E-04	D
Tetrachloroethylene	4.3E-05	D
Toluene	2.4E-04	A
1,1,1-Trichloroethane	2.0E-05	E

Pollutant[b]	Emission Factor[c] (lb/ton)	Emission Factor Rating
Styrene	2.5E-05	D
Xylenes	3.7E-05	C
Vinyl acetate	7.6E-06	E

[a] Source: AP-42 Chapter 1, External Combustion Sources. Factors were developed from emissions data from ten sites firing bituminous coal, eight sites firing subbituminous coal, and from one site firing lignite. The emission factors are applicable to boilers using both wet limestone scrubbers or spray dryers and an electrostatic precipitator (ESP) or fabric filter (FF). In addition, the factors apply to boilers utilizing only an ESP or FF. SCCs = pulverized coal-fired, dry bottom boilers, 1-01-002-02/22, 1-02-002-02/22, 1-03-002-06/22; pulverized coal, dry bottom, tangentially-fired boilers, 1-01-002-12/26, 1-02-002-12/26, 1-03-002-16/26; cyclone boilers, 1-01-002-03/23, 1-02-002-03/23, 1-03-002-03/23; and, atmospheric fluidized bed combustors, circulating bed, 1-01-002-18/38, 1-02-002-18, and 1-03-002-18.

[b] Pollutants sampled for but not detected in any sampling run include: Carbon tetrachloride- 2 sites; 1,3-Dichloropropylene- 2 sites; N-nitrosodimethylamine- 2 sites; Ethylidene dichloride- 2 sites; Hexachlorobutadiene- 1 site; Hexachloroethane- 1 site; Propylene dichloride- 2 sites; 1,1,2,2-Tetrachloroethane- 2 sites; 1,1,2-Trichloroethane- 2 sites; Vinyl chloride- 2 sites; and, Hexachlorobenzene- 2 sites.

[c] Emission factor should be applied to coal feed, as fired. To convert from lb/ton to kg/Mg, multiply by 0.5.

Flue Gas Desulfurization

Potential Section 313 Chemicals from FGD	Source
Metals and/or compounds of arsenic, barium, cadmium, chromium, copper, cobalt, lead, manganese, mercury, nickel, selenium, silver, zinc	Present in flue gas or in lime/limestone

Another significant source of waste at electricity generating facilities is flue gas desulfurization (FGD). FGD is commonly used to control sulfur dioxide emissions as required by the Clean Air Act. Sulfur dioxide is produced during combustion when oxygen is combined with sulfur from coal and can be removed by various types of FGD systems. Ninety five percent of FGD systems used in electricity generating facilities are non-regenerable, meaning that they produce a waste for disposal. These systems may be further categorized as wet scrubber or spray dry systems.

In wet scrubber FGD systems, the flue gas is passed through a lime solution or a limestone slurry, where the calcium from the lime or limestone reacts with the sulfur dioxide in the flue gas to produce various calcium compounds. A high percentage of metals may also be removed from the flue gas as it passes through the lime or limestone, although volatile metals such as mercury and selenium may pass through the FGD system. Section 313 metals such as arsenic, cadmium, chromium, copper, cobalt, lead, manganese, mercury, nickel and selenium, silver, and zinc may be found in limestone as metal carbonates (e.g., cobalt carbonate, manganese carbonate, or zinc carbonate) or as other metal compounds (e.g., silver sulfide, copper sulfide). As the flue gas passes through the FGD system, metal compounds from both the limestone and the flue gas may

chemically convert to other metal compounds (such as sulfites and sulfates). Forced oxidation in FGD systems may also convert one Section 313 metal compound to another, for instance zinc sulfide may oxidize to zinc sulfate. The amount of a compound within a Section 313 metal compound category produced as a result of chemical conversion, even if it is within the same category, must be applied to the manufacturing threshold. Because the *de minimis* exemption only applies to Section 313 chemicals manufactured at the facility as impurities that remain in a product distributed by the facility, metal compounds coincidentally manufactured in FGD systems are not subject to the *de minimis* exemption.

FGD systems result in a waste slurry of hydrated calcium sulfate, hydrated calcium sulfite, and unreacted lime, which may be dewatered and/or stabilized with fly ash and disposed in impoundments or landfills. The treatment technique and efficiency would be reported in Section 7A, Part II of Form R.

Dry non-regenerable FGD systems spray an alkaline solution into the flue gas to react with the sulfur oxides. The water from the solution evaporates into the flue gas, leaving a dry powder, which is collected by a particulate collector such as a baghouse. This method is most common at facilities which burn low sulfur fuel. The Section 313 considerations for wet and dry FGD systems are the same. However, because wet scrubber systems result in the cooling of flue gases, they cause the more volatile trace elements to condense from the vapor phase.

Several information sources may be used to calculate the amount of Section 313 chemicals in FGD wastes. These sources include waste analyses, NPDES permits, and waste characterization performed to meet state or other solid waste management requirements. The best available information should be used to estimate concentrations of Section 313 chemicals in FGD sludge solids and liquors. In the absence of facility specific data, the values presented in Table 5-4 may be used to estimate concentrations. Table 5-4 shows concentrations of certain trace metals in FGD sludge solids and liquors. Only the weight of the parent metal must be considered when reporting releases of Section 313 metal compounds.

Table 5-4 Concentrations of Certain Trace Metals in FGD Sludge Solids and Liquors

Trace Element	Sludge Solids (ppm)	Sludge Liquors (ppm)
Arsenic	52.0	0.1
Boron	530.0	76.0
Cadmium	25.0	0.1
Chromium	180.0	0.3

Table 5-4 Concentrations of Certain Trace Metals in FGD Sludge Solids and Liquors		
Trace Element	Sludge Solids (ppm)	Sludge Liquors (ppm)
Copper	340.0	0.5
Mercury	6.0	0.1
Lead	290.0	0.5
Selenium	60.0	1.9

Source: The Release of Trace Metals From Limestone During Flue Gas Desulfurization by Electric Utilities, p.7.

Some potential releases or waste generation sources associated with FGD systems are:

- Fugitive and/or stack emissions of dry waste FGD material (§5.1, and/or §5.2)
- Discharge of water remaining after sludge dewatering (§5.3 or §6.1)
- Disposal of waste FGD material in on-site landfills, or surface impoundments (§5.5) or off-site to mines, quarries, or waste management facilities (§6.2).

Plant Maintenance

Examples of Potential Section 313 Chemicals Associated with Plant Maintenance	Source
Ammoniated EDTA, ammoniated citric acid, formic acid	Boiler cleaning agents
Hydrochloric acid (aerosol)	Manufactured during evaporation of boiler cleaning wastes
Ammonium bifluoride, thiourea	Inhibitor in boiler
Chemicals in halogenated or non-halogenated solvents	Routine metals cleaning

Boiler Cleaning

In spite of the high-quality water used in modern boilers, boilers gradually accumulate scale and corrosion products. Excessive corrosion or scale build-up on the water-side and fireside of boilers reduces heat transfer across tube walls, which reduces efficiency and can eventually lead to

tube failure. Therefore, boilers require periodic cleaning. Boilers are also cleaned prior to start-up to remove oil, grease, phosphates, nitrites, and suspended and dissolved solids.

High pressure jets of water, sometimes containing alkaline materials, are applied to the fireside surface of the boiler surface to remove the build-up. The wastes are collected and pumped to ash ponds or settling lagoons. Chemicals added to the water jet may be present in the waste.

To effectively remove scale deposits and metals from the water side of the boiler, a number of different cleaning chemicals may be used. Hydrochloric acid is the most commonly utilized cleaning solution; ammoniated EDTA, ammoniated citric acid, and formic acid are also used. Ammonium bifluoride and thiourea may be added as inhibitors to prevent attack of tube walls. Depending on the cleaning solution used, waterside boiler cleaning waste may include copper, nickel, chromium, zinc, ammonium sulfate, ammonium carbonate, copper, hydrochloric or other acids.

Wastes produced from boiler cleaning are sometimes evaporated in the boiler. In this case, if hydrochloric acid is the cleaning solution, hydrochloric acid aerosol may be manufactured. Hydrochloric acid is only reportable for purposes of Section 313 if it is in aerosol form. If hydrochloric acid aerosol is produced via evaporation, the quantity produced would be applied to the 25,000 pound manufacturing threshold.

Reporting of Aqueous 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 used is 10 percent of the total quantity of aqueous ammonia released or transferred. Aqueous ammonia may be generated in solution from 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 ammonium salts are purchased neat or as solids by a facility, then placed in water by that facility, the facility is manufacturing aqueous ammonia.

Boiler cleaning wastes may be treated in one or several treatment steps. Applicable codes to be reported in Part II, Section 7A of Form R are P11(Settling, clarification), P12 (Filtration), C11 (Neutralization), C01 (Chemical Precipitation-lime or sodium hydroxide), P13 (Sludge Dewatering; non-thermal, P99 (other treatment, e.g., solar evaporation).

Wastes from waterside cleaning are sometimes incinerated. On-site incineration should be reported in Section 7A, Part II of Form R, with the appropriate treatment code, while off-site incineration is reported in Section 6.2, Part II of Form R. The quantity of a Section 313 chemical destroyed or chemically converted would be reported in Part II, Section 8.6, Quantity treated on-site, of Form R. Metals should not be reported in Section 8.6. If a waste containing a reportable Section 313 chemical with a heating value at least 5,000 BTU per pound is combusted in the boiler, then the quantities of that chemical that are combusted in the boiler would be reported in Part II, Section 8.2, Quantity used for energy recovery on-site.

Other Plant Maintenance

Other plant maintenance wastes are produced from the cleaning of stacks, condensers, economizers, feedwater pumps, heat exchangers, deaerators, feedwater heaters, and piping, and may contain metal oxides and other Section 313 chemicals. Routine metals cleaning at power plants typically involves halogenated and non-halogenated solvents. At some sites, spent solvents are disposed as hazardous wastes, while at others they are burned in the boilers. These wastes may be sent to on-site ponds, impoundments or landfills, and may be co-managed with combustion wastes.

Floor and yard drain waste streams may be generated from rainfall, seepage from groundwater sources, leachate, equipment cleaning operations and spills. The composition of this waste is highly variable and may include coal dust, fly ash, oil, and detergents, and may be acidic if wastes from air preheater or boiler fire-side washings are present.

Some potential releases or waste generation sources associated with plant maintenance are:

- Releases from pipes equipment and valves during evaporation or burning of waste (fugitive air emissions, (§5.1)
- Evaporation from chemical or waste holding tanks (fugitive air emissions, §5.1)
- Stack emissions of evaporated or burned waste (stack air emissions, §5.2)
- Discharge of treated liquid waste (§5.3 or §6.1)
- Disposal of wastes into ash ponds, landfills or impoundments (releases to land on-site, §5.5)
- Disposal of wastes by a cleaning contractor (transfers to other off-site locations, §6.2).

APPENDIX A
ALPHABETICAL LISTING OF TRI CHEMICALS

CAS No.	CHEMICAL NAME	De Minimis Conc	Appx VIII	RCRA UTS	RCRA Code
4080-31-3	1-(3-Chloroallyl)-3,5,7-triaza-1-azoniaadamantane chloride	1.0			
354-11-0	1,1,1,2-Tetrachloro-2-fluoroethane (HCFC-121a)	1.0			
630-20-6	1,1,1,2-tetrachloroethane	1.0	X	X	U208
71-55-6	1,1,1-Trichloroethane (Methyl chloroform)	1.0	X	X	U226
354-14-3	1,1,2,2-Tetrachloro-1-fluoroethane (HCFC-121)	1.0			
79-34-5	1,1,2,2-Tetrachloroethane	1.0	X	X	U209
79-00-5	1,1,2-Trichloroethane	1.0	X	X	U227
13474-88-9	1,1-Dichloro-1,2,2,3,3-pentafluoropropane (HCFC-225cc)	1.0			
812-04-4	1,1-Dichloro-1,2,2-trifluoroethane (HCFC-123b)	1.0			
111512-56-2	1,1-Dichloro-1,2,3,3,3-pentafluoropropane (HCFC-225eb)	1.0			
1717-00-6	1,1-Dichloro-1-fluoroethane (HCFC-141b)	1.0			
57-14-7	1,1-Dimethyl hydrazine	0.1	X		U098
5124-30-1	1,1-Methylene bis(4-isocyanatocyclohexane)	1.0			
96-18-4	1,2,3-Trichloropropane	0.1	X	X	
120-82-1	1,2,4-Trichlorobenzene	1.0	X	X	
95-63-6	1,2,4-Trimethylbenzene	1.0			
106-88-7	1,2-Butylene oxide	1.0			
96-12-8	1,2-Dibromo-3-chloropropane (DBCP)	0.1	X	X	U066
106-93-4	1,2-Dibromoethane (Ethylene dibromide)	0.1	X	X	U067
422-44-6	1,2-Dichloro-1,1,2,3,3-pentafluoropropane (HCFC-225bb)	1.0			
354-23-4	1,2-Dichloro-1,1,2-trifluoroethane (HCFC-123a)	1.0			
431-86-7	1,2-Dichloro-1,1,3,3,3-pentafluoropropane (HCFC-225da)	1.0			
1649-08-7	1,2-Dichloro-1,1-difluoroethane (HCFC-132b)	1.0			
95-50-1	1,2-Dichlorobenzene	1.0	X	X	U070
107-06-2	1,2-Dichloroethane (Ethylene dichloride)	0.1	X	X	U077
540-59-0	1,2-Dichloroethylene	1.0			
78-87-5	1,2-Dichloropropane	1.0	X	X	U083
122-66-7	1,2-Diphenylhydrazine (Hydrazobenzene)	0.1	X	X	U109
95-54-5	1,2-Phenylenediamine	1.0		X	
615-28-1	1,2-Phenylenediamine dihydrochloride	1.0			
38661-72-2	1,3-Bis(methylisocyanate)cyclohexane	1.0			
106-99-0	1,3-Butadiene	0.1			
507-55-1	1,3-Dichloro-1,1,2,2,3-pentafluoropropane (HCFC-225cb)	1.0			
136013-79-1	1,3-Dichloro-1,1,2,3,3-pentafluoropropane (HCFC-225ea)	1.0			
541-73-1	1,3-Dichlorobenzene	1.0	X	X	U071
542-75-6	1,3-Dichloropropylene	0.1	X		U084
123-61-5	1,3-Phenylene diisocyanate				
108-45-2	1,3-Phenylenediamine	1.0			
10347-54-3	1,4-Bis(methylisocyanate)cyclohexane	1.0			
2556-36-7	1,4-Cyclohexane diisocyanate	1.0			
764-41-0	1,4-Dichloro-2-butene	1.0	X		U074
106-46-7	1,4-Dichlorobenzene	0.1	X	X	U072
123-91-1	1,4-Dioxane	0.1	X	X	U108
104-49-4	1,4-Phenylene diisocyanate				
624-18-0	1,4-Phenylenediamine dihydrochloride	1.0			
3173-72-6	1,5-Naphthalene diisocyanate	1.0			
82-28-0	1-Amino-2-methylanthraquinone	0.1			
35691-65-7	1-Bromo-1-(bromomethyl)-1,3-propanedicarbonitrile	1.0			
354-25-6	1-Chloro-1,1,2,2-tetrafluoroethane (HCFC-124a)	1.0			
75-68-3	1-Chloro-1,1-difluoroethane (HCFC-142b)	1.0			
5522-43-0	1-Nitropyrene	1.0			
16938-22-0	2,2,4-Trimethylhexamethylene diisocyanate	1.0			

128903-21-9	2,2-Dichloro-1,1,1,3,3-pentafluoropropane (HCFC-225aa)	1.0			
306-83-2	2,2-Dichloro-1,1,1-trifluoroethane (HCFC-123)	1.0			
2655-15-4	2,3,5-Trimethylphenyl methylcarbamate	1.0			
422-48-0	2,3-Dichloro-1,1,1,2,3-pentafluoropropane (HCFC-225ba)	1.0			
78-88-6	2,3-Dichloropropene	1.0			
15646-96-5	2,4,4-Trimethylhexamethylene diisocyanate	1.0			
95-95-4	2,4,5-Trichlorophenol	1.0	X	X	
88-06-2	2,4,6-Trichlorophenol	0.1	X	X	
94-75-7	2,4-D [Acetic acid, (2,4-dichloro-phenoxy)-]	1.0	X	X	U240
53404-37-8	2,4-D 2-ethyl-4-methylpentyl ester	0.1			
1928-43-4	2,4-D 2-ethylhexyl ester	0.1			
1929-73-3	2,4-D butoxyethyl ester	0.1			
94-80-4	2,4-D butyl ester	0.1			
2971-38-2	2,4-D chlorocrotyl ester	0.1			
94-11-1	2,4-D isopropyl ester	0.1			
1320-18-9	2,4-D propylene glycol butyl ether ester	0.1			
2702-72-9	2,4-D sodium salt	0.1			
94-82-6	2,4-DB	1.0			
615-05-4	2,4-Diaminoanisole	0.1			
39156-41-7	2,4-Diaminoanisole sulfate	0.1			
95-80-7	2,4-Diaminotoluene	0.1	X		
120-83-2	2,4-Dichlorophenol	1.0	X	X	U081
75790-87-3	2,4'-Diisocyanatodiphenyl sulfide	1.0			
105-67-9	2,4-Dimethylphenol	1.0	X	X	U101
51-28-5	2,4-Dinitrophenol	1.0	X	X	P048
121-14-2	2,4-Dinitrotoluene	1.0	X	X	U105
541-53-7	2,4-Dithiobiuret	1.0	X		P049
120-36-5	2,4-DP	0.1			
576-26-1	2,6-Dimethylphenol	1.0			
606-20-2	2,6-Dinitrotoluene	1.0	X	X	U106
87-62-7	2,6-Xylidine	0.1			
53-96-3	2-Acetylaminofluorene	0.1	X	X	U005
117-79-3	2-Aminoanthraquinone	0.1			
52-51-7	2-Bromo-2-nitropropane-1,3-diol (Bronopol)	1.0			
2837-89-0	2-Chloro-1,1,1,2-tetrafluoroethane (HCFC-124)	0.1			
75-88-7	2-Chloro-1,1,1-trifluoroethane (HCFC-133a)	1.0			
532-27-4	2-Chloroacetophenone	1.0			
110-80-5	2-Ethoxyethanol	1.0	X		U359
149-30-4	2-Mercaptobenzothiazole (MBT)	1.0			
109-86-4	2-Methoxyethanol	1.0			
75-86-5	2-Methyllactonitrile	1.0	X		P069
109-06-8	2-Methylpyridine	1.0	X		U191
88-75-5	2-Nitrophenol	1.0		X	
79-46-9	2-Nitropropane	0.1	X		U171
90-43-7	2-Phenylphenol	1.0			
422-56-0	3,3-Dichloro-1,1,1,2,2-pentafluoropropane (HCFC-225ca)	1.0			
91-94-1	3,3'-Dichlorobenzidine	0.1	X		U073
612-83-9	3,3'-Dichlorobenzidine dihydrochloride	0.1			
64969-34-2	3,3'-Dichlorobenzidine sulfate	0.1			
119-90-4	3,3'-Dimethoxybenzidine	0.1	X		U091
91-93-0	3,3'-Dimethoxybenzidine-4,4'-diisocyanate				
20325-40-0	3,3'-Dimethoxybenzidine dihydrochloride (o-Dianisidine dihydrochloride)	0.1			
111984-09-9	3,3'-Dimethoxybenzidine hydrochloride (o-Dianisidine hydrochloride)	0.1			
91-97-4	3,3'-Dimethyl-4,4'-diphenylene diisocyanate				

119-93-7	3,3'-Dimethylbenzidine (o-Tolidine)	0.1	X		U095
612-82-8	3,3'-Dimethylbenzidine dihydrochloride (o-Tolidine dihydrochloride)	0.1			
41766-75-0	3,3'-Dimethylbenzidine dihydrofluoride (o-Tolidine dihydrofluoride)	0.1			
460-35-5	3-Chloro-1,1,1-trifluoropropane (HCFC-253fb)	1.0			
563-47-3	3-Chloro-2-methyl-1-propene	0.1			
542-76-7	3-Chloropropionitrile	1.0	X		P027
55406-53-6	3-Iodo-2-propynyl butylcarbamate	1.0	X	X	
101-80-4	4,4'-Diaminodiphenyl ether	0.1			
4128-73-8	4,4'-Diisocyanatodiphenyl ether	1.0			
80-05-7	4,4'-Isopropylidenediphenol	1.0			
101-14-4	4,4'-Methylenebis(2-chloroaniline) (MBOCA)	0.1	X	X	U158
101-61-1	4,4'-Methylenebis(N,N-dimethyl)benzenamine	0.1			
101-77-9	4,4'-Methylenedianiline	0.1			
139-65-1	4,4'-Thiodianiline	0.1			
534-52-1	4,6-Dinitro-o-cresol	1.0	X	X	P047
60-09-3	4-Aminoazobenzene	0.1			
92-67-1	4-Aminobiphenyl	0.1	X	X	
60-11-7	4-Dimethylaminoazobenzene	0.1	X	X	U093
75790-84-0	4-Methyldiphenylmethane-3,4-diisocyanate	1.0			
92-93-3	4-Nitrobiphenyl	0.1			
100-02-7	4-Nitrophenol	1.0	X	X	U170
3697-24-3	5-Methylchrysene				
99-59-2	5-Nitro-o-anisidine	1.0			
99-55-8	5-Nitro-o-toluidine	1.0	X	X	U181
57-97-6	7,12-Dimethylbenz(a)anthracene				U094
194-59-2	7H-Dibenzo(c,g)carbazole				
71751-41-2	Abamectin [Avermectin B1]	1.0			
30560-19-1	Acephate (Acetylphosphoramidothioic acid O,S-dimethyl ester)	1.0			
75-07-0	Acetaldehyde	0.1			U001
60-35-5	Acetamide	0.1			
75-05-8	Acetonitrile	1.0	X	X	U003
98-86-2	Acetophenone	1.0	X		U004
62476-59-9	Acifluorfen, sodium salt [5-(2-Chloro-4-(trifluoromethyl)phenoxy)-2-nitrobenzoic acid, sodium salt]	1.0			
107-02-8	Acrolein	1.0	X	X	P003
79-06-1	Acrylamide	0.1	X	X	U007
79-10-7	Acrylic acid	1.0			U008
107-13-1	Acrylonitrile	0.1	X	X	U009
15972-60-8	Alachlor	1.0			
116-06-3	Aldicarb	1.0	X		P070
309-00-2	Aldrin [1,4:5,8-Dimethanonaphthalene, 1,2,3,4,10,10-hexachloro-1,4,4a,5,8,8a-hexahydro-(1.alpha.,4.alpha.,4a.beta.,5.alpha.,8.alpha.,8a.beta.)-]	1.0	X		P004
107-18-6	Allyl alcohol	1.0	X		P005
107-05-1	Allyl chloride	1.0	X	X	
107-11-9	Allylamine	1.0			
319-84-6	alpha-Hexachlorocyclohexane	1.0		X	
134-32-7	alpha-Naphthylamine	0.1	X		U167
7429-90-5	Aluminum (fume or dust)	1.0			
1344-28-1	Aluminum oxide (fibrous form)	1.0			
20859-73-8	Aluminum phosphide	1.0	X		P006
834-12-8	Ametryn (N-Ethyl-N'-(1-methylethyl)-6-(methylthio)-1,3,5,-triazine-2,4-diamine)	1.0			
33089-61-1	Amitraz	1.0			

61-82-5	Amitrole	0.1	X		U011
7664-41-7	Ammonia	1.0			
101-05-3	Anilazine [4,6-Dichloro-N-(2-chlorophenyl)-1,3,5-triazin-2-amine]	1.0			
62-53-3	Aniline	1.0	X	X	U012
120-12-7	Anthracene	1.0		X	
7440-36-0	Antimony	1.0	X	X	
7440-38-2	Arsenic	0.1	X	X	
1332-21-4	Asbestos (friable)	0.1			
1912-24-9	Atrazine (6-Chloro-N-ethyl-N'-(1-methylethyl)-1,3,5-triazine-2,4-diamine)	0.1			
7440-39-3	Barium	1.0	X	X	
22781-23-3	Bendiocarb [2,2-Dimethyl-1,3-benzodioxol-4-ol methylcarbamate]	1.0	X	X	
1861-40-1	Benfluralin (N-Butyl-N-ethyl-2,6-dinitro-4-(trifluoromethyl) benzenamine)	1.0			
17804-35-2	Benomyl	1.0	X	X	
56-55-3	Benz(a)anthracene				U018
98-87-3	Benzal chloride	1.0	X	X	U017
55-21-0	Benzamide	1.0			
71-43-2	Benzene	0.1	X	X	U019
92-87-5	Benzidine	0.1	X		U021
218-01-9	Benzo(a)phenanthrene				
50-32-8	Benzo(a)pyrene				U022
205-99-2	Benzo(b)fluoranthene				
205-82-3	Benzo(j)fluoranthene				
207-08-9	Benzo(k)fluoranthene				
189-55-9	Benzo(rst)pentaphene				U064
98-07-7	Benzoic trichloride (Benzotrichloride)		X		U023
98-88-4	Benzoyl chloride	1.0			
94-36-0	Benzoyl peroxide	1.0			
100-44-7	Benzyl chloride	1.0	X		P028
7440-41-7	Beryllium	0.1	X	X	P015
91-59-8	beta-Naphthylamine	0.1	X	X	U168
57-57-8	beta-Propiolactone	0.1			
82657-04-3	Bifenthrin	1.0			
92-52-4	Biphenyl	1.0			
108-60-1	Bis(2-chloro-1-methylethyl)ether	1.0	X		U027
111-91-1	Bis(2-chloroethoxy) methane	1.0	X	X	U024
111-44-4	Bis(2-chloroethyl) ether	1.0	X	X	U025
103-23-1	Bis(2-ethylhexyl) adipate				
542-88-1	Bis(chloromethyl) ether	0.1	X		P016
56-35-9	Bis(tributyltin) oxide	1.0			
10294-34-5	Boron trichloride	1.0			
7637-07-2	Boron trifluoride	1.0			
314-40-9	Bromacil (5-Bromo-6-methyl-3-(1-methylpropyl)-2,4-(1H,3H)-pyrimidinedione)	1.0			
53404-19-6	Bromacil, lithium salt (2,4-(1H,3H)-Pyrimidinedione, 5-bromo-6-methyl-3 (1-methylpropyl), lithium salt)	1.0			
7726-95-6	Bromine	1.0			
353-59-3	Bromochlorodifluoromethane (Halon 1211)	1.0			
75-25-2	Bromoform (Tribromomethane)	1.0	X	X	U225
74-83-9	Bromomethane (Methyl bromide)	1.0	X	X	U029
75-63-8	Bromotrifluoromethane (Halon 1301)	1.0			
1689-84-5	Bromoxynil (3,5-Dibromo-4-hydroxybenzonitrile)	1.0			

1689-99-2	Bromoxynil octanoate (Octanoic acid, 2,6-dibromo-4-cyanophenyl ester)	1.0			
357-57-3	Brucine	1.0	X		P018
141-32-2	Butyl acrylate	1.0			
123-72-8	Butyraldehyde	1.0			
4680-78-8	C.I. Acid Green 3	1.0			
6459-94-5	C.I. Acid Red 114	0.1			
569-64-2	C.I. Basic Green 4	1.0			
989-38-8	C.I. Basic Red 1	1.0			
1937-37-7	C.I. Direct Black 38	0.1			
28407-37-6	C.I. Direct Blue 218	0.1			
2602-46-2	C.I. Direct Blue 6	0.1			
16071-86-6	C.I. Direct Brown 95	0.1			
2832-40-8	C.I. Disperse Yellow 3	1.0			
81-88-9	C.I. Food Red 15	1.0			
3761-53-3	C.I. Food Red 5	0.1			
3118-97-6	C.I. Solvent Orange 7	1.0			
842-07-9	C.I. Solvent Yellow 14	1.0			
97-56-3	C.I. Solvent Yellow 3	1.0			
492-80-8	C.I. Solvent Yellow 34 (Auramine)	0.1	X		U014
128-66-5	C.I. Vat Yellow 4	1.0			
7440-43-9	Cadmium	0.1	X	X	
156-62-7	Calcium cyanamide	1.0			
133-06-2	Captan [1H-Isoindole-1,3(2H)-dione, 3a,4,7,7a-tetrahydro-2-[(trichloromethyl)thio]-]	1.0			
63-25-2	Carbaryl [1-Naphthalenol, methylcarbamate]	1.0	X	X	
1563-66-2	Carbofuran	1.0	X	X	
75-15-0	Carbon disulfide	1.0	X	X	P022
56-23-5	Carbon tetrachloride	0.1	X	X	U211
463-58-1	Carbonyl sulfide	1.0			
5234-68-4	Carboxin (5,6-Dihydro-2-methyl-N-phenyl-1,4-oxathiin-3-carboxamide)	1.0			
120-80-9	Catechol	1.0			
2439-01-2	Chinomethionat (6-Methyl-1,3-dithiolo[4,5-b]quinoxalin-2-one)	1.0			
133-90-4	Chloramben [Benzoic acid, 3-amino-2,5-dichloro-]	1.0			
57-74-9	Chlordane [4,7-Methanoindan, 1,2,3,4,5,6,7,8,8-octachloro-2,3,3a,4,7,7a-hexahydro-]	0.1	X	X	U036
115-28-6	Chlorendic acid	0.1			
90982-32-4	Chlorimuron ethyl (Ethyl-2-[[[(4-chloro-6-methoxyprimidin-2-yl)-carbonyl]-amino]sulfonyl]benzoate)	1.0			
7782-50-5	Chlorine	1.0			
10049-04-4	Chlorine dioxide	1.0			
79-11-8	Chloroacetic acid	1.0			
108-90-7	Chlorobenzene	1.0	X	X	U037
510-15-6	Chlorobenzilate [Benzeneacetic acid,4-chloro-.alpha.-(4-chlorophenyl)-.alpha.-hydroxy-, ethyl ester]	1.0	X	X	
75-45-6	Chlorodifluoromethane (HCFC-22)	1.0			
75-00-3	Chloroethane (Ethyl chloride)	1.0		X	
67-66-3	Chloroform	0.1	X	X	U044
74-87-3	Chloromethane (Methyl chloride)	1.0	X	X	U045
107-30-2	Chloromethyl methyl ether	0.1	X		U046
76-06-2	Chloropicrin	1.0			
126-99-8	Chloroprene	1.0	X	X	U210
63938-10-3	Chlorotetrafluoroethane	1.0			
1897-45-6	Chlorothalonil [1,3-Benzenedicarbonitrile, 2,4,5,6-tetrachloro-]	1.0			

75-72-9	Chlorotrifluoromethane (CFC-13)	1.0			
5598-13-0	Chlorpyrifos methyl (O,O-Dimethyl-O-(3,5,6-trichloro-2-pyridyl)phosphorothioate)	1.0			
64902-72-3	Chlorsulfuron (2-Chloro-N-[[(4-methoxy-6-methyl-1,3,5-triazin-2-yl)amino]carbonyl]benzenesulfonamide)	1.0			
7440-47-3	Chromium	0.1	X	X	
7440-48-4	Cobalt	0.1			
7440-50-8	Copper	1.0			
8001-58-9	Creosote	0.1			U051
1319-77-3	Cresol (mixed isomers)	1.0	X		U052
4170-30-3	Crotonaldehyde	1.0	X		U053
98-82-8	Cumene	1.0			U055
80-15-9	Cumene hydroperoxide	1.0			U096
135-20-6	Cupferron [Benzeneamine, N-hydroxy-N-nitroso, ammonium salt]	0.1			
21725-46-2	Cyanazine	1.0			
1134-23-2	Cycloate	1.0	X	X	
110-82-7	Cyclohexane	1.0			U056
108-93-0	Cyclohexanol	1.0			
68359-37-5	Cyfluthrin (3-(2,2-Dichloroethenyl)-2,2-dimethylcyclopropanecarboxylic acid, cyano(4-fluoro-3-phenoxyphenyl)methyl ester)	1.0			
68085-85-8	Cyhalothrin (3-(2-Chloro-3,3,3-trifluoro-1-propenyl)-2,2-Dimethylcyclopropanecarboxylic acid cyano(3-phenoxyphenyl) methyl ester)	1.0			
28057-48-9	d-trans-Allethrin [d-trans-Chrysanthemic acid of d-allethrone]	1.0			
533-74-4	Dazomet (Tetrahydro-3,5-dimethyl-2H-1,3,5-thiadiazine-2-thione)	1.0	X		
53404-60-7	Dazomet, sodium salt (Tetrahydro-3,5-dimethyl-2H-1,3,5-thiadiazine-2-thione, ion(1-), sodium)	1.0			
1163-19-5	Decabromodiphenyl oxide	1.0			
13684-56-5	Desmedipham	1.0			
117-81-7	Di(2-ethylhexyl) phthalate (DEHP)	0.1	X	X	U028
2303-16-4	Diallate [Carbamothioic acid, bis(1-methylethyl)-S-(2,3-dichloro-2-propenyl)ester]	1.0	X		U062
25376-45-8	Diaminotoluene (mixed isomers)	0.1	X		U221
333-41-5	Diazinon	1.0			
334-88-3	Diazomethane	1.0			
226-36-8	Dibenz(a,h)acridine				
224-42-0	Dibenz(a,j)acridine				
5385-75-1	Dibenzo(a,e)fluoranthene	1.0			
192-65-4	Dibenzo(a,e)pyrene				
53-70-3	Dibenzo(a,h)anthracene				U063
189-64-0	Dibenzo(a,h)pyrene				
191-30-0	Dibenzo(a,l)pyrene				
132-64-9	Dibenzofuran	1.0			
124-73-2	Dibromotetrafluoroethane (Halon 2402)	1.0			
84-74-2	Dibutyl phthalate	1.0	X	X	U069
1918-00-9	Dicamba (3,6-Dichloro-2-methyoxybenzoic acid)	1.0			
99-30-9	Dichloran (2,6-Dichloro-4-nitroaniline)	1.0			
90454-18-5	Dichloro-1,1,2-trifluoroethane	1.0			
25321-22-6	Dichlorobenzene (mixed isomers)	0.1	X		
75-27-4	Dichlorobromomethane	1.0		X	
75-71-8	Dichlorodifluoromethane (CFC-12)	1.0	X	X	U075
75-43-4	Dichlorofluoromethane (HCFC-21)	1.0			
75-09-2	Dichloromethane (Methylene chloride)	0.1	X	X	U080

127564-92-5	Dichloropentafluoropropane	1.0			
97-23-4	Dichlorophene (2,2'-Methylenebis(4-chlorophenol)	1.0			
76-14-2	Dichlorotetrafluoroethane (CFC-114)	1.0			
34077-87-7	Dichlorotrifluoroethane	1.0			
62-73-7	Dichlorvos [Phosphoric acid, 2-dichloroethenyl dimethyl ester]	0.1			
51338-27-3	Diclofop methyl (2-[4-(2,4-Dichlorophenoxy) phenoxy]propanoic acid, methyl ester)	1.0			
115-32-2	Dicofol [Benzenemethanol, 4-chloro-.alpha.-4-chlorophenyl)-.alpha.-(trichloromethyl)-]	1.0			
77-73-6	Dicyclopentadiene	1.0			
1464-53-5	Diepoxybutane	0.1	X		U085
111-42-2	Diethanolamine	1.0			
38727-55-8	Diethatyl ethyl	1.0			
84-66-2	Diethyl phthalate	0.1			U088
64-67-5	Diethyl sulfate	0.1			
134190-37-7	Diethyldiisocyanatobenzene				
35367-38-5	Diflubenzuron	1.0			
101-90-6	Diglycidyl resorcinol ether	0.1			
94-58-6	Dihydrosafrole	0.1	X		U090
55290-64-7	Dimethipin (2,3,-Dihydro-5,6-dimethyl-1,4-dithiin 1,1,4,4-tetraoxide)	1.0			
60-51-5	Dimethoate	1.0	X		P044
2524-03-0	Dimethyl chlorothiophosphate	1.0			
131-11-3	Dimethyl phthalate	1.0	X	X	U102
77-78-1	Dimethyl sulfate	0.1	X		U103
124-40-3	Dimethylamine	1.0			U092
2300-66-5	Dimethylamine dicamba	1.0			
79-44-7	Dimethylcarbamyl chloride	0.1	X		U097
88-85-7	Dinitrobutyl phenol (Dinoseb)	1.0			P020
25321-14-6	Dinitrotoluene (mixed isomers)	1.0			
39300-45-3	Dinocap	1.0			
957-51-7	Diphenamid	1.0			
122-39-4	Diphenylamine	1.0	X		
2164-07-0	Dipotassium endothall (7-Oxabicyclo(2.2.1)heptane-2,3-dicarboxylic acid, dipotassium salt)	1.0			
136-45-8	Dipropyl isocinchomeronate	1.0			
138-93-2	Disodium cyanodithioimidocarbonate	1.0			
330-54-1	Diuron	1.0			
2439-10-3	Dodine (Dodecylguanidine monoacetate)	1.0			
106-89-8	Epichlorohydrin	0.1	X		U041
13194-48-4	Ethoprop (Phosphorodithioic acid O-ethyl S,S-dipropyl ester)	1.0			
140-88-5	Ethyl acrylate	0.1			U113
541-41-3	Ethyl chloroformate	1.0			
759-94-4	Ethyl dipropylthiocarbamate (EPTC)	1.0	X	X	
100-41-4	Ethylbenzene	1.0		X	
74-85-1	Ethylene	1.0			
107-21-1	Ethylene glycol	1.0			
75-21-8	Ethylene oxide	0.1	X	X	U115
96-45-7	Ethylene thiourea	0.1	X		U116
151-56-4	Ethyleneimine (Aziridine)	0.1	X		P054
75-34-3	Ethylidene dichloride	1.0	X	X	U076
52-85-7	Famphur	1.0	X	X	P097
60168-88-9	Fenarimol (.alpha.-(2-Chlorophenyl)-.alpha.-4-chlorophenyl)-5-pyrimidinemethanol)	1.0			
13356-08-6	Fenbutatin oxide (Hexakis(2-methyl-2-phenylpropyl)distannoxane)	1.0			

66441-23-4	Fenoxaprop ethyl (2-(4-((6-Chloro-2-benzoxazolylen)oxy)phenoxy)propanoic acid, ethyl ester)	1.0			
72490-01-8	Fenoxycarb (2-(4-Phenoxy-phenoxy)-ethyl]carbamic acid ethyl ester)	1.0			
39515-41-8	Fenpropathrin (2,2,3,3-Tetramethylcyclopropane carboxylic acid cyano(3-phenoxyphenyl)methyl ester)	1.0			
55-38-9	Fenthion (O,O-Dimethyl O-[3-methyl-4-(methylthio) phenyl] ester, phosphorothioic acid)	1.0			
51630-58-1	Fenvalerate (4-Chloro-alpha-(1-methylethyl)benzeneacetic acid cyano(3-phenoxyphenyl)methyl ester)	1.0			
14484-64-1	Ferbam (Tris(dimethylcarbamodithioato-S,S')iron)	1.0	X		
69806-50-4	Fluazifop butyl (2-[4-[[5-(Trifluoromethyl)-2-pyridinyl]oxy]-phenoxy]propanoic acid, butyl ester)	1.0			
2164-17-2	Fluometuron [Urea, N,N-dimethyl-N'-[3-(trifluoromethyl)phenyl]-]	1.0			
7782-41-4	Fluorine	1.0	X		P056
51-21-8	Fluorouracil (5-Fluorouracil)	1.0			
69409-94-5	Fluvalinate (N-[2-Chloro-4-(trifluoromethyl)phenyl]-DL-valine(+)-cyano(3-phenoxyphenyl)methyl ester)	1.0			
133-07-3	Folpet	1.0			
72178-02-0	Fomesafen (5-(2-Chloro-4-(trifluoromethyl)phenoxy)-N methylsulfonyl)-2-nitrobenzamide)	1.0			
50-00-0	Formaldehyde	0.1	X		U122
64-18-6	Formic acid	1.0	X		U123
76-13-1	Freon 113 [Ethane, 1,1,2-trichloro-1,2,2,-trifluoro-]	1.0		X	
76-44-8	Heptachlor [1,4,5,6,7,8,8-Heptachloro-3a,4,7,7a-tetrahydro-4,7-methano-1H-indene]		X	X	P059
87-68-3	Hexachloro-1,3-butadiene	1.0	X	X	U128
118-74-1	Hexachlorobenzene	0.1	X	X	U127
77-47-4	Hexachlorocyclopentadiene	1.0	X	X	U130
67-72-1	Hexachloroethane	1.0	X	X	U131
1335-87-1	Hexachloronaphthalene	1.0			
70-30-4	Hexachlorophene	1.0	X		U132
680-31-9	Hexamethylphosphoramide	0.1			
51235-04-2	Hexazinone	1.0			
67485-29-4	Hydramethylnon (Tetrahydro-5,5-dimethyl-2(1H)-pyrimidinone[3-[4-(trifluoromethyl)phenyl]-1-[2-[4-(trifluoromethyl)phenyl]ethenyl]-2-propenylidene]hydrazone)	1.0			
302-01-2	Hydrazine	0.1	X		U133
10034-93-2	Hydrazine sulfate	0.1			
7647-01-0	Hydrochloric acid	1.0			
74-90-8	Hydrogen cyanide	1.0	X		P063
7664-39-3	Hydrogen fluoride	1.0	X		U134
123-31-9	Hydroquinone	1.0			
35554-44-0	Imazalil (1-[2-(2,4-Dichlorophenyl)-2-(2-propenyloxy)ethyl]-1H-imidazole)	1.0			
193-39-5	Indeno[1,2,3-cd]pyrene				U137
13463-40-6	Iron pentacarbonyl	1.0			
78-84-2	Isobutyraldehyde	1.0			
465-73-6	Isodrin	1.0	X	X	P060
25311-71-1	Isofenphos (2-[[Ethoxyl[(1-methylethyl)amino] phosphinothioyl]oxy] benzoic acid 1-methylethyl ester)	1.0			
4098-71-9	Isophorone diisocyanate	1.0			
67-63-0	Isopropyl alcohol (mfg-strong acid process)	1.0			
120-58-1	Isosafrole	1.0	X	X	U141

77501-63-4	Lactofen (5-(2-Chloro-4-(trifluoromethyl)phenoxy)-2-nitro-2-ethoxy-1-methyl-2-oxoethyl ester)	1.0			
7439-92-1	Lead	0.1	X	X	
58-89-9	Lindane [Cyclohexane, 1,2,3,4,5,6-hexachloro-, (1.alpha.,2.alpha.,3.beta.,4.alpha.,5.alpha.,6.beta.)-]	0.1	X	X	U129
330-55-2	Linuron	1.0			
554-13-2	Lithium carbonate	1.0			
108-39-4	m-Cresol	1.0		X*	U052
99-65-0	m-Dinitrobenzene	1.0			
108-38-3	m-Xylene	1.0		X*	U239
121-75-5	Malathion	1.0			
108-31-6	Maleic anhydride	1.0	X		U147
109-77-3	Malononitrile	1.0	X		U149
12427-38-2	Maneb [Carbamodithioic acid, 1,2-ethanediylbis-, manganese complex]	1.0			
7439-96-5	Manganese	1.0			
93-65-2	Mecoprop	0.1			
7439-97-6	Mercury	1.0	X	X	U151
150-50-5	Merphos	1.0			
126-98-7	Methacrylonitrile	1.0	X	X	
137-42-8	Metham sodium (Sodium methyldithiocarbamate)	1.0	X		
67-56-1	Methanol	1.0		X	U154
20354-26-1	Methazole (2-(3,4-Dichlorophenyl)-4-methyl-1,2,4-oxadiazolidine-3,5-dione)	1.0			
2032-65-7	Methiocarb	1.0	X	X	
94-74-6	Methoxone ((4-Chloro-2-methylphenoxy) acetic acid) (MCPA)	0.1			
3653-48-3	Methoxone sodium salt ((4-Chloro-2-methylphenoxy) acetate sodium salt)	0.1			
72-43-5	Methoxychlor [Benzene, 1,1'-(2,2,2-trichloroethylidene)bis [4-methoxy-]	1.0	X	X	U247
96-33-3	Methyl acrylate	1.0			
79-22-1	Methyl chlorocarbonate	1.0	X		U156
78-93-3	Methyl ethyl ketone	1.0	X	X	U159
60-34-4	Methyl hydrazine	1.0	X		P068
74-88-4	Methyl iodide	1.0	X	X	U138
108-10-1	Methyl isobutyl ketone	1.0		X	U161
624-83-9	Methyl isocyanate	1.0	X		P064
556-61-6	Methyl isothiocyanate (Isothiocyanatomethane)	1.0			
80-62-6	Methyl methacrylate	1.0	X	X	U162
298-00-0	Methyl parathion	1.0	X	X	P071
1634-04-4	Methyl tert-butyl ether	1.0			
74-95-3	Methylene bromide	1.0	X	X	U068
101-68-8	Methylenebis(phenylisocyanate) (MBI)				
101-68-8	Methylenebis(phenylisocyanate) (MDI)				
9006-42-2	Metiram	1.0			
21087-64-5	Metribuzin	1.0			
7786-34-7	Mevinphos	1.0			
90-94-8	Michler's ketone	0.1			
2212-67-1	Molinate (1H-Azepine-1 carbothioic acid, hexahydro-S-ethyl ester)	1.0	X	X	
1313-27-5	Molybdenum trioxide	1.0			
76-15-3	Monochloropentafluoroethane (CFC-115)	1.0			
150-68-5	Monuron	1.0			
505-60-2	Mustard gas [Ethane, 1,1'-thiobis[2-chloro-]	0.1	X		
88671-89-0	Myclobutanil (.alpha.-Butyl-.alpha.-(4-chlorophenyl)-1H-1,2,4-triazole-1-propanenitrile)	1.0			

121-69-7	N,N-Dimethylaniline	1.0			
68-12-2	N,N-Dimethylformamide	0.1			
71-36-3	n-Butyl alcohol	1.0		X	U031
110-54-3	n-Hexane	1.0			
872-50-4	N-Methyl-2-pyrrolidone	1.0			
924-42-5	N-Methylolacrylamide	1.0			
759-73-9	N-Nitroso-N-ethylurea	0.1	X		U176
684-93-5	N-Nitroso-N-methylurea	0.1	X		U177
924-16-3	N-Nitrosodi-n-butylamine	0.1	X	X	U172
621-64-7	N-Nitrosodi-n-propylamine	0.1	X	X	U111
55-18-5	N-Nitrosodiethylamine	0.1	X	X	U174
62-75-9	N-Nitrosodimethylamine	0.1	X		P082
86-30-6	N-Nitrosodiphenylamine	1.0		X	
4549-40-0	N-Nitrosomethylvinylamine	0.1	X		P084
59-89-2	N-Nitrosomorpholine	0.1	X	X	
16543-55-8	N-Nitrosonornicotine	0.1	X		
100-75-4	N-Nitrosopiperidine	0.1	X	X	U179
142-59-6	Nabam	1.0			
300-76-5	Naled	1.0			
91-20-3	Naphthalene	1.0	X	X	U165
7440-02-0	Nickel	0.1	X	X	
1929-82-4	Nitrapyrin (2-Chloro-6-(trichloromethyl)pyridine)	1.0			
7697-37-2	Nitric acid	1.0			
139-13-9	Nitrilotriacetic acid	0.1			
98-95-3	Nitrobenzene	1.0	X	X	U169
1836-75-5	Nitrofen [Benzene, 2,4-dichloro-1-(4-nitrophenoxy)-]	0.1			
51-75-2	Nitrogen mustard [2-Chloro-N-(2-chloroethyl)-N-methylethanamine]	0.1	X		
55-63-0	Nitroglycerin	1.0	X		P081
27314-13-2	Norflurazon (4-Chloro-5-(methylamino)-2-[3-(trifluoromethyl)phenyl]-3(2H)-pyridazinone)	1.0			
90-04-0	o-Anisidine	0.1			
134-29-2	o-Anisidine hydrochloride	0.1			
95-48-7	o-Cresol	1.0		X	U052
528-29-0	o-Dinitrobenzene	1.0			
95-53-4	o-Toluidine	0.1	X		U328
636-21-5	o-Toluidine hydrochloride	0.1	X		U222
95-47-6	o-Xylene	1.0		X	U239
2234-13-1	Octachloronaphthalene	1.0			
19044-88-3	Oryzalin (4-(Dipropylamino)-3,5-dinitrobenzenesulfonamide)	1.0			
20816-12-0	Osmium tetroxide	1.0	X		P087
301-12-2	Oxydemeton methyl (S-(2-(Ethylsulfinyl)ethyl) O,O-dimethyl ester phosphorothioic acid)	1.0			
19666-30-9	Oxydiazon (3-[2,4-Dichloro-5-(1-methylethoxy)phenyl]-5-(1,1-dimethylethyl)-1,3,4-oxadiazol-2(3H)-one)	1.0			
42874-03-3	Oxyfluorfen	1.0			
10028-15-6	Ozone	1.0			
104-94-9	p-Anisidine	1.0			
95-69-2	p-Chloro-o-toluidine	0.1			
106-47-8	p-Chloroaniline	0.1	X	X	P024
104-12-1	p-Chlorophenyl isocyanate	1.0			
120-71-8	p-Cresidine	0.1			
106-44-5	p-Cresol	1.0		X*	U239
100-25-4	p-Dinitrobenzene	1.0		X	
100-01-6	p-Nitroaniline	1.0	X	X	P077
156-10-5	p-Nitrosodiphenylamine	1.0			

106-50-3	p-Phenylenediamine	1.0			
106-42-3	p-Xylene	1.0		X*	U239
123-63-7	Paraldehyde	1.0	X		U182
1910-42-5	Paraquat dichloride	1.0			
56-38-2	Parathion [Phosphorothioic acid, O,O-diethyl-O-(4-nitrophenyl) ester]	1.0	X	X	P089
1114-71-2	Pebulate (Butylethylcarbamothioic acid S-propyl ester)	1.0	X	X	
40487-42-1	Pendimethalin (N-(1-Ethylpropyl)-3,4-dimethyl-2,6-dinitrobenzenamine)	1.0			
76-01-7	Pentachloroethane	1.0	X	X	U184
87-86-5	Pentachlorophenol (PCP)	0.1	X	X	
57-33-0	Pentobarbital sodium	1.0			
79-21-0	Peracetic acid	1.0			
594-42-3	Perchloromethyl mercaptan	1.0			
52645-53-1	Permethrin (3-(2,2-Dichloroethenyl)-2,2-dimethylcyclopropane carboxylic acid, (3-phenoxyphenyl)methyl ester)	1.0			
85-01-8	Phenanthrene	1.0		X	
108-95-2	Phenol	1.0	X		U188
26002-80-2	Phenothrin (2,2-Dimethyl-3-(2-methyl-1-propenyl)cyclopropanecarboxylic acid (3-phenoxyphenyl)methyl ester)	1.0			
57-41-0	Phenytoin	0.1			
75-44-5	Phosgene	1.0	X		P095
7803-51-2	Phosphine	1.0	X		P096
7664-38-2	Phosphoric acid	1.0			
7723-14-0	Phosphorus (yellow or white)	1.0			
85-44-9	Phthalic anhydride	1.0	X	X	U190
1918-02-1	Picloram	1.0			
88-89-1	Picric acid	1.0			
51-03-6	Piperonyl butoxide	1.0			
29232-93-7	Pirimiphos methyl (O-(2-(Diethylamino)-6-methyl-4-pyrimidinyl)-O,O-dimethyl phosphorothioate)	1.0			
1336-36-3	Polychlorinated biphenyls (PCBs)	0.1		X	
9016-87-9	Polymeric diphenylmethane diisocyanate	1.0			
7758-01-2	Potassium bromate	0.1			
128-03-0	Potassium dimethyldithiocarbamate	1.0	X		
137-41-7	Potassium N-methyldithiocarbamate	1.0	X		
41198-08-7	Profenofos (O-(4-Bromo-2-chlorophenyl)-O-ethyl-S-propylphosphorothioate)	1.0			
7287-19-6	Prometryn (N,N'-Bis(1-methylethyl)-6-methylthio-1,3,5-triazine-2,4-diamine)	1.0			
23950-58-5	Pronamide	1.0	X	X	U192
1918-16-7	Propachlor (2-Chloro-N-(1-methylethyl)-N-phenylacetamide)	1.0			
1120-71-4	Propane sultone	0.1	X		U193
709-98-8	Propanil (N-(3,4-Dichlorophenyl)propanamide)	1.0			
2312-35-8	Propargite	1.0			
107-19-7	Propargyl alcohol	1.0	X		P102
31218-83-4	Propetamphos (3-[(Ethylamino)methoxyphosphinothioyl]oxy]-2-butenoic acid, 1-methylethyl ester)	1.0			
60207-90-1	Propiconazole (1-[2-(2,4-Dichlorophenyl)-4-propyl-1,3-dioxolan-2-yl]-methyl-1H-1,2,4,-triazole)	1.0			
123-38-6	Propionaldehyde	1.0			
114-26-1	Propoxur [Phenol, 2-(1-methylethoxy)-, methylcarbamate]	1.0	X	X	
115-07-1	Propylene (Propene)	1.0			
75-56-9	Propylene oxide	0.1			
75-55-8	Propyleneimine	0.1	X		P067

110-86-1	Pyridine	1.0	X	X	U196
91-22-5	Quinoline	1.0			
106-51-4	Quinone	1.0	X		U197
82-68-8	Quintozene (Pentachloronitrobenzene)	1.0	X	X	U185
76578-14-8	Quizalofop-ethyl (2-[4-[(6-Chloro-2-quinoxalinyl)oxy]phenoxy] propanoic acid ethyl ester)	1.0			
10453-86-8	Resmethrin ([5-(Phenylmethyl)-3-furanyl]methyl 2,2-dimethyl-3-(2-methyl-1-propenyl)cyclopropanecarboxylate])	1.0			
78-48-8	S,S,S-Tributyltrithiophosphate (DEF)	1.0			
81-07-2	Saccharin (manufacturing)	0.1	X		U202
94-59-7	Safrole	0.1	X	X	U203
78-92-2	sec-Butyl alcohol	1.0			
7782-49-2	Selenium	1.0	X	X	
74051-80-2	Sethoxydim (2-[1-(Ethoxyimino) butyl]-5-[2-(ethylthio)propyl]-3-hydroxyl-2-cyclohexen-1-one)	1.0			
7440-22-4	Silver	1.0	X	X	
122-34-9	Simazine	1.0			
26628-22-8	Sodium azide	1.0			P105
1982-69-0	Sodium dicamba (3,6-Dichloro-2-methoxybenzoic acid, sodium salt)	1.0			
128-04-1	Sodium dimethyldithiocarbamate	1.0	X		
62-74-8	Sodium fluoroacetate	1.0	X		P058
7632-00-0	Sodium nitrite	1.0			
132-27-4	Sodium o-phenylphenoxide	0.1			
131-52-2	Sodium pentachlorophenate	1.0			
100-42-5	Styrene	0.1			
96-09-3	Styrene oxide	0.1			
7664-93-9	Sulfuric acid	1.0			
2699-79-8	Sulfuryl fluoride (Vikane)	1.0			
35400-43-2	Sulprofos (O-Ethyl O-[4-(methylthio)phenyl]phosphorodithioic acid S-propyl ester)	1.0			
34014-18-1	Tebuthiuron (N-[5-(1,1-Dimethylethyl)-1,3,4-thiadiazol-2-yl)-N,N'-dimethylurea)	1.0			
3383-96-8	Temephos	1.0			
5902-51-2	Terbacil (5-Chloro-3-(1,1-dimethylethyl)-6-methyl- 2,4 (1H,3H)-pyrimidinedione)	1.0			
75-65-0	tert-Butyl alcohol	1.0			
127-18-4	Tetrachloroethylene (Perchloroethylene)	0.1	X	X	
961-11-5	Tetrachlorvinphos [Phosphoric acid, 2-chloro-1-(2,3,5-trichlorophenyl) ethenyl dimethyl ester]	1.0			
64-75-5	Tetracycline hydrochloride	1.0			
7696-12-0	Tetramethrin (2,2-Dimethyl-3-(2-methyl-1-propenyl)cyclopropanecarboxylic acid (1,3,4,5,6,7-hexahydro-1,3-dioxo-2H-isoindol-2-yl)methyl ester)	1.0			
7440-28-0	Thallium	1.0	X	X	
148-79-8	Thiabendazole (2-(4-Thiazolyl)-1H-benzimidazole)	1.0			
62-55-5	Thioacetamide	0.1	X		U218
28249-77-6	Thiobencarb (Carbamic acid, diethylthio-, S-(p-chlorobenzyl))	1.0			
59669-26-0	Thiodicarb	1.0	X	X	
23564-05-8	Thiophanate-methyl	1.0	X	X	
23564-06-9	Thiophanate ethyl ([1,2-Phenylenebis (iminocarbonothioyl)] biscarbamic acid diethyl ester)	1.0			
79-19-6	Thiosemicarbazide	1.0	X		P116
62-56-6	Thiourea	0.1	X		U219
137-26-8	Thiram	1.0	X		U244
1314-20-1	Thorium dioxide	1.0			

7550-45-0	Titanium tetrachloride	1.0			
108-88-3	Toluene	1.0	X	X	U220
584-84-9	Toluene-2,4-diisocyanate	0.1			
91-08-7	Toluene-2,6-diisocyanate	0.1			
26471-62-5	Toluene diisocyanate (mixed isomers)	0.1	X		U223
8001-35-2	Toxaphene	0.1	X	X	P123
10061-02-6	trans-1,3-Dichloropropene	0.1		X	
110-57-6	trans-1,4-Dichloro-2-butene	1.0			
43121-43-3	Triadimefon (1-(4-Chlorophenoxy)-3,3-dimethyl-1-(1H-1,2,4-triazol-1-yl)-2-butanone)	1.0			
2303-17-5	Triallate	1.0	X	X	
68-76-8	Triaziquone [2,5-Cyclohexadiene-1,4-dione, 2,3,5-tris(1-aziridinyl)-]	1.0			
101200-48-0	Tribenuron methyl (2-(4-Methoxy-6-methyl-1,3,5-triazin-2-yl)-methylamino)carbonyl)amino)sulfonyl)-, methyl ester)	1.0			
1983-10-4	Tributyltin fluoride	1.0			
2155-70-6	Tributyltin methacrylate	1.0			
52-68-6	Trichlorfon [Phosphonic acid, (2,2,2-trichloro-1-hydroxyethyl)-,dimethyl ester]	1.0			
76-02-8	Trichloroacetyl chloride	1.0			
79-01-6	Trichloroethylene	0.1	X	X	U228
75-69-4	Trichlorofluoromethane (CFC-11)	1.0	X	X	U121
57213-69-1	Triclopyr triethylammonium salt	1.0			
121-44-8	Triethylamine	1.0	X		
1582-09-8	Trifluralin [Benezeneamine, 2,6-dinitro-N,N-dipropyl-4-(trifluoromethyl)-]	1.0			
26644-46-2	Triforine (N,N'-[1,4-Piperazinediylbis(2,2,2-trichloroethylidene)] bisformamide)	1.0			
639-58-7	Triphenyltin chloride	1.0			
76-87-9	Triphenyltin hydroxide	1.0			
126-72-7	Tris(2,3-dibromopropyl) phosphate	0.1	X	X	U235
72-57-1	Trypan blue	0.1	X		U236
51-79-6	Urethane (Ethyl carbamate)	0.1	X		U238
7440-62-2	Vanadium (fume or dust)	1.0		X	
50471-44-8	Vinclozolin (3-(3,5-Dichlorophenyl)-5-ethenyl-5-methyl-2,4-oxazolidinedione)	1.0			
108-05-4	Vinyl acetate	0.1			
593-60-2	Vinyl bromide	0.1			
75-01-4	Vinyl chloride	0.1	X	X	U043
75-35-4	Vinylidene chloride	1.0	X	X	U078
1330-20-7	Xylene (mixed isomers)	1.0		X	U239
7440-66-6	Zinc (fume or dust)	1.0		X	
12122-67-7	Zineb [Carbamodithioic acid, 1,2-ethanediylbis-, zinc complex]	1.0			

* as mixed isomers

Chemical Categories

Section 313 requires reporting on the toxic chemical categories listed below, in addition to the specific toxic chemicals listed above.

The metal compounds listed below, unless otherwise specified, are defined as including any unique chemical substance that contains the named metal (i.e., antimony, nickel, etc.) as part of that chemical's structure.

Toxic chemical categories are subject to the 1 percent *de minimis* concentration unless the substance involved meets the definition of an OSHA carcinogen in which case the 0.1 percent *de minimis* concentration applies. The *de minimis* concentration for each category is provided in parentheses.

Chemical Categories

Antimony Compounds (1.0)

Includes any unique chemical substance that contains antimony as part of that chemical's infrastructure.

Arsenic Compounds (inorganic compounds: 0.1; organic compounds: 1.0)

Includes any unique chemical substance that contains arsenic as part of that chemical's infrastructure.

Barium Compounds (1.0)

Includes any unique chemical substance that contains barium as part of that chemical's infrastructure.

This category does not include: Barium sulfate CAS Number 7727-43-7

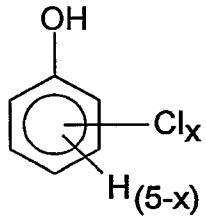
Beryllium Compounds (0.1)

Includes any unique chemical substance that contains beryllium as part of that chemical's infrastructure.

Cadmium Compounds (0.1)

Includes any unique chemical substance that contains cadmium as part of that chemical's infrastructure.

Chlorophenols (0.1)



Where x = 1 to 5

Chromium Compounds (chromium VI compounds: 0.1; chromium III compounds: 1.0)

Includes any unique chemical substance that contains chromium as part of that chemical's infrastructure.

Cobalt Compounds (0.1)

Includes any unique chemical substance that contains cobalt as part of that chemical's infrastructure.

Copper Compounds (1.0)

Includes any unique chemical substance that contains copper as part of that chemical's infrastructure.

This category does not include copper phthalocyanine compounds that are substituted with only hydrogen, and/or chlorine, and/or bromine.

Cyanide Compounds (1.0)

X^+CN^- where $X = H^+$ or any other group where a formal dissociation may occur. For example KCN or $Ca(CN)_2$.

Diisocyanates (1.0)

This category includes only those chemicals listed below.

38661-72-2	1,3-Bis(methylisocyanate)cyclohexane
10347-54-3	1,4-Bis(methylisocyanate)cyclohexane
2556-36-7	1,4-Cyclohexane diisocyanate
134190-37-7	Diethyldiisocyanatobenzene
4128-73-8	4,4'-Diisocyanatodiphenyl ether
75790-87-3	2,4'-Diisocyanatodiphenyl sulfide
91-93-0	3,3'-Dimethoxybenzidine-4,4'-diisocyanate
91-97-4	3,3'-Dimethyl-4,4'-diphenylene diisocyanate
139-25-3	3,3'-Dimethyldiphenylmethane-4,4'-diisocyanate
822-06-0	Hexamethylene-1,6-diisocyanate
4098-71-9	Isophorone diisocyanate

75790-84-0	4-Methyldiphenylmethane-3,4-diisocyanate
5124-30-1	1,1-Methylene bis(4-isocyanatocyclohexane)
101-68-8	Methylenebis(phenylisocyanate) (MDI)
3173-72-6	1,5-Naphthalene diisocyanate
123-61-5	1,3-Phenylene diisocyanate
104-49-4	1,4-Phenylene diisocyanate
9016-87-9	Polymeric diphenylmethane diisocyanate
16938-22-0	2,2,4-Trimethylhexamethylene diisocyanate
15646-96-5	2,4,4-Trimethylhexamethylene diisocyanate

Ethylenebisdithiocarbamic acid, salts and esters (EBDCs) (1.0)

Includes any unique chemical substance that is or that contains EBDC or an EBDC salt or ester as part of that chemical's infrastructure.

Certain Glycol Ethers (1.0)

$R\text{-}(OCH_2CH_2)_n\text{-}OR'$

Where n = 1, 2, or 3

R = alkyl C7 or less; or

R = phenyl or alkyl substituted phenyl;

R' = H, or alkyl C7 or less; or

OR' consisting of carboxylic acid ester, sulfate, phosphate, nitrate, or sulfonate.

Lead Compounds (inorganic compounds: 0.1; organic compounds 1.0)

Includes any unique chemical substance that contains lead as part of that chemical's infrastructure.

Manganese Compounds (1.0)

Includes any unique chemical substance that contains manganese as part of that chemical's infrastructure.

Mercury Compounds (1.0)

Includes any unique chemical substance that contains mercury as part of that chemical's infrastructure.

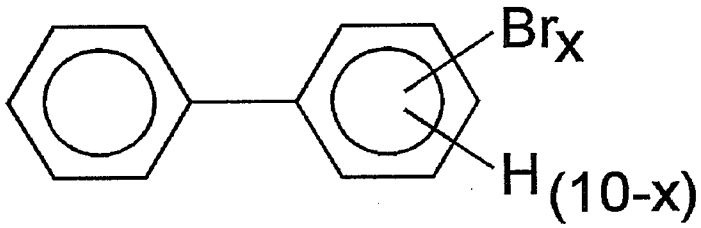
Nickel Compounds (0.1)

Includes any unique chemical substance that contains nickel as part of that chemical's infrastructure.

Nicotine and salts (1.0)

Includes any unique chemical substance that contains nicotine or a nicotine salt as part of that chemical's infrastructure.

Nitrate compounds (water dissociable; reportable only when in aqueous solution) (1.0)
Polybrominated Biphenyls (PBBs) (0.1)



Where x = 1 to 10

Polychlorinated alkanes (C10 to C13) (1.0, except for those members of the category that have an average chain length of 12 carbons and contain an average chlorine content of 60 percent by weight which are subject to the 0.1 percent *de minimis*)

$C_xH_{2x+2-y}Cl_y$
where x = 10 to 13;
y = 3 to 12; and
the average chlorine content ranges from 40 - 70% with the limiting molecular formulas $C_{10}H_{19}Cl_3$ and $C_{13}H_{16}Cl_{12}$.

Polycyclic aromatic compounds (PACs) (0.1, except for benzo(a)phenanthrene and dibenzo(a,e)fluoranthene which are subject to the 1.0 percent *de minimis*)

This category includes only those chemicals listed below.

56-55-3	Benz(a)anthracene
205-99-2	Benzo(b)fluoranthene
205-82-3	Benzo(j)fluoranthene
207-08-9	Benzo(k)fluoranthene
189-55-9	Benzo(rst)pentaphene
218-01-9	Benzo(a)phenanthrene
50-32-8	Benzo(a)pyrene
226-36-8	Dibenz(a,h)acridine
224-42-0	Dibenz(a,j)acridine
53-70-3	Dibenzo(a,h)anthracene
194-59-2	7H-Dibenzo(c,g)carbazole
5385-75-1	Dibenzo(a,e)fluoranthene

192-65-4	Dibenzo(a,e)pyrene
189-64-0	Dibenzo(a,h)pyrene
191-30-0	Dibenzo(a,l)pyrene
57-97-6	7,12-Dimethylbenz(a)anthracene
193-39-5	Indeno[1,2,3-cd]pyrene
3697-24-3	5-Methylchrysene
5522-43-0	1-Nitropyrene

Selenium Compounds (1.0)

Includes any unique chemical substance that contains selenium part of that chemical's infrastructure.

Silver Compounds (1.0)

Includes any unique chemical substance that contains silver part of that chemical's infrastructure.

Strychnine and salts (1.0)

Includes any unique chemical substance that contains strychnine or a strychnine salt as part of that chemical's infrastructure.

Thallium Compounds (1.0)

Includes any unique chemical substance that contains thallium as part of that chemical's infrastructure.

Warfarin and salts (1.0)

Includes any unique chemical substance that contains warfarin or a warfarin salt as part of that chemical's infrastructure.

Zinc Compounds (1.0)

Includes any unique chemical substance that contains zinc as part of that chemical's infrastructure.

APPENDIX B
BIBLIOGRAPHY

Electric Power Research Institute (EPRI), *Inorganic Constituents in Fossil Fuel Combustion Residuals*. Volume I. August 1987.

Electric Power Research Institute (EPRI). *Boiler Chemical Cleaning Waste Management Manual*. August 1992.

Kirk-Othmer Encyclopedia of Chemical Technology, 3rd Edition. "Power Generation". Volume 20. John Wiley & Sons, Inc. New York, NY. 1996.

Office of Management and Budget, *Standard Industrial Classification Manual*, 1987.

Science Applications International Corporation. *SIC Code Profile 49 Electric, Gas, and Sanitary Services*. 1996.

U.S. Environmental Protection Agency. *Economic Analysis of the Final Rule to Add Certain Industry Groups to EPCRA Section 313*, Office of Pollution Prevention and Toxics, April, 1997.

U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. *Compilation of Air Pollutant Emission Factors, 5th Edition, Volume I: Stationary Point and Area Sources* (AP-42). EPA 450-AP-425ED. 1995

U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response. *Report to Congress on Wastes from the Combustion of Coal by Electric Utility Power Plants*. EPA 530-SW-88-002. 1988.

U.S. Environmental Protection Agency, Office of Water. *Preliminary Data Summary for the Steam Electric Point Source Category*. EPA 821-R-96-010. July 1996.

U.S. Environmental Protection Agency, Office of Prevention, Pesticides and Toxic Substances. *The Effect of Combustion on Trace Metals in Coal and Oil Fuels for Electric Generating Facilities*. December 1996.

U.S. Environmental Protection Agency, Office of Prevention, Pesticides and Toxic Substances. *The Release of Trace Metals From Limestone During Flue Gas Desulfurization by Electric Utilities*. March 1997.

U.S. Environmental Protection Agency, Office of Research and Development. *Hydrogen Chloride and Hydrogen Fluoride Emission Factors for the NAPAP Emission Inventory*. EPA 600/7-85-041. October 1985.

APPENDIX C
SECTION 313 RELATED MATERIALS AND ELECTRONIC ACCESS TO INFORMATION

Ordering information for the following documents can be obtained by calling the EPCRA Hotline at 1-800-535-0202.

Common Synonyms for Section 313 Chemicals. EPA 745-R-95-008. March 1995.

Compilation of Air Pollutant Emission Factors, 5th Edition, Volume I: Stationary Point and Area Sources **(AP-42)**. EPA 450-AP-425ED. 1995.

Consolidated List of Chemicals Subject to Reporting Under the Act (Title III List of Lists). EPA 550-B-96-015.

Estimating Releases and Waste Treatment Efficiencies for the Toxic Chemical Release Inventory Form. EPA 560/4-88-002. December 1987.

Estimating Releases of Mineral Acid Discharges Using pH Measurements. June 1991.

Interpretations of Waste Management Activities: Recycling, Combustion for Energy Recovery, Waste Stabilization and Release. April, 1997.

Protocol for Equipment Leak Emission Estimates. EPA 453/R-95-017. November 1995.

Toxic Chemical Release Inventory Questions and Answers, Revised 1990 Version. EPA 560/4/91-003.

World Wide Web Resources

Code of Federal Regulations, 40 CFR
www.epa.gov/epacfr40

CHEMDAT8/WATER8
www.epa.gov/ttn/chief/software.html#water8

Clearinghouse for Inventories and Emission Factors (CHIEF)
www.epa.gov/ttn/chief/

Compilation of Air Pollutant Emission Factors (AP-42)
www.epa.gov/ttn/chief/ap42etc.html

EPA homepage
www.epa.gov

Federal Registers
www.epa.gov/EPA-TRI

MSDSs (Note: A number of organizations maintain databases that contain MSDS information. The following is a short list of web sites with MSDS information.)
www.dehs.umn.edu/msds.html
www.nwfsc.noaa.gov/msds.html
www.chem.utah.edu/msds

SPECIATE
www.epa.gov/ttn/chief/software.html#speciate

TANKS
www.epa.gov/ttn/chief/tanks.html

TOXNET
www.nlm.nih.gov/pubs/factsheets/toxnetfs.html

TRI homepage
www.epa.gov/opptintr/tri