United States Environmental Protection Agency
Office of Environmental Information Washington, DC 20460
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EMERGENCY PLANNING AND COMMUNITY RIGHT-TO-KNOW ACT - SECTION 313:

Guidance for Reporting Releases and Other Waste Management Quantities of Toxic Chemicals: Lead and Lead Compounds

Section 313 of the Emergency Planning and Community Right-to-Know Act of 1986 (EPCRA) requires certain facilities manufacturing, processing, or otherwise using listed toxic chemicals to report the annual quantity of such chemicals entering each environmental medium. Such facilities must also report pollution prevention and recycling data for such chemicals, pursuant to section 6607 of the Pollution Prevention Act, 42 U.S.C. 13106.

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EXECUTIVE SUMMARY

The U.S. Environmental Protection Agency's (EPA's) Toxics Release Inventory (TRI) Program was established by Congress under section 313 of the *Emergency Planning and Community Right-to-Know Act of 1986* (EPCRA), and expanded by the Pollution Prevention Act of 1990. It requires certain facilities in covered industry sectors to file reports of their environmental releases and other waste management quantities of chemicals listed on the EPCRA section 313 list of toxic chemicals if they manufacture, process, or otherwise use more than established threshold quantities of these chemicals. The TRI Program is responsible for collecting the release and other waste management information and disseminating it to the public. These data inform the public of releases and other waste management quantities of toxic chemicals in their communities, and enable citizens to make informed decisions regarding the consequences of such releases. The releases and other waste management quantities of a listed chemical are filed by completing an EPCRA section 313 release report (Form R) and submitting it to the U.S. EPA, state, and tribal governments.

Lead and lead compounds were on the original EPCRA section 313 list of toxic chemicals. On January 17, 2001, EPA published a rule that classified lead and lead compounds as PBT chemicals and lowered the previously existing 25,000 pound and 10,000 pound reporting thresholds for lead and lead compounds to 100 pounds[1]. Provided SIC code and employee criteria are met, facilities that manufacture, process, or otherwise use more than 100 pounds of lead or any lead compound(s) must now report to EPA and state/tribal governments their releases and other waste management quantities. The lower reporting thresholds apply to lead and all lead compounds, except for lead contained in stainless steel, brass, and bronze alloys. The new requirements apply to annual Form R reports to be submitted by July 1, 2002, for the calendar year 2001, and July 1 of each year thereafter. The reason for the lower reporting threshold is that lead and lead compounds are persistent, bioaccumulative, and toxic (PBT) chemicals. The rule is part of the Agency's effort to expand the public's right to know about release and other waste management quantities of toxic chemicals – particularly PBT chemicals – in their communities. As a result of this rulemaking and reduced threshold, EPA anticipates many more release reports (Form Rs) to be filed with EPA. Many of these additional reports will be filed by those entities that previously did not file release reports for lead and lead compounds because they did not meet the 25,000 pound and 10,000 pound thresholds.

EPA has developed this guidance document to assist regulated entities, particularly those that are not familiar with completing and submitting EPCRA section 313 release reports, in complying with this new regulation. This guidance document is intended to provide clear, easy to follow guidance on: the specific details of this new regulation; what facilities must file release reports for lead and lead compounds; what forms of lead are not affected by the new reporting requirements; and methods to estimate releases of lead and lead compounds into the environment following manufacture, processing, otherwise use, waste management or source reduction activities of lead and lead compounds.

[1]Lead and Lead Compounds; Lowering of Reporting Thresholds; Community Right-to-Know Toxic Chemical Release Reporting; Final Rule. 66 Federal Register, 4499-4547 (January 17, 2001)

DISCLAIMER

This guidance document is intended to assist industry with complying with EPCRA section 313 reporting requirements for lead and lead compounds. In addition to providing an overview of aspects of the statutory and regulatory requirements of the EPCRA section 313 program, this document also provides recommendations and emission factors to assist industry with EPCRA reporting. These recommendations do not supersede any statutory or regulatory requirements, are subject to change, and are not independently binding on either EPA or covered facilities. Additionally, if a conflict exists between this guidance and the statutory or regulatory requirements, the conflict must be resolved in favor of the statute or regulation. Although EPA encourages industry to consider these recommendations and emission factors, in reviewing this document, industry should be aware that these recommendations and emission factors were developed to address common circumstances at typical facilities. The circumstances at a specific facility may significantly differ from those contemplated in the development of this document. Thus, individual facilities may find that the recommendations and emission factors provided in this document are inapplicable to their processes or circumstances, and that alternative approaches or information are more accurate and/or more appropriate for meeting the statutory and regulatory requirements of EPCRA section 313. To that end, industry should use readily available facility-specific information and process knowledge, where available, to meet the requirements of EPCRA section 313. EPCRA section 313 also provides that, in the absence of such readily available data, a reporting facility may make reasonable estimates to meet those EPCRA section 313 requirements. Facilities are encouraged to contact the Agency with any additional or clarifying questions about the recommendations and emission factors in this document, or if the facility believes that EPA has incorrectly characterized a particular process or recommendation. Additional guidance documents, including industry specific and chemical specific guidance documents, are also available at the EPA TRI website: http://www.epa.gov/tri.

CHAPTER 1
INTRODUCTION

Section 1.1 Background

The Toxics Release Inventory (TRI) Program was established by Congress under section 313 of the *Emergency Planning and Community Right-to-Know Act of 1986* (EPCRA) to increase the public's knowledge of, and access to, information on the release and other waste management quantities of toxic chemicals in their communities. The TRI was expanded in 1990 by the Pollution Prevention Act (PPA). Section 313 of EPCRA and the PPA provides the public with information on releases of toxic chemicals in their communities. This is achieved by requiring those facilities that manufacture, process, or otherwise use such chemicals in quantities that exceed established thresholds for these activities to report annually to the U.S. Environmental Protection Agency (EPA), and state and tribal governments, their environmental releases and other waste management quantities of these substances. EPCRA section 313 mandates that EPA establish and maintain a publicly available database consisting of the information reported under section 313. The TRI database includes information on the following:

- What chemicals were released into the local environment during the preceding year;
- How much of each chemical went into the air, water, and land in a particular year;
- How much of the chemicals were transported away from the reporting facility for disposal, treatment, recycling, or energy recovery;
- How chemical wastes were treated at the reporting facility;
- The efficiency of waste treatment; and
- Pollution prevention and chemical recycling activities.

The TRI database provides a comprehensive overview of toxic chemical pollution from facilities in the United States.

For most listed chemicals, the threshold quantities for reporting releases and other waste management quantities are: 25,000 pounds (for the total amount of a listed chemical manufactured or processed annually) and 10,000 pounds (for the total amount of a listed chemical that is otherwise used annually). Lower thresholds have recently been established[2] for those chemicals that are persistent, bioaccumulative, and toxic (PBT). PBT chemicals are of greater concern because not only are they toxic, but also remain in the environment for long periods of time, are not readily destroyed, and build up or accumulate within the food web. The reason for the lower reporting thresholds for PBT chemicals is that under the 25,000 pound and 10,000 pound activity thresholds a significant amount of the releases and other waste management quantities of listed PBT chemicals were not being reported. Thus the public did not have important information about PBT chemicals being released in their

[2]Persistent Bioaccumulative Toxic (PBT) Chemicals; Lowering of Reporting Thresholds for Certain PBT Chemicals; Addition of Certain PBT Chemicals; Community Right-to-Know Toxic Chemical Reporting; Final Rule. 64 Federal Register, 58666-58753 (October 29, 1999).

communities. By lowering the 25,000 pound and 10,000 pound reporting thresholds for PBT chemicals, additional releases and other waste management quantities of PBT chemicals will be captured.

Lead and lead compounds were on the original EPCRA section 313 list of toxic chemicals. On January 17, 2001 EPA published a final rule[3] that classified lead and lead compounds as PBT chemicals and lowered the 25,000 pound and 10,000 pound reporting thresholds for lead and lead compounds to 100 pounds, with the exception of lead contained in stainless steel, brass, and bronze alloys. For stainless steel, brass or bronze alloys that contain lead, the quantity of lead contained in these alloys is still applied to the 25,000 pound and 10,000 pound reporting thresholds. These three alloys, when they contain lead, are often referred to in this document as the "qualified alloys". EPA deferred its decision on lowering the 25,000 pound and 10,000 pound reporting thresholds for lead when it is contained in stainless steel, brass, and bronze alloys because the Agency is currently evaluating a previously submitted petition as well as comments received in response to previous petition denials that requested the Agency revise the EPCRA section 313 reporting requirements for certain metals contained in stainless steel, brass, and bronze alloys. EPA is currently reviewing whether there should be any reporting changes regarding the listed constituents (e.g., lead) of stainless steel, brass and bronze alloys. The final lead rule is based on EPA's finding that lead and lead compounds are persistent bioaccumulative and toxic substances. The basis for the 100 pound threshold is discussed in detail in Section VI (page 42232) of the Preamble to the proposed lead rule (7). EPA's responses to public comments pertaining to the 100 pound threshold are discussed on page 4530 of the Preamble to the final lead rule (2). The rule is part of the Agency's effort to expand the public's right to know about release and other waste management quantities of toxic chemicals – particularly PBT chemicals – in their communities. Hence, provided SIC code and employee criteria are met, facilities that manufacture, process, or otherwise use more than 100 pounds of lead or any lead compound(s) must now report annually to EPA and state/tribal governments their releases and other waste management quantities.

Up until promulgation of the new lead rule, only those facilities that manufactured or processed more than 25,000 pounds (or otherwise used more than 10,000 pounds) of lead or lead compounds were required to report. The primary difference between the new rule and the previous requirements is that the new rule requires any affected facility that manufactures, processes, or otherwise uses more than 100 pounds of lead or lead compound(s) annually to report. Under the new rule additional data pertaining to releases of lead and lead compounds into the environment will be captured. The new TRI lead rule does not in any way prevent or restrict any facility from manufacturing, processing, or otherwise using lead or lead compounds, or from releasing lead into the environment.

1.1.1 What is the Intent of this Document?

EPA has developed this guidance document to assist regulated entities, particularly those that are not familiar with completing and submitting EPCRA section 313 release reports, in complying with this new regulation. This guidance document is intended to provide clear, easy to follow guidance on:

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[3] Lead and Lead Compounds; Lowering of Reporting Thresholds; Community Right-to-Know Toxic Chemical Release Reporting; Final Rule. 66 Federal Register, 4499-4547 (January 17, 2001); Reference 2 in Section 6.0.

the specific details of this new regulation; what facilities must file release reports for lead and lead compounds; what forms of lead are not affected by the new reporting requirements; and methods to estimate releases of lead and lead compounds into the environment following manufacture, processing, otherwise use, waste management or source reduction activities of lead and lead compounds. This document explains the EPCRA section 313 reporting requirements, and provides guidance on how to estimate annual releases and other waste management quantities of lead and lead compounds for certain industries and industrial activities. Because each facility is unique, the recommendations presented may have to be adjusted to the specific nature of operations at your facility or industrial activity.

The primary objectives of this guidance document are:

- Provide explanation and assistance on EPCRA section 313 and PPA section 6607 reporting requirements for lead and the lead compounds category;
- Promote consistency in the method of estimating annual releases and other waste management quantities of lead and lead compounds for certain industries and industrial classes; and
- Reduce the level of effort expended by those facilities that prepare an EPCRA section 313 report for lead and/or the lead compounds category.

Section 1.2 Who Must Report?

To understand the following discussion one must first understand how EPCRA defines a facility. The term "facility" is defined as, "all buildings, equipment, structures, and other stationary items which are located on a single site or on contiguous or adjacent sites and which are owned or operated by the same person (or by any person which controls, which is controlled by, or under common control with, such person)" (EPCRA Section 329(4)). A facility may contain more than one "establishment" (40 CFR 372.3). An "establishment" is defined as, "an economic unit, generally at a single physical location, where business is conducted or where services or industrial operations are performed" (40 CFR 372.3).

EPA recognizes that for business reasons it may be easier and more appropriate for establishments at one facility to report separately. However, the combined quantities of EPCRA section 313 chemicals and chemical categories manufactured, processed, or otherwise used in all establishments making up that facility must be considered for threshold determinations (40 CFR 372.30 (c)). Also, the combined release and other waste management quantities reported singly for each establishment must total those for the facility as a whole (40 CFR 372.30(c)). Thus, if a facility is comprised of more than one establishment, once a reporting (activity) threshold[4] is exceeded by the

[4] A reporting threshold for a listed chemical is a pre-established annual manufacture, process or otherwise use quantity that when exceeded within a calendar year by a facility triggers reporting of environmental releases and other waste management quantities of the chemical. Most listed chemicals have two reporting thresholds. These are: 25,000 pounds per calendar year for manufacture or processing activities; and 10,000 pounds per calendar year for otherwise use activities. Reporting thresholds are also known as activity thresholds, because they are related to manufacturing, processing, or otherwise use activities. See **Section 1.3** for more details.

facility as a whole, release and other waste management quantities from all establishments at the facility must be determined and reported, provided of course, that the facility meets the SIC code and employee threshold criteria. Additional discussion of this requirement is given in EPA's document titled *Revised EPCRA Section 313 Questions and Answers* (1).

A facility is subject to the provisions of EPCRA section 313, only if it meets all three of the following criteria:

1. It is included in any of the following Standard Industrial Classification[5] (SIC) Codes; and

SIC Code	Industry
10 (except SIC codes 1011, 1081, and 1094)	Metal Mining[6]
12 (except SIC code 1241)	Coal Mining[6]
20 through 39	Manufacturing Industries
4911, 4931, or 4939 (each limited to facilities that combust coal and/or oil for the purpose of generating power for distribution in commerce)	Electric Utilities
4953 (limited to facilities regulated under the Resource Conservation and Recovery Act, subtitle C, 42 U.S.C. section 6921 et seq.)	Commercial Hazardous Waste Treatment
5169	Chemicals and Allied Products-Wholesale
5171	Petroleum Bulk Terminals and Plants
7389 (limited to facilities primarily engaged in solvent recovery services on a contract or fee basis)	Solvent Recovery Services

2. It has 10 or more full-time employees (or the equivalent of 20,000 hours per year); and

[5] Specific information on industries and their corresponding SIC Codes is available from the following website developed by the Occupational Safety and Health Administration (OSHA): http://www.osha.gov/oshstats/sicser.html

[6] In March of 2001 the United States District Court for the District of Colorado decided National Mining Association v. Browner [EPA]. In that case, the court determined that mining facilities had been properly added to EPCRA section 313 coverage and were therefore subject to section 313 reporting requirements. However, the court overturned EPA's interpretation that extraction and beneficiation of naturally occurring, undisturbed ores is "processing," on the grounds that such ores had not been manufactured within the meaning of EPCRA section 313. The Court did not attempt to determine the full scope of a mining facility's reporting obligations, rather, the court only addressed the claims the National Mining Association raised. EPCRA section 313 clearly identifies "preparation" and "production" of toxic chemicals as threshold activities that trigger reporting; therefore, covered facilities have a statutory obligation to determine how to report their preparatory and production activities in compliance with the statute's requirements. In regulations not challenged in the NMA litigation, EPA defined 'beneficiation' as 'the preparation of ores to regulate the size (including crushing and grinding) of the product, to remove unwanted constituents, or to improve the quality, purity, or grade of a desired product." 40 C.F.R. section 372.3."'

3. It manufactures (includes imports), processes, or otherwise uses any of the toxic chemicals listed on the EPCRA section 313 list in amounts greater than the threshold quantities established in 40 CFR 372.25, 372.28. (See Section 1.3 for a description of reporting thresholds.)

These three criteria alone, not the quantity released and otherwise managed as waste, determine whether a facility must prepare an EPCRA section 313 report. A facility that meets these three criteria is still required to prepare an EPCRA section 313 report even if that facility has zero release and other waste management quantities of EPCRA section 313 chemicals or chemical categories. In addition, pursuant to Executive Order 13148 entitled "Greening the Government Through Leadership in Environmental Management," federal facilities are required to comply with the reporting requirements of EPCRA section 313. This requirement is mandated regardless of the federal facility's SIC code.

The overall reporting process is illustrated in Figure 1-1. More details on this process, particularly its application to lead and lead compounds, are provided throughout this document and in the references cited herein.

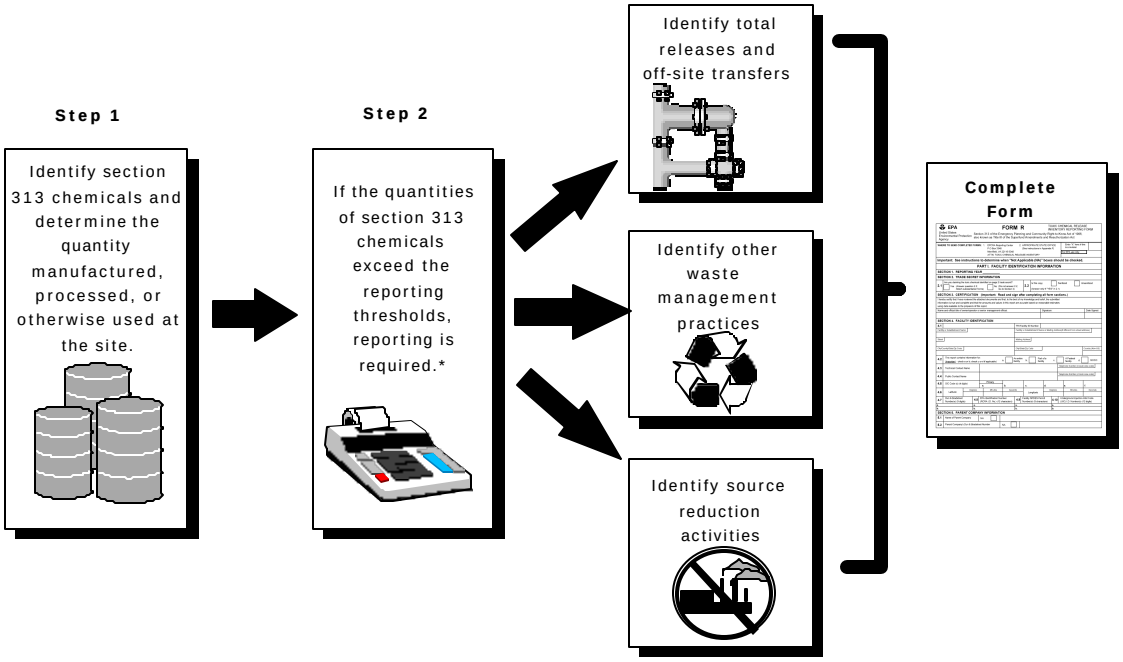

Figure 1-1. TRI Reporting Process

Section 1.3 What Are the Reporting (Activity) Thresholds?

A reporting threshold for a listed chemical is a pre-established quantity pertaining to the manufacture, processing or otherwise use of the chemical, such that when the quantity is exceeded within a calendar year by a facility, requires the facility to report environmental releases and other waste management quantities of the chemical. Reporting thresholds are also known as activity thresholds, because they are related to manufacturing, processing, or otherwise use activities. EPCRA section 313

establishes two default reporting thresholds. These are: 25,000 pounds per year for manufacture or processing of a listed chemical and 10,000 pounds per year for otherwise using a listed chemical [42 U.S.C. Š 11023(f)(1))]. Thus, unless a different threshold has been established, if a covered facility manufactures more than 25,000 pounds of a listed chemical within a particular calendar year, that facility must report their releases and other waste management quantities to the U.S. EPA, and state and tribal governments. The same would hold true if the facility processed more than 25,000 pounds or otherwise used more than 10,000 pounds of the chemical.

EPCRA section 313 authorizes EPA to establish different thresholds for particular chemicals, classes of chemicals, or categories of facilities, if a different threshold is warranted (42 U.S.C. Š 11023(f)(2)). EPA has used this authority to establish lower thresholds for PBT chemicals. (See 40 CFR 370.28, 64 FR 58666 and 66 FR 4500.) The determination of whether a facility needs to report environmental releases and other waste management quantities of a listed chemical is based on a prior determination of whether any of the reporting thresholds have been exceeded within a calendar year (i.e., January 1 through December 31 of a given year).

The thresholds are determined separately for lead (using the weight of the metal) and for lead compounds (using the weight of the entire lead compound and combining the weights of all lead compounds; 40 CFR 372.25(h)). Provided that the facility meets the SIC code and employee threshold criteria, reporting for <u>lead</u> is required:

- If a facility *manufactures, processes, or otherwise uses* more than 100 pounds of lead (<u>not</u> contained in stainless steel, brass, or bronze alloys) during the calendar year, or;
- If a facility *manufactures or processes* more than 25,000 pounds of lead (regardless of whether it is contained in stainless steel, brass, or bronze alloys) during the calendar year, or;
- If a facility *otherwise uses* more than 10,000 pounds of lead (regardless of whether it is contained in stainless steel, brass, or bronze alloys) during the calendar year.

Additionally, provided that the facility meets the SIC code and employee threshold criteria, reporting for the <u>lead compounds category</u> is required:

- If a facility *manufactures, processes, or otherwise uses* more than 100 pounds of a lead compound or a combination of lead compounds during the calendar year.

The 25,000 pound (manufacture or processing) and 10,000 pound (otherwise use) reporting thresholds are still in effect for lead contained in stainless steel, brass, or bronze alloys. The reporting of lead in these alloys is described in detail in Section 3.0.

The terms manufacture, process, and otherwise use are defined in 40 CFR 372.3 as:

Manufacture means to produce, prepare, import, or compound a toxic chemical. Manufacture also applies to a toxic chemical that is produced coincidentally during the manufacture, processing, use, or disposal of another chemical or mixture of chemicals, including a toxic chemical that is separated from that other chemical or mixture of chemicals as a byproduct, and a toxic chemical that remains in that other chemical or mixture of chemicals as an impurity.

Process means the preparation of a toxic chemical, after its manufacture, for distribution in commerce: (1) in the same form or physical state as, or in a different form or physical state from, that in which it was received by the person so preparing such substance, or (2) as part of an article containing the toxic chemical. Process also applies to the processing of a toxic chemical contained in a mixture or trade name product.

Otherwise use means any use of a toxic chemical, including a toxic chemical contained in a mixture or other trade name product or waste, that is not covered by the terms "manufacture" or "process." Otherwise use of a toxic chemical does not include disposal, stabilization (without subsequent distribution in commerce), or treatment for destruction unless:

1) the toxic chemical that was disposed, stabilized, or treated for destruction was received from off site for the purposes of further waste management; or

2) the toxic chemical that was disposed, stabilized, or treated for destruction was manufactured as a result of waste management activities on materials received from off-site for the purposes of further waste management activities. Relabeling or redistribution of the toxic chemical where no repackaging of the toxic chemical occurs does not constitute otherwise use or processing of the toxic chemical.

It is important to note that lead is *not* included in the lead compounds category: lead and lead compounds are listed separately on the EPCRA section 313 list of toxic chemicals. This means that for facilities that manufacture, process, or otherwise both lead and one or more lead compounds, determinations of whether the 100 pound reporting threshold has been exceeded for the manufacturing, processing, or otherwise use of lead must be made separately from the same determinations for the lead compound(s). That is, for purposes of determining whether a threshold has been exceeded, one should not combine the quantities of lead and lead compounds. For purposes of EPCRA section 313 reporting, threshold determinations for chemical categories must be based on the total of all toxic chemicals in the category (see 40 CFR 372.25(d)). For example, a facility that manufactures three lead compounds would count the total amount manufactured of all three lead compounds towards the manufacturing threshold for the category. In the case of lead compounds, the threshold for manufacturing lead compounds is 100 pounds. The manufacture of lead compounds includes lead compounds that are generated but not released (e.g., chemical intermediates). One report is filed for the category and all releases and waste management quantities are reported on one Form R report.

If a reporting threshold is exceeded for both lead and the lead compounds category, only a single EPCRA section 313 report needs to be prepared, and this would be for lead compounds. This is allowed because if a facility exceeds a threshold for lead compounds, the facility must only report the

quantity of the parent metal (lead) contained in the compounds that is released or otherwise managed as waste, not the quantity of the lead compound that is released or otherwise managed as waste (40 CFR 372.25(h)). If a facility exceeds the threshold quantity for either the manufacturing, processing, or otherwise use activities for an EPCRA section 313 chemical or chemical category, the facility must file an EPCRA section 313 report for that chemical or chemical category, even if the facility has zero release and other waste management activity quantities. Exceeding the chemical activity (reporting) threshold quantity, not the quantity released or otherwise managed as waste, determines whether the facility must report.

To assist facilities in determining if they may need to report, Table 1-1 lists some common potential industries and process sources of lead and lead compounds. Note that this table is not intended to be all-inclusive (see also Section 4.3). If you manufacture, process, or otherwise use lead or lead compounds in other operations you must consider the lead and lead compounds in threshold determinations. For more information on threshold determinations in general, see Chapter 2, and for information pertaining to threshold determinations when processing or otherwise using lead in stainless steel, brass, or bronze alloys, see Chapter 3.

Table 1-1
Industry and Process Sources of Lead and Lead Compounds

Industry/Process	Lead or Lead Compounds	Reference[1]
Metal mining: constituent in ore	Lead and lead compounds	3, 4
Smelting and refining: constituent in ore	Lead	3, 4
Coal mining: trace constituent in ore	Lead compounds	3, 4
Steel industry: coke production, trace constituent in coal	Lead compounds	3, 4
Fabricated metal products: article component (e.g., ammunition, galvanized products, pipe organs)	Lead and lead compounds	3, 4
Electronic product components (e.g, batteries, electroplating of printed circuit boards, solder)	Lead	3, 4
Other product components (e.g., blown glass, dental amalgam fillings, lead cable coating, lead oxides in pigments and inks)	Lead and lead compounds	3, 4
Paper manufacturing: present in wood and chemicals	Lead	3, 4
Plastic materials and resin manufacture: formulation component	Lead compounds	3, 4
Chemical manufacture: organo-lead compound production, rubber, reactants, and catalysts	Lead and lead compounds	3, 4
Carbon black production: trace constituent in crude oil	Lead compounds	3
Petroleum refining: trace constituent in petroleum crude	Lead compounds	3, 4
Cement: trace constituent in raw materials	Lead	3, 4
Coal, oil, wood combustion (electric utilities, other facility electricity generation): traces in fuels	Lead and lead compounds	3, 4, 5
Waste treatment and solvent recovery: trace constituent in waste stream	Lead and lead compounds	3
Incineration of municipal and various industrial wastes	Lead and lead compounds	3, 4
Wholesale distribution of lead chemicals and compounds	Lead and lead compounds	3
Bulk petroleum stations: trace constituent in petroleum products	Lead compounds	3

[1]Numbers correspond to the references listed in the reference section at the end of this document.

Section 1.4 What Other Changes to the EPCRA Section 313 Reporting Requirements Apply to Lead and the Lead Compounds Category?

EPA has also made modifications and/or clarifications to certain reporting exemptions and requirements for the PBT chemicals that are subject to lower reporting thresholds; including lead and the lead compounds category. These include: elimination of the *de minimis* exemption; elimination of the use of the Form A Certification Statement for alternative reporting; elimination of range reporting; and issues dealing with data precision. Each of the changes as they apply to lead and the lead compounds category is discussed in the following subsections. Other EPCRA section 313 exemptions that are not discussed below (e.g., those about articles, uses, and laboratories as described in 40 CFR 372.38 (b), (c), and (d)) have not been changed as a result of the new rule (see also Section 2.1.2).

1.4.1 *De Minimis* Exemption

The *de minimis* exemption allows facilities to disregard certain minimal concentrations of toxic chemicals in mixtures or other trade name products they process or otherwise use from determinations of whether reporting thresholds have been exceeded, as well as release and other waste management calculations (40 CFR 372.38(a)).

Modifications to Reporting Exemptions for Lead and Lead Compounds*

- *Elimination of the de minimis exemption**;
- *Elimination of the use of the Form A Certification Statement for alternative reporting*;
- *Elimination of Range Reporting; and*
- *Additional Data Reporting Precision: to one-tenth of a pound where applicable.*

* These modifications do not pertain to lead contained in stainless steel, brass, or bronze alloys.

** Except for purposes of supplier notification.

EPA eliminated the *de minimis* exemption for EPCRA section 313 chemicals that have been classified as PBT chemicals, including lead and the lead compounds category, except for lead contained in stainless steel, brass, or bronze alloys (40 CFR 372.38(a)). This means that facilities are required to include **all** amounts of lead compounds or lead (except for lead in stainless steel, brass, or bronze alloys as summarized in Table 3-3) in threshold determinations, and **all** amounts of lead or the metal portion of lead compounds in release and other waste management calculations, regardless of the concentration of lead or lead compounds in mixtures or trade name products (40 CFR 372.38(a)). However, the elimination of the *de minimis* exemption for reporting PBT chemicals does not affect (negate) the applicability of the *de minimis* exemption to the supplier notification requirements (e.g., for facilities that manufacture or sell toxic chemicals as described in 40 CFR 372.45), or to threshold or release calculations performed only on lead contained in stainless steel, brass, or bronze alloys. Thus, suppliers of lead or lead compounds may continue to use the *de minimis* exemption for supplier notification purposes, and facilities may continue to use the *de minimis* exemption for threshold or release calculations performed only on lead contained in stainless steel, brass, or bronze alloys. For lead contained in stainless steel, brass, or

bronze alloys, the *de minimis* level is 0.1%. For supplier notification requirements, the *de minimis* levels are as follows: for lead, 0.1%; for lead compounds that are inorganic, 0.1%; for lead compounds that are organic, 1% (40 CFR Š 372.38(a)).

1.4.2 Alternate Reporting Threshold (1 Million Pounds) and Form A Certification Statement

Ordinarily, facilities that exceed EPCRA section 313 reporting thresholds for a listed chemical do not have to file a Form R report provided that their total annual reportable amount of the production-related waste for that chemical does not exceed 500 pounds and that their amounts manufactured, processed, or otherwise used for that chemical do not exceed one million pounds (40 CFR 372.27). Under such circumstances the facility has the option of filing a two-page certification statement known as a "Form A" instead of the longer Form R. The Form A is a certification that once completed and signed certifies that the facility is not required to file a Form R for the chemical because the facility did not exceed 500 pounds for the total annual reportable amount for that chemical, and that their amounts manufactured or processed or otherwise used did not exceed one million pounds.

EPA has excluded EPCRA section 313 PBT chemicals, including lead and the lead compounds category (except for lead contained in stainless steel, brass, or bronze alloys) from eligibility for filing a Form A Certification Statement in lieu of a Form R report (40 CFR 372.27(e)). Therefore, submitting a Form A rather than a Form R is not an option for reporting releases and other waste management quantities of lead and lead compounds. Use of the alternate threshold of 1 million pounds and Form A Certification Statement is permissible, however, for reporting releases of lead contained in stainless steel, brass, or bronze alloys. For other alloys that contain lead the 100 pound reporting threshold applies and the alternate threshold of 1 million pounds and Form A Certification Statement cannot be used.

1.4.3 Range Reporting

For facilities with total annual releases or off-site transfers of an EPCRA section 313 chemical of less than 1,000 pounds, EPA allows the amounts to be reported in Sections 5 and 6 of Part II of the Form R either as an estimate or by using range codes (A = 0 - 10 pounds, B = 11 - 499 pounds, and C = 500 - 1,000 pounds) (40 CFR 372.85(b)(15)(i)).

EPA has eliminated range reporting for releases and other waste management quantities in Sections 5 and 6 of Part II of the Form R for EPCRA section 313 PBT chemicals, including lead and the lead compounds category, except for lead contained in stainless steel, brass, or bronze alloys. This means that for those sections of the Form R for which range reporting is an option, the option cannot be used when reporting on lead and/or the lead compounds category (40 CFR 372.85(b)(15)(i)). Range reporting is permissible, however, for lead contained in stainless steel, brass, or bronze alloys. Range reporting is not permissible for other alloys that contain lead. Thus, for lead compounds or lead **not** contained in stainless steel, brass, or bronze alloys facilities are required to report an actual release number rather than a selected range of releases. It is important to note that the elimination of range reporting for PBT chemicals, including lead and lead compounds, does not affect the applicability of range reporting for the maximum amount on site as required by EPCRA section 313(g) [Part 4.1 on page 2 of the Form R.].

1.4.4 Data Precision

EPCRA Section 313 (g) (2) provides that in the absence of readily available data a facility is permitted to make reasonable estimates when submitting data required by EPCRA section 313. When estimating release and other waste management quantities of a listed chemical for purposes of reporting, facilities should base these determinations at a level of precision supported by available data and the estimation techniques used in the determinations. The facility is required to make a reasonable estimate when it lacks readily available data. When expressing, on a Form R, release and other waste management quantities for most listed chemicals EPA allows facilities to "round off" release and other waste management estimates to zero if the estimates are 0.5 pounds or less. This option is **not** allowed, however, for PBT chemicals, including lead and the lead compounds category (64 FR 42236). When expressing release and other waste management quantities of lead or lead compounds on a Form R, the level of precision one should use is one-tenth (0.1) of a pound. Thus, when reporting releases and other waste management quantities of lead and compounds, facilities should round-off to the nearest 0.1 pound.

Section 1.5 Useful TRI Resources

There are many useful resources available that contain information that may be helpful in understanding the TRI program and its requirements. Below is a list of useful TRI resources.

- *The TRI Information Kit* is a publication containing the basic information about TRI. This Kit is available free of charge, while supplies last, from the EPA National Service Center for Environmental Publications (NSCEP). You can request a copy of the TRI Information Kit (document control number: EPA 749-K-98-001) via regular mail, telephone, fax, or online at:

  Mail Order:
  U.S. Environmental Protection Agency
  National Service Center for Environmental Publications (NSCEP)
  P.O. Box 42419
  Cincinnati, Ohio 45242-2419

  Telephone Order: (800) 490-9198 - toll free
  Fax Order: (513) 489-8695 or (513) 489-8692
  Online Order: http://www.epa.gov/ncepihom

- *Toxic Chemical Release Inventory Reporting Forms and Instructions.* U.S. EPA, Office of Information Analysis and Access (http://www.epa.gov/tri). You should consult the most current version before preparing any report for your facility;

- *Common Synonyms for Chemicals Listed Under Section 313 of EPCRA.* U.S. EPA, 1995.

- There are many guidance documents, including those developed for specific chemicals and specific industry sectors, available from the TRI website (http://www.epa.gov/tri/guid_docs). These documents include:

  - *Revised 1998 EPCRA Section 313 Questions and Answers* (December 1998);
  - *EPCRA Section 313 Questions and Answers Addendum for Federal Facilities* - Revised 1999 Version;
  - Industry-specific guidance documents;
  - Chemical-specific guidance documents;
  - *Waste Management Activities: Recycling, Combustion for Energy Recovery, Treatment for Destruction, Waste Stabilization and Release* (August 1999); and
  - *EPCRA Section 313 Release Reporting Requirements.*

- On-line access to TRI data is available from the following:
  - EPA's Internet site, http://www.epa.gov/tri;
  - TRI Explorer (http://www.epa.gov/triexplorer);
  - Envirofacts Data Warehouse and Applications Internet Site (http://www.epa.gov/enviro/html/tris/tris_query.html);
  - TOXNET (National Library of Medicine) (http://toxnet.nlm.nih.gov);
  - Right-to-Know Network (RTK NET) (http://www.rtk.net); and
  - EPA's annual TRI data release materials (summary information).

- Additional public access to TRI data is available from the following:
  - TRI Reports and Data (EPA TRI Web Site, http://www.epa.gov/tri);
  - TRI Public Data Release Annual Report (EPA TRI Web Site, http://www.epa.gov/tri);
  - TRI Public Data Release State Fact Sheets (EPA TRI Web Site, http://www.epa.gov/tri);
  - State Data files (EPA TRI Web Site, http://www.epa.gov/tri);
  - TRI User Support Service: (202) 260-1531; and
  - EPCRA Hotline: (800) 424-9346 or (703) 412-9810.

- Additional technical guidance is available from the Technology Transfer Network (TTN) (http://www.epa.gov/ttn/) and includes information on the following:
  - Help Desk (919) 541-5384;
  - Compilation of Air Pollutant Emission Factors (AP-42);
  - WATER9 program;
  - Updates WATER8, CHEMDAT8, and CHEM9;
  - TANKS program; and
  - Clearinghouse for Inventories and Emission Factors (CHIEF).

- Industry sector notebooks are available from The Office of Enforcement and Compliance Assurance (OECA) (http://es.epa.gov/oeca/sector) that profile selected industries and provide the following information:

- A comprehensive environmental profile;
- Industrial process information;
- Pollution prevention techniques;
- Pollutant release data;
- Regulatory requirements; and
- Compliance/enforcement history.

CHAPTER 2
GUIDANCE FOR DETERMINING WHETHER REPORTING THRESHOLDS ARE EXCEEDED AND REPORTING ENVIRONMENTAL RELEASES OF LEAD AND LEAD COMPOUNDS

Section 2.1 General Guidance

This chapter provides guidance that facilities should find helpful in determining whether they have exceeded the 100 pound reporting threshold for lead or lead compounds, and, if so, in estimating and reporting annual releases and other waste management quantities for lead and the lead compounds category. Unless otherwise stated, the guidance in this chapter, as it pertains to lead, only deals with situations in which the lead is not contained in stainless steel, brass, or bronze alloys. Guidance pertaining to determining whether a facility has exceeded a reporting threshold for lead when it is contained in stainless steel, brass, or bronze alloys is not presented in this chapter, but is presented in detail in the next chapter of this document. For those facilities that only manufacture, process or otherwise use lead compounds or lead not contained in a stainless steel, brass or bronze alloy only the 100 pound reporting threshold needs to be considered. It is important to emphasize, however, that for those facilities that manufacture, process, or otherwise use lead as well as stainless steel, brass or bronze alloys that contain lead, the quantities of lead **not** in stainless steel, brass or bronze alloys are applied to the 25,000 pound and 10,000 pound reporting thresholds, as well as the 100 pound reporting thresholds. This point is discussed in detail in the next chapter.

Important Points Regarding the Threshold Calculations

- *Lead and Lead Compounds are Separately Listed on the EPCRA section 313 list;*
- *There is only one listing for lead, but there are **three** reporting thresholds: 25,000 pounds (lbs), 10,000 lbs, and 100 lbs;*
- *The 100 lb threshold is applied to lead only when it is NOT contained in stainless steel, brass or bronze alloy;*
- *The 25,000 lb and 10,000 lb thresholds apply to lead both when it is contained in stainless steel, brass or bronze alloy and when it is not;*
- *Quantities of lead **not** contained in stainless steel, brass, or bronze alloys are STILL applied to the 25,000 lb and 10,000 lb thresholds, in addition to the 100 lb threshold; and*
- *There is only one listing for lead compounds, and only one reporting threshold for lead compounds: 100 lbs.*

This chapter is not intended to provide complete guidance for all situations involving lead and lead compounds. The reader is advised to consult industry-specific guidance documents applicable to his or her facility for more detailed guidance. This document includes concentration and emission factor data which may be used as default values in determining whether the reporting thresholds have been exceeded, and calculating releases and other waste management quantities. EPA recommends that facilities complete these determinations and calculations using best readily available information applicable to their operations, even when it differs from the data provided herein. In the absence of such information, EPCRA section 313 permits a

reporting facility to make a reasonable estimate. EPA also recommends that facilities maintain documentation of the basis for making these estimates (see 40 CFR Š 372.10). Facilities are not required to perform additional testing for EPCRA section 313 reporting.

2.1.1 Determining Whether the 100 Pound Reporting Thresholds Have Been Exceeded

As discussed in Chapter 1, Section 1.3, EPA lowered the reporting threshold for lead and the lead compounds category to 100 pounds per year for each of the three reporting activities: manufacturing; processing; and otherwise use. The determination of whether the 100 pound reporting threshold is exceeded for any of these activities is made independently. Thus, when determining if a threshold is exceeded for lead, one should calculate separately the amount of lead manufactured, the amount of lead processed, and the amount of lead otherwise used. These calculations must also be conducted separately for lead and for lead compounds. To determine if a threshold is exceeded for the lead compounds category, use the entire weight of the lead compound and include all lead compounds for each threshold determination (40 CFR 372.25(h)). (Some typical quantities required to meet the threshold for fuels and other selected materials may be found in Table 4-8 of Chapter 4) However, in reporting releases and other waste management quantities, the quantities of lead can be combined on the Form R report, and submission of only one Form R is necessary if reporting for both lead and lead compounds. The first example below illustrates a few key points for determining whether the 100 pound threshold has been exceeded for lead metal (Pb^0) versus the lead compounds category.

Lead is often present as an impurity in fuels such as, for example, coal or oil. Lead present as an impurity in the fuel forms a lead compound that is coincidentally manufactured as a result of the combustion, and subsequently released or otherwise managed as waste. Lead may be present in the fuel either in its elemental form (Pb^0) or as a lead compound (PbX). If you burn fuels (e.g., coal or oil) on site you must consider, for purposes of complying with section 313 of EPCRA, the lead present in the fuel and any lead compound(s) that are formed from the combustion. In the absence of any other data, EPA recommends assuming elemental lead is present in the fuel, and that it is converted to lead monoxide (PbO), a lead compound, during combustion(s). In this case, you would apply the amount of lead in the fuel to the otherwise use threshold for lead and the amount of lead monoxide formed to the manufacturing threshold for lead compounds. The second example below demonstrates this point. See Section 4.5 of Chapter 4 for more information pertaining to combustion of fuels containing lead.

Example - Threshold Determinations For Lead Metal Versus Lead Compounds

During the calendar year your facility: manufactures 5 pounds of lead monoxide (PbO), a lead compound; processes 200 pounds of a material containing 55% lead metal (Pb^0) (not contained in stainless steel, brass, or bronze alloys); processes 99 pounds of lead sulfide (PbS), another lead compound; otherwise uses 50 pounds of lead metal; and otherwise uses 8 pounds of lead tetraoxide, (Pb_3O_4), another lead compound.
To determine whether you are required to submit a Form R release report, you first need to determine whether you have exceeded the 100 pound threshold for manufacturing, processing or otherwise use activities for lead metal or the lead compounds. To do this, you must calculate separately the quantities of lead metal and lead compounds that were manufactured, processed, or otherwise used. Thus, a total of six separate calculations must be performed. These are: 1) what quantity of lead was manufactured; 2) what quantity of lead was processed; 3) what quantity of lead was otherwise used; 4) what quantity of lead compounds were manufactured; 5) what quantity of lead compounds were processed; and 6) what quantity of lead compounds were otherwise used. If the answer to any of these calculations is greater than 100 pounds, you have tripped the threshold and must file a Form R release report. The calculations are shown below.

Lead Metal (Pb^0)
1) Manufacturing: None specified above.
2) Processing: 200 lbs of Pb × 0.55 = 110 lbs of Pb.
3) Otherwise Use: Given above as 50 lbs of Pb.

Lead Compounds
4) Manufacturing: Given above as 5 lbs of PbO.
5) Processing: Given above as 99 lbs of PbS.
6) Otherwise Use: Given above as 8 lbs of Pb_3O_4.

The only threshold that your facility exceeded was the 100 lb threshold for processing lead (metal). This means you must submit an EPCRA section 313 report for lead, and you must calculate all releases and other non-exempt waste management activity quantities of lead from your facility, including releases from the otherwise use activity for lead metal (40 CFR 372.85(b)(15)(i)).

You do not have to report releases and other waste management quantities of the lead portion of the lead compounds that resulted from the manufacturing, processing, or otherwise use of lead compounds because you did not exceed any thresholds for lead compounds. However, if your facility had processed more than 100 lbs of PbS (instead of 99 pounds), you would have also exceeded the threshold for processing lead compounds and you would have to report all releases and other non-exempt waste management activity quantities of lead from all lead compounds at your facility.

If your facility exceeds a threshold for both lead and lead compounds, you are allowed to prepare one Form R report that accounts for your releases of lead resulting from all of your non-exempt activities involving both lead and lead compounds. In this case, the lead associated with your activities involving lead compounds include:

Manufacturing: 5 lbs of PbO × (207.2; mol. wt. Pb/223.2; mol. wt. PbO) = 4.6 lbs Pb
Processing: 100 lbs PbS × (207.2; mol. wt. Pb/239.26; mol. wt. PbS) = 86.6 lbs Pb
Otherwise Use: 8 lbs of Pb_3O_4 × (621.6; mol. wt. of 3Pb/685.6; mol. wt. of Pb_3O_4) = 7.3 lbs of Pb

Example - Determining the Amount of Lead Combusted and Lead Monoxide Formed

Your facility operates several coal-fired boilers to produce heat, steam, and electricity (coal is not directly processed or used in your production process). The supplier of the coal provided you with a Material Safety Data Sheet (MSDS) stating that the lead content of the coal is 7 ppmw. Using inventory records, you know that 13,600,000 pounds of coal were burned in this boiler during the calendar year. By burning coal that contains lead, you have otherwise used lead, and it can reasonably be assumed you have coincidentally manufactured PbO during the combustion of the coal. Two threshold calculations, therefore, must be performed: one for the otherwise use of lead, the other for the manufacture of lead oxide, a lead compound.

Otherwise Use of Lead Metal (Pb^0):

$$(7 \text{ lb lead}/1 \times 10^6 \text{ lb coal}) \times 13{,}600{,}000 \text{ lb coal/yr} = 95.2 \text{ lb lead/yr}$$

Manufacturing of Lead Compounds (PbO):

95.2 lb lead/yr × (223.2; mol. wt. PbO/207.2; mol. wt. Pb) = 103 lb PbO/yr

While your facility did not exceed the 100 lb/yr threshold for otherwise using lead (in coal), your facility exceeded the 100 lb/yr threshold for manufacturing lead compounds and, therefore, you will have to file an EPCRA section 313 (Form R) report for lead compounds this year.

The concentration of lead or lead compounds may be known as a specific concentration, as an average, as a range, or as an upper or lower boundary. If you know the specific concentration of lead or lead compounds, you must use that value for estimates (40 CFR 372.30 (b)(i)). If only an average

concentration is provided (e.g., by the supplier), use that value in the threshold calculation. If only the upper-bound concentration is known, you must use that value in the threshold calculation (40 CFR 372.30(b)(3)(ii)). If only the lower-bound concentration is known, or the concentration is given as a range of an upper and lower boundary, EPA has developed the following guidance on the use of this type of information in threshold determinations:

- If the concentration is given as a range or an upper and lower boundary, EPA recommends that you use the mid-point in your calculations;
- If only the lower bound concentration of lead or lead compounds is given and the concentrations of the other components are given, EPA recommends that you subtract the other component total from 100% to calculate the upper bound of the lead or lead compound(s). EPA recommends that you then determine the mid-point for use in your calculations;
- If only the lower-bound concentration of lead or lead compounds is given and the concentration of the other components is not given, EPA recommends that you assume the upper bound for the lead or lead compounds is 100% and use the mid-point. Alternatively, product quality requirements or information available from the most similar process stream may be used to determine the upper bound of the range.

Example - Determining the Amount of Lead Processed

Your facility processes a chemical substance that contains lead as an impurity. You have information indicating that the lead content of the chemical substance is 2.2 to 2.6 percent by weight. Using inventory records, you know that 750,000 pounds of the chemical substance was processed at your facility during the calendar year. Using the mid-point of the range of lead concentrations available (2.4% or 0.024 pounds (lbs) of lead/100 lbs of chemical substance), you can determine whether you have exceeded the processing threshold.

$$(0.024 \text{ lb lead/lb chemical substance}) \times 750{,}000 \text{ lb chemical substance/yr} = 18{,}000 \text{ lb lead/yr}$$

Your facility exceeded the 100 lb/yr processing threshold for lead and, consequently, will have to report for lead this year.

Chemical production facilities may manufacture lead compounds for other industry use. Production records are a good source for determining the amount manufactured. You must also include any importation of lead or lead compounds in your manufacturing threshold determination (EPCRA Section 313(b)(1)(C)(i)). You can obtain these amounts from purchasing records.

2.1.2 Exemptions

EPA has established five classes of exemptions for purposes of EPCRA section 313:

- *De minimis*;
- Articles;

- Laboratory activities;

- Otherwise use exemptions, including:
  - Motor vehicle maintenance;
  - Routine janitorial or facility grounds maintenance;
  - Structural components;
  - Personal use; and
  - Intake water and air.

- Mining, including:
  - Metal mining (overburden)
  - Coal mining (extraction)

Typically, EPCRA section 313 chemicals or chemical categories that qualify for these exemptions may be excluded from threshold determinations and release or other waste management estimations. As discussed in Section 1.3 of Chapter 1, not all of these exemptions are permissible for EPCRA section 313 threshold calculations and release reporting for lead and lead compounds. The *de minimis* exemption does not apply to lead, lead compounds, or other PBT chemicals or chemical categories (40 CFR 372.38(a)), except when lead is contained in stainless steel, brass, or bronze alloys (see Chapter 3).

For the purpose of the article exemption, an article is defined as a manufactured item that:

- Is formed to a specific shape or design during manufacture;

- Has end-use functions dependent in whole or in part upon its shape or design; and

- Does not release an EPCRA section 313 chemical under normal conditions of processing or otherwise use of the item at the facility (40 CFR 372.3).

If you receive a manufactured article from another facility (e.g., a battery containing lead), the lead in that article may be exempt from threshold determinations and release and other waste management calculations if you meet the following criteria:

- You process or otherwise use it without changing the shape or design; and

- Your processing or otherwise use does not result in the release of more than 0.5 pounds of lead or any other TRI chemical in a reporting year from all like articles.

For example, a covered facility cuts metal sheets containing nickel, releasing fumes. It then further grinds the metal sheets to their final shape, producing grindings. For the sheets to retain their article status, the release of fumes and grindings to any media must be equal to or less than 0.5 pound/year. The 0.5 pound/year release value applies to aggregate grindings and fumes from like

articles being processed or otherwise used in all manners at the facility. This value applies to the total aggregate grindings and fumes of the listed toxic chemical from both steps of the process (i.e., cutting and grinding). The various shapes resulting from the cutting are "the same type of item" as the initial sheet. Thus, the amount of fumes resulting from cutting should be added to the amount of grindings (reference 1 - Q&A 357). Please refer to Appendix A, Directive #1 - Article Exemption in the *Revised EPCRA Section 313 Questions and Answers* (reference 1 of this document) and to Appendix B of this document for additional information on article exemptions. Another example demonstrating the use of exemptions is presented below.

Example - Use of Exemptions When Determining Whether a Reporting Threshold has been Exceeded for Lead or Lead Compounds

In a calendar year a food processing facility: purchased 40 lead-acid batteries for use in forklifts (and other industrial equipment) which contained 9.7 pounds of lead each (388 pounds total); used a 63/37-tin/lead solder alloy to fix broken parts on forklifts (2 pounds of lead) and to construct a metal bracket to be used in an experiment in the facility's laboratory (1 pound of lead); installed stainless steel equipment containing a total of 157.8 pounds of lead; combusted in its boilers coal containing 95.2 pounds of lead; and purchased and used lead-based paint which contained 6.3 pounds of lead tetraoxide.

Questions: Did the facility exceed any of the reporting thresholds for lead or lead compounds? Can any exemptions be applied in making this determination, or to reporting of releases if thresholds are exceeded?

The following considerations and calculations are needed in order to answer the above questions.

1. Otherwise Use of Lead and Lead Compounds:
In the example, otherwise use of lead includes the lead present in the coal that was combusted, the lead in the batteries purchased, and the lead in the stainless steel. The lead tetraoxide in the paint is, of course, a lead compound and subject to a separate otherwise use threshold determination. In this example, both the new 100-pound threshold and the traditional 10,000-pound threshold need to be considered for lead: the 10,000 pound threshold must be considered because of the lead in the stainless steel.

a. The lead in the batteries is subject to the article exemption and is not counted toward either the new 100-pound or the traditional 10,000-pound otherwise use thresholds (provided all aspects of the article exemption are met). For the purpose of this example, we shall assume the article exemption criteria were met for the facility and all 388 pounds of lead in the batteries will be ignored for all purposes.

b. The lead in the 63/37-tin/lead solder alloy is subject to the activity-use exemption for maintaining motor vehicles operated by the facility and the laboratory activity exemption (provided all aspects of these exemptions are met). If the criteria of these exemptions are not met, the lead in the solder would be counted toward both the 100-pound and the 10,000-pound otherwise use thresholds. For the purpose of this example, however, we shall assume the criteria for both exemptions were met for the facility and the 3 pounds of lead in the solder used will be ignored for all purposes.

c. As stated in the lead rule, the lead contained in the stainless steel is not subject to the new 100-pound threshold, but does remain subject to the 10,000-pound otherwise use threshold (or, as appropriate, the 25,000-pound manufacture or process thresholds). Further, the *de minimis* and article exemptions may apply if all aspects of those exemptions are met.

In this example, the quantity of lead contained in the stainless steel is below the 10,000-pound threshold and the sum of all sources of lead at the facility from all activities could not approach the 10,000 pound otherwise use threshold, therefore the quantity of lead in the stainless steel can be ignored for threshold calculations and from calculations of releases and other waste management quantities (see Figure 3-1).

d. The lead contained in the coal is subject to the new 100-pound otherwise use threshold. The 95.2 pounds of lead contained in the coal is, however, below the 100-pound threshold. Unless other reportable sources of lead are used elsewhere in the facility the threshold will not be met. In this example, those other sources are not present, so no reporting is triggered by coal usage alone. The facility must, however, also consider the formation of lead compounds caused by the combustion of the coal (see coincidental manufacture of lead compounds below).

e. The lead compounds contained in the paint are subject to the 100-pound otherwise use threshold for lead compounds, which must be calculated separately from the lead threshold calculations.

In this example, 6.3 pounds of lead compounds are used which is below the 100-pound lead compound threshold. Since there are no other activities at the facility that contribute towards the lead compound "otherwise use" 100 pound threshold, this threshold is not exceeded. However, while reporting is not required for the otherwise use activity of lead compounds, lead compound usage may need to be considered when calculating releases and other waste management quantities if the threshold reporting quantity for lead compounds is exceeded by the facility's other activities (see coincidental manufacture of lead compounds below).

2. Coincidental Manufacture of Lead Compounds:

a. The facility's combustion of coal containing 95.2 pounds of lead results in the formation of 103 pounds of lead monoxide (a lead compound) as shown below:

95.2 lb lead/yr × (223.2; mol. wt. PbO/207.2; mol. wt. Pb) = 103 PbO/yr

This exceeds the 100-pound threshold, so completion and submission of a Form R report is required.

The facility has exceeded a reporting threshold for lead compounds because it manufactured more than 100 pounds of a lead compound. Thus, releases and other waste management quantities must be reported. Unless otherwise exempted, all lead compounds and their quantities must be considered when calculating releases and other waste management quantities. Thus, in this example the fate of the 6.3 pounds of lead tetraoxide in the paint will need to be considered in such calculations.

Important note: Use of the Form A Certification Statement in lieu of a Form R report is not permissible for lead compounds or lead not contained in stainless steel, brass, or bronze alloys.

Recycling of releases from articles allows them to remain as exempt articles. For example, a covered facility processes a metal item containing nickel, the finished product retains in part the dimension characteristics of the original item, and all of the metal shavings resulting from the process are sent off site for recycling. The item would still be exempt as an article (1 - Q&A 374).

Any lead or lead compounds manufactured, processed, or otherwise used in laboratories under the supervision of a technically qualified individual may be exempt from threshold determinations and release and other waste management calculations (40 CFR 372.38(d)). Note that the laboratory exemption does not apply in the following cases:

1) Specialty chemical production;
2) Manufacture, processing, or use of toxic chemicals in pilot plant scale operations; and,
3) Activities conducted outside the laboratory.

The activity-related exemptions are available for lead and lead compounds (see 40 CFR 372.38(c) for a complete description of each). The activity-related exemptions encompass materials

used: 1) to maintain motor vehicle fleets; 2) as or in structural components of the facility; 3) for janitorial or facility grounds maintenance; 4) only for personal use; and 5) materials that are naturally occurring contaminants in incoming process air and water.

In addition to the five exemptions discussed above, EPA has established guidance for metal and coal mining facilities that may manufacture, process, or otherwise use lead. This guidance applies to coal extraction and metal mining activities. Regarding coal extraction, per 40 CFR 372.38(g), if a toxic chemical is manufactured, processed, or otherwise used in extraction by a facility in SIC code 12, the facility is not required to consider the quantity of the toxic chemical so manufactured, processed, or otherwise used when determining whether an applicable threshold has been exceeded under § 372.25, § 372.27, or § 372.28, or determining the amounts to be reported under § 372.30. For additional information regarding coal extraction, refer to *Section 313 Emergency Planning and Community Right-to-Know Act Guidance for Coal Mining Facilities*. This document is available on the TRI Home Page (http://www.epa.gov/tri/guid_docs).

Regarding metal mining, per 40 CFR 372.38(h), if a toxic chemical that is a constituent of overburden[7] is processed or otherwise used by facilities in SIC code 10, a person is not required to consider the quantity of the toxic chemical so processed, or otherwise used when determining whether an applicable threshold has been exceeded under § 372.25, § 372.27, or § 372.28, or determining the amounts to be reported under § 372.30. For additional information regarding metal mining, refer to *Section 313 Emergency Planning and Community Right-to-Know Act Guidance for Metal Mining Facilities*. This document is available on the TRI Home Page (http://www.epa.gov/tri/guid_docs).

Section 2.2 Guidance for Reporting Annual Environmental Releases and Other Waste Management Quantities of Lead

When reporting releases and other waste management quantities for lead or the lead compound category, only the amount of elemental lead should be reported on the Form R (40 CFR 372.25(h)). EPA recommends that you calculate lead releases and other waste management quantities by following these steps:

1. Identify the processes/operations where lead or lead compounds may be manufactured, processed, or otherwise used;

2. Determine potential sources of releases and other waste management quantities from these processes (e.g., wastewater discharge, emissions from operations);

3. Identify the types of releases and other waste management quantities. These types correspond to sections in the Form R (e.g., stack emissions, quantity sent off site for recycling);

[7]For purposes of EPCRA section 313 reporting, overburden is "the unconsolidated material that overlies a deposit of useful materials or ore. It does not include any portion of the ore or waste rock." 40 CFR 372.3 .

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

During threshold determinations, you should have identified the processes and operations in which lead (and lead compounds) are found. Potential release and other waste management sources of lead include the following:

- Accidental spills and releases;
- Air pollution control devices (e.g., baghouses, electrostatic precipitators, and scrubbers);
- Clean up and housekeeping practices;
- Combustion by-products;
- Container residues;
- Fittings and pumps;
- Process discharge stream;
- Recycling and energy recovery by-products;
- Storage tanks;
- Tower stacks;
- Transfer operations;
- Treatment sludge;
- Volatilization from processes; and
- Waste treatment discharges.

After determining the release and other waste management activity sources of lead and lead compounds, you are ready to determine the types of releases and other waste management quantities. These final destinations of lead (not including incorporation into a final product) correspond to elements of the Form R (http://www.epa.gov/tri/report). The potential types of releases and other waste management quantities include:

- **Fugitive or nonpoint air emissions (Part II, Section 5.1 of Form R):** Lead emissions are considered to be fugitive if not released through stacks, vents, ducts, pipes, or any other confined air stream. You should include: (1) fugitive equipment

leaks from valves, pump seals, flanges, compressors, sampling connections, open-ended lines, etc.; (2) evaporative losses from surface impoundments and spills; (3) releases from building ventilation systems; and (4) any other fugitive or non-point air emissions.

- **Stack or point air emissions (Part II, Section 5.2 of Form R):** Lead emissions are considered to be stack or point emissions if released through stacks, confined vents, ducts, pipes, or other confined air streams. You should include emissions from storage tanks. Air releases from air pollution control equipment would generally fall in this category. Using the control efficiency of an air pollution control device, you can determine how much lead is released through the air device.

- **Discharges to receiving streams or water bodies (Part II, Section 5.3 of Form R):** Lead may be released in wastewater directly from the process or from a treatment system. Monitoring is often performed at either type of outfall. This information can be used to determine the concentration of lead leaving the facility.

- **Underground injection on site (Part II, Section 5.4 of Form R):** This waste management type is not common for lead and lead compounds. However, if applicable you must report the quantity to various classes of underground injection wells.

- **Disposal to land on site (Part II, Section 5.5 of Form R):** This type of release may occur if materials containing lead or lead compounds are spilled during processing or transfer operations, or if lead or lead compounds are disposed in an on-site landfill.

- **Discharges to Publicly Owned Treatment Works (POTW) (Part II, Section 6.1 of Form R):** As with the receiving stream discharge, monitoring data may be available to determine the lead concentration in a waste stream from a process or from a treatment operation.

- **Transfers to other off-site locations (Part II, Section 6.2 of Form R):** This type includes off-site transfers for disposal, treatment, recycling, or energy recovery. However, lead and lead compounds, like other metals and metal compounds, cannot be treated for destruction and do not have enough heat value to be combusted for energy recovery (see EPA's current version of the Toxic Chemical Release Inventory Reporting Forms and Instructions). As a result, all off-site transfers of lead and lead compounds should be reported as transfers for disposal or for recycling.

- **On-site waste treatment (Part II, Section 7A of Form R):** You should report the amount of lead treated by your facility. Following treatment, lead may be present in sludge or the water (at a reduced concentration). Typically, EPA considers the removal of particulate matter from a gas stream (e.g., by a baghouse

or electrostatic precipitator) to be an on-site treatment operation. Therefore, any lead or lead compounds in the particulate matter has been "treated on site" and this activity should be reported in Section 7A of the Form R.

- **On-site energy recovery (Part II, Section 7B of Form R):** EPA believes that chemicals that do not contribute significant heat energy during the combustion process should not be considered for energy recovery. Therefore, lead and the metal portion of lead compounds should not be reported as having been combusted for energy recovery.

- **On-site recycling (Part II, Section 7C of Form R).** If you perform lead recycling (for example the remelting of scrap metal generated on site), you should report the amount recycled in Section 7C of the Form R.

Once you have determined that you exceeded a threshold, and after you have identified all of the potential sources for release and other waste management activity types, you must estimate the quantities of lead and the lead portion of lead compounds released and otherwise managed as waste. EPA has identified four basic methods that may be used to develop estimates (each method has been assigned a code that must be included when reporting). The basic methods and corresponding codes are:

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

Descriptions of these basic methods are provided in the U.S. EPA publication, *Estimating Releases and Waste Treatment Efficiencies for the Toxic Chemical Release Inventory Forms* (6) (http://www.epa.gov/ncepihom) and in the annual *TRI Reporting Forms and Instructions* (http://www.epa.gov/tri/report.htm). Many data sources exist for these (and other) methods of developing estimates. Table 2-1 presents potential data sources and the estimation methodology in which each estimation source is most likely to prove useful. Based on site-specific knowledge and potential data sources available, you should be able to determine the best method for calculating each release and other waste management activity quantity.

Table 2-1
Potential Data Sources for Release and Other Waste Management Calculations

DATA SOURCES	
Monitoring Data	**Mass Balance**
C Air permits	C Air emissions inventory
C Continuous emission monitoring	C Hazardous material inventory
C Effluent limitations	C Hazardous waste manifests
C Hazardous waste analysis	C MSDSs[5]
C Industrial hygiene monitoring data	C Pollution prevention reports
C NPDES[1] water permits	C Spill event records
C Outfall monitoring data	C Supply and purchasing records
C POTW pretreatment standards	
C RCRA[2] hazardous waste permit	**Engineering Calculations**
C Stack monitoring data	C NTI[6] database
C New Source Performance Standards	C Facility non-chemical specific emission factors.
C Title V Air Permit Data	C Henry's Law
C MACT[3] Air Standards	C Raoult's Law
	C SOCMI[7] or trade association non-chemical specific emission factors
Emission Factors	
C AP-42[4] chemical specific emission factors	C Solubilities
C Facility or trade association derived chemical-specific emission factors	C Volatilization rates

[1]National Pollutant Discharge Elimination System. [2]Resource Conservation Recovery Act. [3]Maximum Achievable Control Technology. [4]Compilation of Emission Factors, U.S. EPA. [5]Material Safety Data Sheets. [6]National Toxic Inventory. [7]Synthetic Organic Chemicals Manufacturing Industry.

CHAPTER 3
QUALIFICATION FOR STAINLESS STEEL, BRASS, AND BRONZE ALLOYS THAT CONTAIN LEAD

Section 3.1 The Qualified Alloys: Stainless Steel, Brass, and Bronze Alloys that Contain Lead

An alloy is a solid mixture that contains two or more elements, at least one of which being a metal. Examples of alloys are stainless steel, brass, and bronze, which are three of the most commonly used alloys (9). The major metal in stainless steel is iron. However, depending on the type of stainless steel, there can be substantial amounts of chromium, manganese, and/or nickel, which are added to minimize the corrosion of the stainless steel. The major metal in brass and bronze is copper; however, substantial amounts of nickel and/or zinc may also be present. Brass is an alloy of copper and zinc with other metals in varying lesser amounts. Bronze is an alloy of copper and tin with smaller amounts of other metals. The final lead rule[8] lowered the 25,000 pound and 10,000 pound reporting thresholds for lead and lead compounds to 100 pounds, with the exception of lead contained in stainless steel, brass, and bronze alloys. For stainless steel, brass or bronze alloys that contain lead, the quantity of lead contained in these alloys is still applied to the 25,000 pound and 10,000 pound reporting thresholds. These three alloys, when they contain lead, are referred to in this document as the "qualified alloys".

EPA deferred on lowering the 25,000 pound and 10,000 pound reporting thresholds for lead when it is in stainless steel, brass, and bronze alloys because the Agency is currently evaluating a previously submitted petition as well as comments received in response to previous petition denials that requested the Agency to revise the EPCRA section 313 reporting requirements for certain metals contained in stainless steel, brass, and bronze alloys. EPA is reviewing whether there should be any reporting changes regarding the listed constituents (e.g., lead) of stainless steel, brass and bronze alloys. It is important to note that stainless steel, brass and bronze alloys, even when they contain lead, are not listed on the EPCRA section 313 list of toxic chemicals: they are not listed chemicals. Lead, of course, is included on the EPCRA section 313 list of toxic chemicals, and its presence in stainless steel, brass or bronze alloys does not change its status as a listed chemical, or as a PBT chemical.

As mentioned in Chapter 2, there is only one reporting threshold for the manufacturing, processing or otherwise use activities of lead compounds, and that is 100 pounds. Thus, a facility that manufactures, processes or otherwise uses more than 100 pounds of a single lead compound or combination of lead compounds within a calendar year must report their environmental releases and other waste management quantities of the compound(s). For lead metal (Pb^0) there are **three** reporting thresholds: 25,000 pounds; 10,000 pounds; and 100 pounds. The 25,000 pound threshold pertains to the manufacture or processing of all lead metal: lead contained in stainless steel, brass or bronze alloys (the qualified alloys) **and** lead that is not contained in one of the qualified alloys. Similarly, the 10,000 pound threshold pertains to the otherwise use of all lead metal. Thus a facility that manufactures or processes within a calendar year more than 25,000 pounds of lead, regardless of whether the lead is in

[8] Lead and Lead Compounds; Lowering of Reporting Thresholds; Community Right-to-Know Toxic Chemical Release Reporting; Final Rule. Federal Register, 66, 4499-4547 (January 17, 2001).

a qualified alloy, is required to report their environmental releases and other waste management quantities of lead. The same is true if the facility otherwise uses more than 10,000 pounds of lead. The 100 pound threshold only pertains to the manufacture, processing, or otherwise use of lead when it is **not** in stainless steel, brass or bronze alloys. Lead that is in stainless steel, brass or bronze alloys should not be included in determinations of whether the 100 pound threshold for lead has been exceeded. Those facilities that manufacture, process or otherwise use within a calendar year more than 100 pounds of lead that is not contained in a qualified alloy must report their environmental releases and other waste management quantities.

The determination of whether a facility has to file a release report for lead must be based on a prior determination of whether that facility has exceeded any of the three reporting thresholds for lead. Ostensibly, those facilities that do not manufacture, process or otherwise use stainless steel, brass or bronze alloys that contain lead will not have to determine whether they have exceeded the 25,000 pound or 10,000 pound thresholds. Or, in other words, those facilities that manufacture, process, or otherwise use lead only when it is not contained in stainless steel, brass, or bronze alloy will only have to determine whether they have exceeded the 100 pound threshold. Facilities that manufacture, process or otherwise use lead when it is both in stainless steel brass or bronze alloys and when it is not in these alloys must consider all three thresholds. An important point to remember is that when determining whether a facility has exceeded the 25,000 pound or 10,000 pound thresholds, any lead that is **not** in stainless steel, brass or bronze alloys must also be included in the determination. Figure 3-1 summarizes the basic steps that need to be taken when determining whether a facility has exceeded any of the three reporting thresholds for lead. The remainder of this chapter discusses these steps in greater detail, and provides examples to illustrate how such determinations should be made.

This chapter also provides a general discussion on what stainless steel, brass and bronze alloys are. A more detailed discussion on the composition of stainless steel, brass and bronze alloys is provided in Appendix A. A comprehensive discussion on the chemistry, composition, and environmental fate of alloys, including stainless steel, brass and bronze alloys is available in an EPA document entitled *Report on the Corrosion of Certain Alloys*[9] (8).

3.1.1 Definition of Stainless Steel Alloy

The American Iron and Steel Institute (AISI) defines alloy steels as follows: "....common custom steel is considered to be alloy steel when the maximum of the range given for the content of alloying elements exceeds one or more of the following limits: manganese (Mn), 1.65%; silicon (Si), 0.60%; copper (Cu), 0.60%; or in which a definite range or a definite minimum quantity of any of the following elements is specified or required within the limits of the recognized field of constructional alloy steels: aluminum (Al), boron (B), chromium (Cr) up to 4.00%, cobalt (Co), niobium (Nb), molybdenum (Mo), nickel (Ni), titanium (Ti), tungsten (W), vanadium (V), zirconium (Zr), or any other alloying element added to obtain a desired alloying effect."

[9] The reference to the alloys document pertains to the draft version (dated July 2001) of the document. A revised version is expected to be released by EPA in 2002.

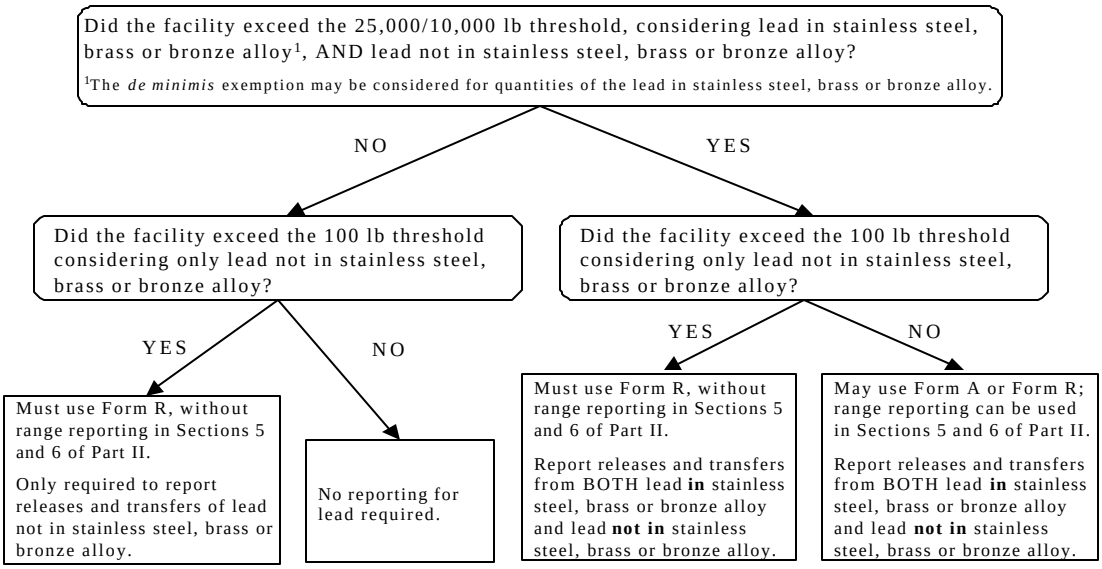

Figure 3-1. Reporting Thresholds and Requirements for Lead
(This flow chart does not apply to Lead Compounds, which is a separately listed TRI chemical.)

Steels that contain 4% or more of chromium are included, by convention, among the special types of alloy steels known as **stainless steels** (8). Trace concentrations of lead may be contained in stainless steel as an impurity. The main reason for the existence of stainless steels is their resistance to corrosion. More than 180 different alloys belong to the stainless steel group and each year new ones and modifications of existing ones appear. In some stainless steels the chromium content approaches 30%. Corrosion and oxidation resistance of stainless steels increase as the chromium content is increased. By increasing the amount of the chromium content and by the presence of other elements, such as molybdenum or titanium, the corrosion resistance of stainless steels can be varied over a tremendous range.

Some Important Points about Alloys

- *An alloy is a solid mixture that contains two or more elements, at least one of which is a metal;*
- *With regard to the TRI Lead Rule and this document, the "qualified alloys" are stainless steel, brass and bronze alloys that contain lead;*
- *Stainless steels are steels that contain 4% or more of chromium;*
- *Brass is an alloy that consists chiefly of copper and zinc in variable proportions, and to a lesser extent other elements;*
- *Bronze is an alloy that consists chiefly of copper and tin in variable proportions, and to a lesser extent other elements.*

3.1.2 Definitions of Brass and Bronze

Brass is an alloy that consists chiefly of copper and zinc in variable proportions, and to a lesser extent other elements. **Bronze** is an alloy that consists chiefly of copper and tin in variable proportions, and to a lesser extent other elements. There are a number of different types of brass and bronze that differ in the concentrations of copper, zinc, tin or other metals.

Copper and its alloys, including brass and bronze, are classified in the United States by composition according to Copper Development Association (CDA) designations which have been incorporated into the Unified Numbering System (UNS) for metals and alloys. Wrought copper materials are assigned five digit numerical designations which range from C10100 through C79999, but only the first three or sometimes four numerals are frequently used for brevity. Designations that start with 8 or 9 are reserved for cast copper alloys. The designations and principal alloying elements of wrought copper alloys are given in Table 3-1.

Table 3-1
UNS (CDA) Designations for Brass and Bronze Alloys

Alloy group	UNS (CDA) designation	Principal alloy elements
Brasses	C20500-C28580	Zn
Leaded brasses	C31200-C38590	Zn-Pb
Tin brasses	C40400-C40980	Sn, Zn
Phosphor bronzes	C50100-C52400	Sn-P
Leaded bronzes	C53200-C54800	Sn-P, Pb
Phosphorus-silver	C55180-C55284	Ag-P
Aluminum bronze	C60600-C64400	Al, Fe, Ni, Co, Si
Silicon bronze	C64700-C66100	Si, Sn
Modified brass	C66400-C69950	Zn, Al, Si, Mn

Brass and bronze can be grouped according to how the principal elemental additions affect properties. This grouping depends primarily on whether the additions that dissolve in the liquid copper can form discrete second phases during melting/casting or in-process thermal treatment. Brass and bronze are considered to be solid solution alloys when copper dissolves other elements to varying degrees to produce a single-phase alloy that is strengthened relative to unalloyed copper. The contribution to strengthening from an element depends on the amount of the element in solution and by its particular physical characteristics, such as atom size and valency. Tin, silicon, and aluminum show the highest strengthening efficiency of the common elemental additives, whereas nickel and zinc are the least efficient. The limiting factor in their alloy range is the extent to which the elements, either singly or in combination, remain dissolved in the copper during processing. Table 3-2 gives the designations and compositions of some specific brass and bronze wrought alloys. More details on these specific alloys are provided in Appendix A.

Table 3-2
UNS (CDA) Designation and Compositions of Some Brass and Bronze Wrought Alloys

Alloy group	UNS designation	Elemental composition, wt% [a]
Zinc brass	C260	30 Zn
Leaded brass	C360	35 Zn, 3 Pb
Tin brass	C425	9.5 Zn, 2.0 Sn
Phosphor bronze	C510	5.0 Sn, 0.1 P
Aluminum bronze	C638	2.8 Al, 1.8 Si
Silicon bronze	C654	3.0 Si, 1.5 Sn, 0.1 Cr
Silicon bronze	C655	3.3 Si, 0.9 Mn
Modified Cu-Zn	C688	22.7 Zn, 3.4 Al, 0.4 Co

[a]Remaining percentage is copper.

Section 3.2 Determining When Reporting of Releases and Other Waste Management Quantities for the Qualified Alloys is Required

As discussed above, there is only one reporting threshold for lead compounds, and that is 100 pounds. Hence, a facility that either manufactures, processes or otherwise uses more than 100 pounds annually of a single lead compound, or more than one lead compound, will have to report releases and other waste management quantities of the lead contained in the lead compound(s). For lead metal (Pb^0), there are three reporting thresholds: 25,000 pounds; 10,000 pounds; and 100 pounds, that pertain to the manufacture, processing or otherwise use of this chemical. A facility must file an EPCRA section 313 report if it manufactures, processes, or otherwise uses more than 100 pounds of lead (not contained in stainless steel, brass, or bronze alloy) during the calendar year. For lead contained in stainless steel, brass or bronze alloy the 25,000 pound threshold for manufacturing and processing, and the 10,000 pound threshold for otherwise use, is applied. As illustrated in Figure 3-1, facilities that manufacture, process, or otherwise use lead and stainless steel, brass, or bronze alloys that contain lead must apply all quantities of lead (regardless of whether they are in an alloy) to the 25,000 pound threshold for manufacturing and processing or the 10,000 pound threshold for otherwise use. When conducting threshold evaluations a facility must consider the amount of lead not in stainless steel, brass, or bronze alloys toward both the 100 pound threshold AND the 25,000 and 10,000 pound thresholds (see Figure 3-1). Of course, facilities that manufacture, process, or otherwise use lead only when it is not contained in any of the qualified alloys would only have to consider the 100 pound threshold.

Thus, the qualification for lead contained in stainless steel, brass or bronze alloys creates three potential scenarios for facilities that may manufacture, process, or otherwise use lead as well as stainless steel, brass or bronze alloys that contain lead: 1) all lead is in forms other than stainless steel, brass, or bronze alloy; 2) all lead is in stainless steel, brass, or bronze alloy; and 3) some lead is in stainless steel, brass, or bronze alloy and some is not; i.e., some lead may be manufactured, processed, or otherwise used elsewhere at the facility. Table 3-3 summarizes what a facility needs to consider in determining whether they need to report releases and other waste management quantities under each of these scenarios and, if reporting is required, what options the facility has in filing reports. Table 3-3 refers to

the following three **variables**: 1) Form A Certification Statement; 2) range reporting for Sections 5 and 6 of Part II of the Form R; and 3) *de minimis* exemption. These variables, as well as their applicability, are discussed in Chapter 1, Section 1.3. Additional details on these variables can be found in the "Toxic Chemical Release Inventory Reporting Forms & Instructions" package, which is published annually by EPA and can be obtained from the Internet at http://www.epa.gov/tri.

Table 3-3
Threshold Scenarios and Options Involving Lead and the Qualified Alloys

Scenario	Option
None of the lead at the facility is contained in a qualified alloy. In this scenario all lead quantities are "not in stainless steel, brass, or bronze alloys." In principle the 100 pound, 25,000 pound and 10,000 pound thresholds are applicable. However, since none of the lead is in a qualified alloy, as a practical matter what really determines whether reporting is required in this scenario is whether the 100 pound threshold is "triggered" (i.e., exceeded.)	In this scenario, the facility may NOT use ANY of the following **variables**: *de minimis* exemption, Form A Certification Statement, and range reporting for Sections 5 and 6 of Part II of the Form R.
All of the lead is only in qualified alloys. Thus, all lead quantities to be considered in the threshold determination are only "in stainless steel, brass, or bronze alloys." Therefore, only the 25,000/10,000 pound thresholds need to be considered.	If either the 25,000 or 10,000 pound thresholds are exceeded: The facility can use the *de minimis* exemption (if otherwise applicable). The facility may also use the Form A Certification Statement and range reporting options for completing Sections 5 and 6 of Part II of the Form R.
Lead is in qualified alloys AND not in qualified alloys. Quantities of lead are "in stainless steel, brass or bronze alloys" *and* "not in stainless steel, brass, or bronze alloys". Thus, all three reporting thresholds: i.e., the 100 pound, 25,000 pound and 10,000 pound thresholds need to be considered, and the facility will need to determine whether any of these thresholds have been triggered (exceeded). Those quantities of lead not in qualified alloys are to be applied to all three reporting thresholds. Those quantities of lead that are only in the specified alloys should only be applied to the 25,000 pound and 10,000 pound thresholds.	The facility may take the *de minimis* exemption for those quantities of lead "in stainless steel, brass, or bronze alloys" that meet the *de minimis* exemption requirements (*e.g.*, manufactured as an impurity). The facility may not take the *de minimis* exemption for any of the lead "not in stainless steel, brass, or bronze alloys." If the 100 pound reporting threshold is exceeded, the facility may NOT use the following variables: Form A Certification Statement and range reporting for Sections 5 and 6 of Part II of the Form R, regardless of whether the 25,000/10,000 pound threshold is exceeded. If only the 25,000 or 10,000 pound threshold is exceeded, the facility may use the Form A Certification Statement or range reporting variables even though, in this example, quantities of lead "not in stainless steel, brass, or bronze alloys" were included in the threshold calculation. The reporting variables cannot be used once the 100 pound threshold has been exceeded.

The following example demonstrates some of the points described in the above threshold determination scenarios. Other examples are included in Appendix B, which presents a series of questions and answers regarding the reporting of lead and lead compounds. The first part of Appendix B repeats selected questions and answers about EPCRA section 313 reporting of metal and metal compounds that have been published elsewhere (1), while the second part of Appendix B presents questions and answers received by the Agency since the promulgation of the lead rule that are specific to the reporting of lead and lead compounds and that have not yet been published elsewhere.

Examples - Threshold Determinations for Various Scenarios Involving Lead Alloys

1) Consider a facility that processes 20,000 pounds of lead in a stainless steel alloy and 275 pounds of lead in another alloy that is not stainless steel, brass, or bronze during the calendar year. Does this facility need to file an EPCRA section 313 report for lead?

Yes, this facility must file an EPCRA section 313 Form R report for lead (a Form A Certification Statement is not an option). While this facility did not exceed the 25,000 pound threshold for processing lead in all forms, it exceeded the 100 pound threshold for processing lead in forms other than in stainless steel, brass, or bronze alloys. This facility is only required to report releases and transfers of lead not contained in stainless steel, brass, or bronze alloys, and cannot use range reporting in Sections 5 and 6 of Part II of the Form R.

2) Consider a facility that processes 24,950 pounds of lead in a stainless steel alloy and 75 pounds of lead in another alloy that is not stainless steel, brass, or bronze during the calendar year. Does this facility need to file an EPCRA section 313 report for lead?

Yes, this facility must file an EPCRA section 313 report for lead. This facility exceeded the 25,000 pound threshold for processing of lead in all forms (24,950 pounds in a qualified alloy plus 75 pounds in a non-qualified alloy = 25,025 pounds total); therefore, this facility must file a report. Since this facility did not exceed the 100 pound threshold for processing lead in forms other than stainless steel, brass, or bronze alloys, this facility may file a Form A Certification Statement rather than a Form R report if it meets the other requirements (less than 1,000,000 pounds manufactured, processed, or otherwise used and less than 500 pounds for the total annual reportable amount) for completing a Form A Certification Statement. This facility is required to report releases and transfers of all lead (both contained in the stainless steel alloy and not contained in stainless steel, brass, or bronze alloys), and can use range reporting in Sections 5 and 6 of Part II of the Form R.

3) Consider a facility that processes 275 pounds of lead metal that is not in stainless steel, brass, or bronze alloys and in a separate operation processes 24,900 pounds of lead in a brass alloy during the calendar year. Does this facility have to file an EPCRA section 313 report for lead and is this facility required to report quantities released and otherwise managed as waste from the lead in all sources?

Yes, this facility must file a Form R report for lead. This facility exceeded both the 25,000 pound processing threshold for lead in all forms (275 pounds of lead in a non-qualified alloy plus 24,900 pounds in a brass alloy = 25,175 pounds total) and the 100 pound threshold for lead not contained in stainless steel, brass, or bronze alloys. Therefore, this facility must complete a Form R (it cannot use a Form A Certification Statement). This facility must consider the amount of lead in both the qualified and non-qualified alloys when estimating its releases and quantities otherwise managed as waste (although the *de minimis* exemption can be used for waste streams that apply to the 24,900 pounds of lead in the brass alloy, if appropriate). This facility cannot use range reporting in Sections 5 and 6 of Part II of the Form R.

4) Consider a facility that processes 90 pounds of a lead compound, 95 pounds of lead metal (i.e., lead that is not contained in stainless steel, brass, or bronze alloys) and 24,910 pounds of lead in a stainless steel alloy during the calendar year. Does this facility have to file an EPCRA section 313 report for lead?

Examples (continued)- Threshold Determinations for Various Scenarios Involving Lead Alloys

Yes, this facility must file an EPCRA section 313 report for lead. This facility exceeded the 25,000 pound threshold for processing of lead in all forms (95 pounds not in a qualified alloy plus 24,910 pounds in stainless steel = 25,005 pounds total) and must, therefore, file a report. Since this facility did not exceed the 100 pound threshold for processing of lead not in stainless steel, brass, or bronze alloys, this facility may file a Form A Certification Statement rather than a Form R report if it meets the other requirements (less than 1,000,000 pounds manufactured, processed, or otherwise used and less than 500 pounds for the total annual reportable amount released) for completing a Form A Certification Statement. This facility is required to report releases and transfers of all lead (both contained in the stainless steel alloy and not contained in stainless steel, brass, or bronze alloys), and can use range reporting in Sections 5 and 6 of Part II of the Form R.

Note, however, that this facility did not exceed the 100 pound processing threshold for lead compounds and, therefore, does not need to report its processing of a lead compound. None of the lead in the lead compound is factored into the above threshold determinations for lead, or toward release or otherwise managed quantity estimates for lead.

5) Consider a facility that processes 26,500,000 pounds of a stainless steel alloy containing 0.0950% lead. Does this facility have to file an EPCRA section 313 report for lead?

The amount of lead in the stainless steel alloy processed is calculated as follows:
(26,500,000 pounds alloy) x (0.0950% lead) = 25,200 pounds lead

While the threshold for processing lead appears to have been exceeded : 25,200 pounds is more than the 25,000 pound threshold for processing lead, the lead in the alloy is less than the *de minimis* concentration (0.1%) and therefore does not have to be considered in the threshold calculation (i.e., is exempt from the threshold calculation). Thus, because the *de minimis* concentration for lead is 0.1%, and this facility processed lead only in the form of the qualified alloy of stainless steel (i.e., the 100 pound threshold was not also exceeded), this facility is not required to file an EPCRA section 313 report.

It is important to note that if a facility exceeds the 100 pound threshold for lead not contained in stainless steel, brass, or bronze alloys, they must complete a Form R. Keep in mind that the *de minimis* exemption may apply when estimating the amounts of release and otherwise managed quantities associated with the lead in the qualified alloys. Clarification on "melting" qualified alloys is presented in Part 2 of Appendix B, Q&A 6.

CHAPTER 4
SOURCES OF LEAD AND LEAD COMPOUNDS

This chapter provides an overview of where EPA believes lead and lead compounds are likely to be found at facilities and which operations may manufacture, process, or otherwise use lead or lead compounds. You should determine if the sources of lead and lead compounds discussed in this chapter apply to your facility. EPA recognizes that this document is not exhaustive and that many additional sources of lead and lead compounds exist. You should carefully consider all potential sources, not just those discussed in this document.

Section 4.1 Physical and Chemical Nature of Lead and Lead Compounds

In pure form, lead metal (Pb^0) is silvery in appearance. Lead metal oxidizes and turns bluish-gray when exposed to air. It is soft enough to be scratched with a fingernail. It is dense, malleable, and readily fusible (10). Its properties include a low melting point; ease of casting; high density; low strength; ease of fabrication; acid resistance; electrochemical reaction with sulfuric acid; chemical stability in air, water, and soils; and the ability to attenuate sound waves, atomic radiation and mechanical vibration (11). The physical properties of lead are presented in Table 4-1.

Lead in its elemental or pure form rarely occurs in nature. Lead most commonly occurs as the mineral galena (lead sulfide [PbS]), a lead compound, and is sometimes found in other mineral forms, which are of lesser commercial importance, such as anglesite ($PbSO_4$) and cerussite ($PbCO_3$) (10). Table 4-2 presents properties of these three mineral compounds. Lead is hardened by alloying it with small amounts of arsenic, copper, antimony, or other metals (10). These alloys are frequently used in manufacturing various lead-containing products. A list of typical end uses for lead alloys is given in Table 4-3.

Lead in its compound form also has many uses in manufacturing processes, primarily as pigments. Lead compounds can be classified into the following general categories:

- Organolead compounds;
- Lead oxides;
- Lead sulfides; and
- Lead salts.

Each of these classes of lead compounds is discussed briefly below. Table 4-4 presents a summary of the chemical formulas and end uses of the most commonly used lead compounds.

4.1.1 Organolead Compounds

Organolead compounds are compounds that contain lead and carbon and have at least one lead-carbon bond. Only two types of organolead compounds have found large-scale commercial applications: tetramethyllead (TML) and tetraethyllead (TEL). Both TML and TEL were once manufactured in large quantities in the United States because they were used extensively in automotive gasoline. However, due to strict regulations that have essentially outlawed the use lead as an additive

in gasoline, the commercial production or importation of TML and TEL in the United States is now greatly reduced. Special use of lead as an additive in certain types of fuels, such as fuels for certain racing cars and aircraft, is still permitted, however.

Table 4-1
Physical Properties of Lead

Property	Value
Atomic weight	207.2 Daltons
Melting point	327EC
Boiling point	1770EC
Specific gravity	
20EC	11.35 g/cm^3
327EC (solid)	11.00 g/cm^3
327EC (liquid)	10.67 g/cm^3
Specific heat	130 J/(kg-K)[a]
Latent heat of fusion	25 J/g[a]
Latent heat of vaporization	860 J/g[a]
Vapor pressure	
980EC	0.133 kPa[b]
1160EC	1.33 kPa[b]
1420EC	13.33 kPa[b]
1500EC	26.7 kPa[b]
1600EC	53.3 kPa[b]
Thermal conductivity	
28EC	34.7 W/(m-K)
100EC	33.0 W/(m-K)
327EC (solid)	30.5 W/(m-K)
327EC (liquid)	24.6 W/(m-K)
Thermal conductivity (relative to Ag = 100)	8.2
Coefficient of linear expansion, at 20EC per EC	29.1x10^{-6}
Surface tension at 360EC, mN/m (= dyn/cm)	442

Source: Reference 12

[a] To convert J to cal, divide by 4.184.

[b] To convert kPa to mm Hg, multiply by 7.5.

Table 4-2
Physical Properties of the Principal Lead-Ore Compounds

Parameter	Galena	Cerussite	Anglesite
Formula	PbS	$PbCO_3$	$PbSO_4$
Lead, weight percent	86.6 %	77.5 %	68.3 %
Hardness, Mohs scale	2.5 to 2.75	3 to 3.5	2.5 to 3
Luster	Metallic	Adamantine to vitreous, resinous	Adamantine to vitreous, resinous
Color	Lead gray	Colorless to white	Colorless to white
Density, g/cm^3	7.58	6.55	6.38

Source: Reference 13

Table 4-3
Uses of Lead Alloys

Alloy	Uses
Lead - Copper	
<0.10% copper by wt.	Lead sheet Lead pipes Sheathings for electric power cables Wire and other fabricated lead products Tank linings Tubes for acid-mist precipitators Steam heating pipes for acid-plating baths
60 to 70% copper by wt. (leaded brass or bronze)	Bearings and bushings
Lead - Antimony	Lead-acid battery positive grids, posts, and connectors Flashings and roofing materials Cable sheathings Ammunition Tank linings, pumps, valves, pipes, and heating and cooling coils in chemical operations using sulfuric acid or sulfate solutions at elevated temperatures Lead sheet Anodes in metal-plating and metal-electrowinning operations Collapsible tubes Wheel-balancing weights for automobiles and trucks Special weights and castings Battery cable clamps
Lead - Antimony - Tin	Printing-type metals Bushing and sleeve bearings Journal bearings in freight cars and mobile cranes Decorative, slush, and special castings (e.g., miniature figures, casket trim, belt buckles, trophies, and holloware)

Table 4-3 (Continued)
Use of Lead Alloys

Alloy	Uses
Lead - Tin	Solders for sealing and joining metals (e.g., electronic applications including printed circuit boards) Automobile radiators High-temperature heat exchangers Terne-steel sheets for radio and television chassis, roofs, fuel tanks, air filters, oil filters, gaskets, metal furniture, gutters, and downspouts Coating of copper sheet used for building flashings Coating of steel and copper electronic components Electroplating
Lead - Calcium	Grids for large stationary stand-by power, submarine, and specialty sealed batteries Original equipment automotive batteries Negative grids for replacement batteries Electrowinning anodes Cable sheathing, sleeving for cable splices, specialty boat keels, and lead-alloy tapes
Lead - Calcium - Aluminum	Negative battery grids
Lead - Calcium - Tin	Maintenance-free automotive battery grids Electrowinning anodes
Lead - Silver	Insoluble anodes for zinc and manganese electroplating Anodes in the d-c cathodic protection of steel pipe and structures used in fresh, brackish, or seawater Solder in high pressure, high temperature cooling systems Positive grids of lead-acid batteries Soft solders
Lead - Silver - Antimony	Production of thin copper foil for electronics
Lead - Silver - Calcium	Zinc electrowinning
Lead - Strontium - Tin	Maintenance-free battery grids Bearings
Lead - Tellurium	Used in pipes and sheets for chemical installations Shielding for nuclear reactors Cable sheathing
Fusible (lead, cadmium, bismuth, and tin in varying compositions)[a]	Fuses Low-melting sprinkler systems Foundry patterns Molds, dies, punches, chucks, cores, mandrels, flexible tubing, and low-temperature solder
Lead - Idium	Used to solder metals to glass
Lead - Lithium and Lead - Lithium - Tin	Battery grids Bearings

[a] Alloys that melt at very low temperatures (i.e., 32EF to 361.4EF [0EC to 183EC]).
Source: Reference 14

Table 4-4
Lead Compounds *

Compound	CAS Number	Chemical Formula or Description	Uses
Lead acetate	301-04-2	$Pb(C_2H_3O_2)_2 \cdot 3H_2O$	Dyeing of textiles, waterproofing, varnishes, lead driers, chrome pigments, gold cyanidation process, insecticide, anti-fouling paints, analytical reagent, hair dye
Lead alkyl, mixed	--	A mixture containing various methyl and ethyl derivatives of tetraethyl lead and tetramethyl lead	Anti-knock agents in aviation gasoline
Lead antimonate	13510-89-9	$Pb_3(SbO_4)_2$	Staining glass, crockery, and porcelain
Lead arsenate	7645-25-2	$Pb_3(AsO_4)_2$	Insecticide, herbicide
Lead arsenite	10031-13-7	$Pb(AsO_2)_2$	Insecticide
Lead azide	13424-46-9	$Pb(N_3)_2$	Primary detonating compound for high explosives
Lead borate	14720-53-7	$Pb(BO_2)_2 \cdot H_2O$	Varnish and paint drier, waterproofing paints, lead glass, electrically conductive ceramic coatings
Lead borosilicate	--	Composed of a mixture of the borate and silicate of lead	A constituent of optical glass
Lead carbonate, basic	598-63-0	$2PbCO_3 \cdot Pb(OH)_2$	Exterior paint pigments, ceramic glazes
Lead chloride	7758-95-4	$PbCl_2$	Preparation of lead salts, lead chromate pigments, analytical reagent
Lead chromate	7758-97-6	$PbCrO_4$	Pigment in industrial paints, rubber, plastics, ceramic coatings; organic analysis
Lead cyanide	592-05-2	$Pb(CN)_2$	Metallurgy
Lead dimethyl dithiocarbamate	19010-66-3	$Pb[SCSN(CH_3)_2]_2$	Vulcanization accelerator with litharge
Lead dioxide	1309-60-0	PbO_2	Oxidizing agent, electrodes, lead-acid storage batteries, curing agent for polysulfide elastomers, textiles (mordant, discharge in dyeing with indigo), matches, explosives, analytical reagent.
Lead fluoborate	13814-96-5	B_2F_8Pb	Salt for electroplating lead; can be mixed with stannous fluoborate to electroplate any composition of tin and lead as an alloy

Table 4-4 (Continued)
Lead Compounds *

Compound	CAS Number	Chemical Formula or Description	Uses
Lead fluoride	7783-46-2	PbF_2	Electronic and optical applications, starting materials for growing single-crystal solid-state lasers, high-temperature dry film lubricants in the form of ceramic-bonded coatings
Lead fluosilicate	25808-74-6	$PbSiF_6 \cdot 2H_2O$	Solution for electrorefining lead
Lead formate	811-54-1	$Pb(CHO_2)_2$	Reagent in analytical determinations
Lead hydroxide	19783-14-3	$Pb(OH)_2$	Lead salts, lead dioxide
Lead iodide	10101-63-0	PbI_2	Bronzing, printing, photography, cloud seeding
Lead linoleate	16996-51-3	$Pb(C_{18}H_{31}O_2)_2$	Medicine, drier in paints and varnishes
Lead maleate, tribasic	--	$C_4H_6O_5 \cdot Pb$	Vulcanizing agent for chlorosulfonated polyethylene. Highly basic stabilizer with high heat stability in vinyls
Lead molybdate	10190-55-3	$PbMoO_4$	Analytical chemistry, pigments
Lead â-naphthalenesulfonate	--	$Pb(C_{10}H_7SO_3)_2$	Organic preparations
Lead naphthenate	61790-14-5	$C_7H_{12}O_2 \cdot xPb$	Paint and varnish drier, wood preservative, insecticide, catalyst for reaction between unsaturated fatty acids and sulfates in the presence of air, lube oil additive
Lead nitrate	10099-74-8	$Pb(NO_3)_2$	Lead salts, mordant in dyeing and printing calico, matches, mordant for staining mother of pearl, oxidizer in the dye industry, sensitizer in photography, explosives, tanning, process engraving, and lithography
Lead oleate	1120-46-3	$[CH_3(CH_2)_7CH{:}CH(CH_2)_7COO]_2Pb$	Varnishes, lacquers, paint drier, high-pressure lubricants
Lead oxide, red	1314-41-6	Pb_3O_4	Storage batteries, glass, pottery, and enameling, varnish, purification of alcohol, packing pipe joints, metal-protective paints, fluxes and ceramic glazes.
Lead phosphate	7446-27-7	$Pb_3(PO_4)_2$	Stabilizing agent in plastics
Lead phosphate, dibasic	--	$PbHPO_4$	Imparting heat resistance and pearlescence to polystyrene and casein plastics
Lead phosphite, dibasic	15845-52-0	$2PbO \cdot PbHPO_3 \cdot 1/2H_2O$	Heat and light stabilizer for vinyl plastics and chlorinated paraffins. As a UV screening and antioxidizing stabilizer for vinyl and other chlorinated resins in paints and plastics

Table 4-4 (Continued)
Lead Compounds *

Compound	CAS Number	Chemical Formula or Description	Uses
Lead phthalate, dibasic	--	$C_6H_4(COO)_2Pb•PbO$	Heat and light stabilizer for general vinyl use
Lead resinate	9008-26-8	$Pb(C_{20}H_{29}O_2)_2$	Paint and varnish drier, textile waterproofing agent
Lead salicylate	--	$Pb(OOCC_6H_4OH)_2•H_2O$	Stabilizer or costabilizer for flooring and other vinyl compounds requiring good light stability
Lead sesquioxide	1314-27-8	Pb_2O_3	Ceramics, ceramic cements, metallurgy, varnishes
Lead silicate	11120-22-2	$3PbO•SiO_2$	Ceramics, fireproofing fabrics
Lead silicate, basic	--	A pigment made up of an adherent surface layer of basic lead silicate and basic lead sulfate cemented to silica	Pigment in industrial paints
Lead silicochromate	11113-70-5	A yellow lead-silicon pigment	Normal lead silicon chromate is used as a yellow prime pigment for traffic marking paints. Basic lead silicon chromate is used as a corrosive inhibitive pigment for metal protective coatings, primers, and finishers. Also for industrial enamels requiring a high gloss
Lead sodium thiosulfate	--	$PbS_2O_3•2Na_2S_2O_3$	Matches
Lead stannate	12036-31-6	$PbSnO_3•2H_2O$	Additive in ceramic capacitors, pyrotechnics
Lead stearate	52652-59-2	$Pb(C_{18}H_{35}O_2)_2$	Varnish and lacquer drier, high-pressure lubricants, lubricant in extrusion processes stabilizer for vinyl polymers, corrosion inhibitor for petroleum, component of greases, waxes, and paints
Lead subacetate	1335-32-6	$2Pb(OH)_2Pb(C_2H_3O_2)_2$	Decolorizing agent (sugar solutions, etc.)
Lead suboxide	--	Pb_2O	In storage batteries
Lead sulfate	7446-14-2	$PbSO_4$	Storage batteries, paint pigments
Lead sulfate, basic	--	$PbSO_4•PbO$	Paints, ceramics, pigments
Lead sulfate, blue basic	--	Composition: Lead sulfate (min) 45%, lead oxide (min) 30%, lead sulfide (max) 12%, lead sulfite (max) 5%, zinc oxide 5%, carbon and undetermined matter (max) 5%	Components of structural-metal priming coat paints, rust-inhibitor in paints, lubricants, vinyl plastics, and rubber products

Table 4-4 (Continued)
Lead Compounds *

Compound	CAS Number	Chemical Formula or Description	Uses
Lead sulfate, tribasic	--	$3PbO \cdot PbSO_4 \cdot H_2O$	Electrical and other vinyl compounds requiring high heat stability
Lead sulfide	1314-87-0	PbS	Ceramics, infrared radiation detector, semi-conductor, ceramic glaze, source of lead
Lead telluride	1314-91-6	PbTe	Single crystals used as photoconductor and semiconductor in thermocouples
Lead tetraacetate	546-67-8	$Pb(CH_3COO)_4$	Oxidizing agent in organic synthesis, laboratory reagent
Lead thiocyanate	592-87-0	$Pb(SCN)_2$	Ingredient of priming mix for small-arms cartridges, safety matches, dyeing
Lead titanate	12060-00-3	$PbTiO_3$	Industrial paint pigment
Lead tungstate	7759-01-5	$PbWO_4$	Pigment
Lead vanadate	10099-79-3	$Pb(VO_3)_2$	Preparation of other vanadium compounds, pigment
Lead zirconate titanate	12626-81-2	$PbTiZrO_3$	Element in hi-fi sets and as a transducer for ultrasonic cleaners, ferroelectric materials in computer memory units
Litharge	1317-36-8	PbO	Storage batteries, ceramic cements and fluxes, pottery and glazes, glass, chromium pigments, oil refining, varnishes, paints, enamels, assay of precious metal ores, manufacture of red lead, cement (with glycerol), acid-resisting compositions, match-head compositions, other lead compounds, rubber accelerator

Source: Reference 15

* Some of the lead compounds listed in this table are stated as being used in paints and other coating materials. It should be noted that the use of lead compounds in paints and other coating materials has been restricted by various regulations. Nowadays, the major uses of lead based paints and other coating materials are: as metal primers in automobile refinishing; anti-corrosive undercoatings in the automobile industry; in public works applications (such as bridges and roads, for example); in traffic paints; in art materials; and in marine applications (such as boats and buoys).

4.1.2 Lead Oxides

Lead oxide is a general term and includes lead monoxide or "litharge" (PbO); lead tetraoxide or "red lead" (Pb_3O_4); and black or "gray" oxide, which is a mixture of 70 percent lead monoxide and 30 percent metallic lead. Litharge is used primarily in the manufacture of various ceramic products. Because of its electrical and electronic properties, litharge is also used in capacitors and electrophotographic plates, as well as in ferromagnetic and ferroelectric materials. It is also used as an activator in rubber, a curing agent in elastomers, a sulfur removal agent in the production of thiols and in oil refining, and an oxidation catalyst in several organic chemical processes. It also has important markets in the production of many lead chemicals, dry colors, soaps (i.e., lead stearate), and driers for paint. Another important use of litharge is the production of lead salts, particularly those used as stabilizers for plastics, notably polyvinyl chloride materials (16).

Lead tetraoxide (Pb_3O_4) or red lead is a brilliant orange-red pigment. It is used as a pigment in anticorrosion paints for steel surfaces. It is also used in lead oxide pastes for tubular storage batteries, in ballistic modifiers for high-energy propellants, in ceramic glazes for porcelain, in lubricants for hot pressing metals, in radiation-shielding foam coatings in clinical x-ray exposure, and in rubber adhesives for roadway joints (14). Black lead is made for specific use in the manufacture of lead acid storage batteries (16). Lead dioxide (PbO_2) is a brownish, black powder. Because of its strong oxidizing properties, it is used in the manufacture of dyes and to control burning in incendiary fires. It is also used as a curing agent for liquid polysulfide polymers and low molecular weight butyl and polyisopropane (17). Lead titanate ($PbTiO_3$) and lead zirconate ($PbZrO_3$) are two lead oxides that are frequently mixed, resulting in highly desirable piezoelectric properties that are used in high-power acoustic radiating transducers, hydrophones, and specialty instruments (18).

4.1.3 Lead Sulfides

Lead sulfide (PbS) or galena is one of the most common lead minerals, appearing black and opaque. It is an efficient heat conductor and has semiconductor properties, making it desirable for use in photoelectric cells. Lead sulfide is used in ceramics, infrared radiation detectors, and ceramic glaze (18,19).

4.1.4 Lead Salts

Many lead salts are colored and, therefore, are used commercially as pigments. Basic lead carbonate ($Pb(OH)_2 \cdot 2PbCO_3$), basic lead sulfate ($Pb(SO_4) \cdot PbO$), and basic lead silicates ($3PbO \cdot SiO_2$) are well known white pigments. Basic lead carbonate is used as a component of ceramic glazes, as a curing agent with peroxides to form improved polyethylene wire insulation, as a color-changing component of temperature-sensitive inks, as a component of lubricating greases, and as a component of weighted nylon-reinforced fish nets made of polyvinylchloride (PVC) fibers (14). Basic lead sulfate helps provide efficient, long-term, economic heat stability to flexible and rigid PVC. In neat form lead sulfate can be dispersed easily, and has excellent electrical insulation properties. It is also an effective activator for azodicarbonamide blowing agents for vinyl foams (14). Basic lead silicates are used by the glass, ceramic, paint, rubber, and plastics industries. Lead monosilicate ($3PbO \cdot 3SiO_2$) is used in formulating lead-bearing glazes for the ceramics industry and as a source of PbO in the glass industry. Lead bisilicate ($PbO \cdot O \cdot O_3Al_2O_3 \cdot 1.95SiO_2$) was developed as a low solubility source of lead

in ceramic glazes for foodware. Tribasic lead silicate ($3PbO \cdot SiO_2$) is used primarily by glass and frit producers (14).

Lead chromates (e.g., $PbCrO_4$), are orange or yellow in color and, as such, are used frequently as orange and yellow pigments (15). Lead borates [$Pb(BO_2)_2H_2O$], germanates ($PbO \cdot GeO_2$), and silicates ($PbO \cdot SiO_2$) are glass-forming compounds that impart unique properties to glasses, enamels, glazes, and other ceramics. Other salts are used as stabilizers for plastics and rubbers, explosives, and in electroplating (14,15).

Section 4.2 Overview of Production and Use

Lead is obtained in one of two ways: either by primary production through mining of ores or secondary production through recycling. According to the U.S. Bureau of Mines, the 1999 domestic production of recoverable lead from lead ores was 503,000 tons, or 30 percent of the total lead produced domestically. The 1999 quantity of domestic refined lead recovered from lead scrap was 1,110,000 tons, or 66 percent of the total lead produced domestically (20). In 1999, domestic lead ore mining in the United States accounted for about 17 percent of the total amount of the world mined production of lead for that year. Australia, China, and Peru accounted for about 48 percent of the world's mined production of lead in 1999. Other major lead ore producing countries include Canada, Mexico, North Korea, Morocco, South Africa, and Sweden (20).

Most of the lead ore mined in the United States comes from Alaska and the "lead-belt" in southeast Missouri. The recoverable lead mine production from Alaska and Missouri was about 92 percent of the total lead mine production in the United States in 1999. Lead is also mined in Idaho, Montana, New York, and Tennessee. In these states, lead is recovered from lead, zinc, lead-zinc, and silver ore deposits (20). Lead ore is mined underground except when it is mined with copper ores, which are typically mined in open pits. The lead content of ores typically ranges from 3 to 8 percent, and the lead is usually in the form of a lead compound. The ores are extracted and beneficiated to produce a lead ore concentrate of 55 to 70 percent lead. Once dried, the lead-ore concentrates are shipped to primary lead smelter/refinery plants for further processing. Lead ore concentrates are processed at primary lead smelter/refinery plants to produce lead metal or alloys. Primary lead smelting generally falls into SIC code 3339. Facilities with this primary SIC code must file EPCRA section 313 reports if applicable thresholds are exceeded. In 1999, primary lead smelter/refinery plants operating in the United States produced 350,000 tons of refined lead (20).

Lead is among the most recycled nonferrous metals in the world. Secondary production (from recycled materials) has risen steadily, such that in 1999, secondary output surpassed primary output in the United States by about a factor of three. This growth reflects the favorable economic conditions associated with lead recycling and the ability of lead to retain its physical and chemical properties when recycled (21). Secondary lead smelters and refineries recover and refine metal from lead-bearing scrap materials and residues to produce lead and lead alloy ingots, lead oxide, and lead pigments. About 92 percent of recycled scrap was from lead-acid battery plates (20). Secondary lead smelting and refining generally falls into SIC code 3341. Facilities with this primary SIC code must file EPCRA section 313 reports if applicable thresholds are exceeded. In 1999, 1,680,000 tons of lead were consumed by product manufacturing sectors in the United States. Figure 4-1 shows the various manufacturing sectors consuming lead in 1999 (20).

As shown in Figure 4-1, the manufacture of storage batteries (SIC code 3691) is the major end use of lead (accounting for 88 percent of domestic lead use). About 50 percent of the total storage battery consumption is for manufacturing battery posts and grids, and 50 percent was for manufacturing lead oxides used in battery paste (20). The manufacture of ammunition and "other oxides" (SIC code 3482) are the next largest uses of lead, each accounting for about 3 percent of the total domestic lead consumption in 1999. "Other oxides" include the manufacture of pigments and chemicals, paints, glass, and ceramic products (various SIC codes; see Figure 4-1).

The manufacture of casting materials, solder, and sheet metal (various SIC codes; see Figure 4-1) each accounted for 1 to 2 percent of total lead consumption in 1999 (20). Some uses of lead experiencing increased growth over the past few years with continued growth expected are the use of lead in cathode ray tubes for television and computer screens (to protect viewer and service technicians from harmful radiation), and use of lead solder in the microelectronics industry (21).

Tables 4-5 and 4-6 provide summaries of the facilities filing EPCRA section 313 reports for lead and lead compounds, respectively, in reporting year 1998. These tables provide an indication of the type and number of facilities in various SIC codes that were required to report for lead and lead compounds at the threshold quantities of 25,000/10,000 pounds. As a result of the lead rule and corresponding 100 pound threshold for lead and lead compounds, EPA anticipates many more release reports (Form R reports) to be filed with EPA. Many of these additional reports will be filed by those entities that previously did not file release reports for lead and lead compounds because they did not exceed the 25,000 pound and 10,000 pound thresholds. Table 4-7 shows those industries for which EPA expects to receive additional or first-time release reports as a result of the lead rule.

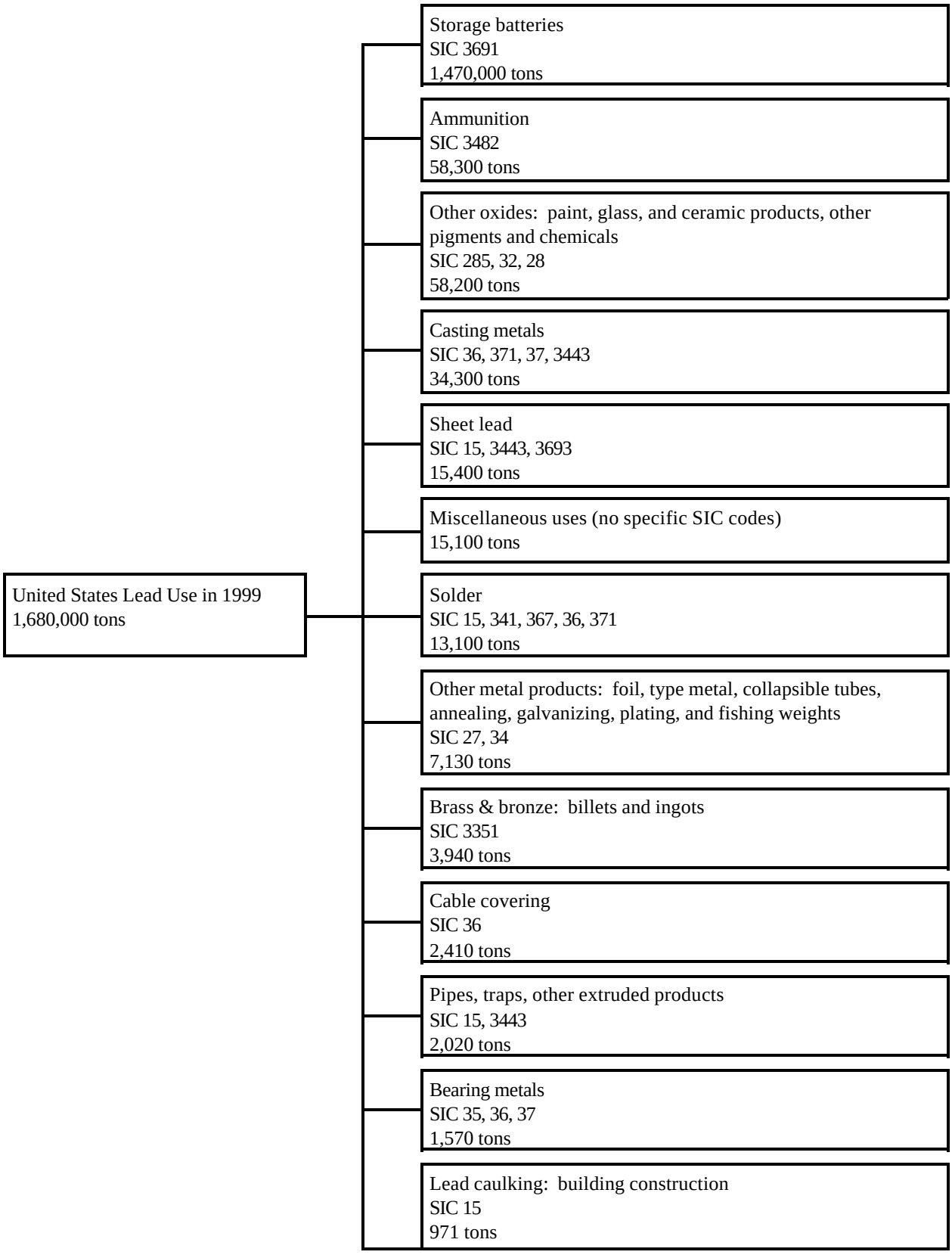

Figure 4-1. Usage of Lead in the United States in 1999

Source: Reference 20.

Table 4-5
Summary of TRI Reporting For Lead, 1998

SIC Code and Name	Number of Facilities	Number of Form R Reports	Number of Form A Reports	Section 8.1 Releases (pounds)[1]	Total Section 8 Quantities (pounds)[2]	Total Section 8 Quantities, Excluding Recycling (pounds)[3]
No SIC reported	2	2	0	39,509	53,017	39,509
10 - Metal Mining	9	8	1	444,949	446,049	444,949
12 - Coal Mining	4	0	4	--	--	--
22 - Textile Mill Products	1	1	0	0	0	0
24 - Lumber and wood products except furniture	2	1	1	3,367	3,367	3,367
25 - Furniture and fixtures	4	3	1	9,536	65,485	19,072
26 - Paper and allied products	1	1	0	--	10,334	--
28 - Chemicals and allied products	15	11	4	9,901	125,785	14,945
29 Petroleum refining and related industries	14	10	4	2,833	3,155	2,976
30 Rubber and misc plastic products	20	18	2	17,570	814,707	36,302
32 - Stone, clay, glass, and concrete products	25	23	2	67,141	6,289,243	431,669
33 - Primary metals industries	253	228	25	6,432,432	245,245,857	8,562,985
34 - Fabricated metal products, except machinery and transportation equipment	203	180	23	1,080,911	16,991,833	1,144,434
35 - Industrial and commercial machinery and computer equipment	49	42	7	5,608	802,658	10,456
36 Electronic and other electrical equipment and components, except computer equipment	96	86	10	366,858	13,610,170	428,622
37 - Transportation equipment	78	64	15	1,050,608	8,246,915	1,059,367
38 - Measuring and analyzing instruments	13	12	1	12,706	340,276	12,719
39 - Miscellaneous manufacturing industries	11	6	5	24,275	92,232	29,882
4911 - Electric services	16	14	2	367,473	367,473	367,473
4931 - Electric and other services	1	1	0	14,876	14,876	14,876
4953 - Refuse systems	23	23	0	12,645,894	14,067,649	14,036,625
5169 - Chemicals and allied products, n.e.c	4	1	3	70	70	70
5171 - Bulk petroleum	4	3	1	414	828	414
7389 - Solvent recovery services	1	1	0	0	52,364	52,364
87 - Engineering, accounting, research, management, and related services	2	2	0	21,190	322,825	31,358
92 - Justice, public order, and safety	2	2	0	98,697	144,319	103,402
97 - National security and international affairs	2	2	0	26,121	85,121	26,121
Invalid SIC code	1	1	0	--	1	--
Total	856	746	111	22,742,939	308,196,609	26,873,957

Source: Toxics Release Inventory (References 1, 22)

[1] **Section 8.1 Releases** represents the quantity of the toxic chemical released due to production related events by the facility to all environmental media both on and off site during the calendar year.

[2] **Total Section 8 Quantities** represents the sum of total waste managed (i.e., recycled on and off site, energy recovery on and off site, treated on and off site, and quantities released on and off site).

[3] **Total Section 8 Quantities, Excluding Recycling** represents the Total Section 8 Quantities minus waste quantities recycled on and off site.

Table 4-6
Summary of TRI Reporting For Lead Compounds, 1998

SIC Code and Name	Number of Facilities	Number of Form R Reports	Number of Form A Reports	Section 8.1 Releases (pounds)[1]	Total Section 8 Quantities (pounds)[2]	Total Section 8 Quantities, Excluding Recycling (pounds)[3]
No SIC reported	1	1	0	10	9,314	10
10 - Metal Mining	40	39	1	208,175,220	208,924,887	208,187,912
12 - Coal Mining	3	3	0	299,000	299,000	299,000
22 - Textile Mill Products	6	6	0	11,907	44,149	13,578
24 - Lumber and wood products except furniture	2	2	0	60	20,414	60
25 - Furniture and fixtures	3	3	0	50,300	50,300	50,300
26 - Paper and allied products	1	1	0	59	39,740	59
28 - Chemicals and allied products	136	105	31	593,389	6,180,703	2,421,039
29 Petroleum refining and related industries	27	22	5	93,736	103,972	102,879
30 Rubber and misc plastic products	87	68	19	93,817	583,578	123,553
32 - Stone, clay, glass, and concrete products	56	54	2	3,528,509	93,818,384	3,703,890
33 - Primary metals industries	259	246	16	45,873,698	306,450,807	46,582,979
34 - Fabricated metal products, except machinery and transportation equipment	48	44	4	117,340	2,196,410	148,675
35 - Industrial and commercial machinery and computer equipment	12	11	1	23,302	627,679	23,683
36 Electronic and other electrical equipment and components, except computer equipment	131	130	1	1,771,229	351,105,737	1,964,758
37 - Transportation equipment	46	42	4	103,186	2,119,311	130,018
38 - Measuring and analyzing instruments	4	4	0	315	83,227	388
39 - Miscellaneous manufacturing industries	3	3	0	540	52,543	1,144
4911 - Electric services	156	155	2	7,969,935	8,065,179	8,060,772
4931 - Electric and other services	1	1	0	21,000	21,000	21,000
4953 - Refuse systems	37	37	0	20,663,756	37,774,431	29,243,640
5169 - Chemicals and allied products, n.e.c	2	1	1	NR	NR	NR
5171 - Bulk petroleum	1	1	0	0	0	0
7389 - Solvent recovery services	1	1	0	113,050	113,050	113,050
87 - Engineering, accounting, research, management, and related services	1	1	0	23	23	23
97 - National security and international affairs	2	2	0	887	39,030	39,030
Invalid SIC code	2	2	0	98,726	101,113	98,731
Total	1,068	985	87	289,602,994	1,018,823,981	301,330,171

NR = none reported.
Source: Toxic Release Inventory (References 1, 22)

[1] **Section 8.1 Releases** represents the quantity of the toxic chemical released due to production related events by the facility to all environmental media both on and off site during the calendar year.

[2] **Total Section 8 Quantities** represents the sum of total waste managed (i.e., recycled on and off site, energy recovery on and off site, treated on and off site, and quantities released on and off site).

[3] **Total Section 8 Quantities, Excluding Recycling** represents the Total Section 8 Quantities minus waste quantities recycled on and off site.

Table 4-7
Industries Expected to Increase The Number of EPCRA Section 313 Reports Filed For Lead and Lead Compounds for Reporting Year 2001 and Beyond

SIC Code	Industry	SIC Code	Industry
20 - 39	Coal-, oil-, and wood-fired industrial sources	3334	Primary production of aluminum
1021	Copper ores	3341	Secondary smelting of nonferrous metals
1031	Lead and zinc ores	3351	Copper rolling and drawing (brass and bronze)
1041	Gold ores	3353	Aluminum sheet plate and foil
12	Coal mining	3354	Aluminum extruded products
2047	Dog and cat food	3363	Aluminum die-casting
2048	Prepared feeds, n.e.c.	3365	Aluminum foundries
2611	Pulp mills	3471	Electroplating, plating, polishing, anodizing, and coloring
2816	Inorganic pigments	3479	Galvanizing (part of SIC 3471, metal coating, engraving and allied services)
28197	Inorganic potassium and sodium compounds, n.e.c.	3482	Small arms ammunition
2821	Plastics materials, synthetic resins, and nonvulcanizable elastomers	3671	Electron tubes
2873	Nitrogeneous fertilizers, except organics	3672	Printed circuit boards
28733	Organic fertilizers	3674	Semiconductors and related devices
2874	Phosphatic fertilizers	3675	Electronic capacitors
2875	Fertilizers, mixing only	3676	Electronic resistors
2911	Petroleum refining	3677	Electronic coils and transformers
3229	Pressed and blown glassware, n.e.c.	3678	Electronic connectors
3231821	Stained glass	3679	Electronic components, n.e.c.
3241	Cement, hydraulic	3691	Storage battery manufacturing
3261	Vitreous plumbing fixtures	371	Motor vehicles and motor vehicle equipment
3312	Blast furnaces and steel mills	39312	Organ manufacturing
3313	Electrometallurgical products (ferroalloys)	4911	Electric services (coal and oil facilities only)
3315	Steel wiredrawing and steel nails and spikes	4931	Electric and other services (coal and oil facilities only)
3321	Gray/ductile iron foundries	4939	Combination utilities (coal and oil facilities only)
3322	Malleable iron foundries	4953	Refuse systems
3324	Steel investment foundries	5171	Bulk petroleum
3325	Steel foundries, n.e.c.	7389	Solvent recovery services

Source: Reference 1

Section 4.3 Lead in Raw Materials

Raw materials involved in activities at a wide variety of facilities may contain metallic lead or lead compounds. Lead is present as a trace constituent in many metal ores, including zinc, copper,

gold, silver, and molybdenum ores. Lead is also a trace constituent in fuels such as coal, oil, or wood that is processed or otherwise used by many facilities. Because lead is present as a trace constituent in crude oil, it can also be found in many products derived from oil such as heating oils and gasolines. Table 4-8 lists some typical concentrations of lead in these types of raw materials and the corresponding quantity of material needed to meet the 100 pound threshold. Note that lead concentrations in metal ores vary from mine to mine and in oil-based products by the source of the crude oil and the specific manufacturer of the products. Note also that Table 4-8 is not comprehensive - lead and lead compounds may be contained in many other raw materials for many other processes.

Facilities should use the best readily available information that is applicable to their operations. For purposes of TRI reporting, the lead concentration in the raw materials used at a particular site should be used in threshold and release and other waste management calculations when such concentrations are known, rather than the common lead concentrations shown in Table 4-8. In the absence of site-specific information, EPA recommends that you contact your supplier or an applicable trade association to determine whether lead concentration data is available for the raw materials you use. In the absence of such data, EPCRA section 313 allows a reporting facility to make a reasonable estimate (42 U.S.C. Š 11023(g)(2)).

Table 4-8
Typical Concentration of Lead In Raw Materials and Quantity Required to Meet the 100 Pound Reporting Threshold

Raw Material	Concentration Lead (ppmw)	Reference[1]	Quantity Needed to Meet the 100 pound (lb) Lead Threshold
Copper ores	11,000	3	9,090 lbs
Lead and zinc ores	24,000	3	4,170 lbs
Gold ores	6.60	3	1.52×10^7 lbs
Bituminous coal[2]	3 to 111	23	3.33×10^7 to 9.01×10^5 lbs
Subbituminous coal[2]	2.07 to 31	23	4.83×10^7 to 3.23×10^6 lbs
Lignite coal[2]	3.73 to 9.8	23	2.68×10^7 to 1.02×10^7 lbs
Wood	20	4	5.00×10^6 lbs
Crude oil	0.31	3	4.30×10^7 gallons[4]
No. 2 fuel oil[3]	0.50	3	2.82×10^7 gallons[4]
No. 6 fuel oil[3]	1	3	1.27×10^7 gallons[4]
Gasoline	0.079	3	2.10×10^8 gallons[4]
Aviation gas	1,750	3	9.25×10^3 gallons[4]
JP-4	<3	24	$>5.12 \times 10^6$ gallons[4]
Natural gas	<0.05 mg/m^3	25	$>9.08 \times 10^8$ m^3

[1]Numbers correspond to the references listed in Section 6.0.

[2]These ranges were obtained from the EPCRA Section 313 Industry Guidance for Electric Generating Facilities (http://www.epa.gov/tri/guid_docs) which should be consulted to obtain the appropriate concentration for a particular coal type from a particular state.

[3]Constituents are most likely metal compounds rather than elemental lead. Lead is listed in this table because concentration data are for only the metal occurring in the fuel. Concentrations for metal compounds would be somewhat higher depending on the metal compound.

[4]Assumes the following densities: Crude Oil - 7.5 lb/gallon; No. 2 Fuel Oil - 7.1 lb/gallon; No. 6 Fuel Oil - 7.9 lb/gallon; Gasoline - 6.0 lb/gallon; Aviation Gas - 6.2 lb/gallon; JP-4 - 6.5 lb/gallon.

Coal and oil are common fuel sources at many facilities covered under EPCRA section 313, and are used especially for electric power generation. Section 4.5 discusses combustion of lead-containing fuels in more detail. Oil feedstocks (including No. 2 fuel oil and No. 6 fuel oil) are processed through carbon black production facilities and petroleum bulk stations and terminals.

Section 4.4 Recovery, Recycle, and Reuse of Lead and Lead Compounds

The manufacture and subsequent processing of lead may result from a facility's lead recovery activities. A facility may recover lead from batteries, dismantled equipment, or from scrap and industrial wastes using a thermal or chemical extractive process. Major sources of recycled or recovered lead include scrap batteries and wastes and sludges from electrolytic refining plants. Secondary smelting operations recover lead for reuse or sale. For EPCRA section 313 reporting, it is important to note that the process of melting metals releases metals to the environment and that EPA has not yet promulgated regulations defining waste management activities such as recycling. The following paragraphs provide some guidance on these topics.

Melting of a metal can cause it to be released into the environment. When in a molten state the most common forms in which the metal can be released are vapors and particulates from handling and heating raw materials, and refining operations. Lead and lead compounds may be present in a raw material, and may be found in fumes and dust that evolve from heating and refining operations that involve the raw material. EPA does not have a regulatory definition of a fume or a dust, but considers dusts, for the purposes of reporting, 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 the gaseous state, in distinction to a gas or vapor. Fume arises from the heating of solids. The condensation is often accompanied by a chemical reaction, such as oxidation. Fumes flocculate and coalesce. [Q&A 302 in Reference 1 provides more detail on fumes and vapors.]

In the past, there has been some difficulty in determining the difference between recycling and reuse. According to EPA's document *Interpretations of Waste Management Activities: Recycling, Combustion for Energy Recovery, Treatment for Destruction, Waste Stabilization and Release (August 1999)*, recycling is defined as: (1) the recovery for reuse of a toxic chemical from a gaseous, aerosol, aqueous, liquid, or solid stream; or (2) the reuse, or the recovery for reuse of a toxic chemical that is a RCRA hazardous waste or is a constituent of a RCRA hazardous waste as defined in 40 CFR 261. EPA considers the direct recirculation of a toxic chemical within a process or between processes without any reclamation to be "reuse" of the toxic chemical rather than recycling. The direct use, direct further use, or direct reuse of the toxic chemical is not recycling provided that there is no reclamation of the chemical prior to that continued use or reuse (26).

Pursuant to the Pollution Prevention Act (PPA) of 1990, facilities must report the quantities of toxic chemicals released, treated for destruction, combusted for energy recovery and recycled (42 U.S.C. Š 13106(b)). EPA has not yet promulgated regulations defining these waste management activities. EPA considers toxic chemicals "recycled" when the toxic chemicals are recovered for reuse. If toxic chemicals are directly reused, without any intervening reclamation or recovery steps, the toxic

chemicals are not considered recycled for Form R reporting purposes. That is, direct reuse is not a reportable activity. Reclamation or recovery would not include simple phase changing of the toxic chemical before further reuse (e.g., simple remelting of scrap metal). A reclamation and recovery step, however, would include changing the relative amounts of the chemicals in an alloy. A recovery step would include removing toxic chemicals from a pollution control device or removing contaminants from the toxic chemical after it has been used and can no longer be used for its intended purpose. Accordingly, if the scrap metal is not mixed with other scrap and can be remelted and directly reused, without any recovery steps, then the toxic chemicals in the scrap metal are being directly reused. Facilities should use their best available information in determining if the scrap sent off site is being directly reused or, instead, is recycled because of an intervening reclamation or recovery step prior to reuse.[10] In the absence of such readily available data, EPCRA section 313 permits a reporting facility to make a reasonable estimate. For documentation requirements facilities should refer to 40 CFR section 372.10, which addresses the EPCRA section 313 recordkeeping requirements.

Section 4.5 Combustion of Fuels Containing Lead

As mentioned in Chapter 2, section 2.1.1 of this document, fuels (e.g., coal or oil) contain trace quantities of some EPCRA section 313 chemicals, including lead and lead compounds, as impurities. All EPCRA section 313 chemicals contained in fuels combusted for energy production are considered otherwise used (40 CFR Š 372.3). Thus, the amount of lead and lead compounds present in the fuel must be included in the otherwise use threshold. Lead may be present in the fuel either in its elemental form [i.e., lead metal (Pb^0)] or as a lead compound. In the absence of any other data, EPA recommends assuming elemental lead (Pb^0) is present in the fuel.

Additionally, during combustion processes it is expected that lead is converted to various lead compounds (e.g., lead oxides). EPA considers this to be "coincidental manufacture" of lead compounds. Therefore, the amount of lead compounds generated from fuel combustion must be applied to the 100 pound manufacturing threshold (40 CFR 372.3). Recall that lead and lead compounds are separately listed substances, and threshold calculations should be made for them separately. Unless facilities have information to indicate otherwise, EPA recommends they assume that they manufacture lead monoxide (PbO) during combustion, and that 100% of the lead portion of the lead or lead compounds in the fuel is converted to PbO (e.g., the lowest molecular weight lead oxide). The amount of metal compound manufactured is determined by the total weight of the compound, not the parent metal (40 CFR Š 372.25(h)). To summarize the EPCRA considerations for lead and lead compounds when combusting fuels, if you burn fuels (e.g., coal or oil) on site you must consider, for purposes of complying with section 313 of EPCRA: 1) the otherwise use of the lead present in the fuel; and 2) the manufacture of any lead compound(s) that are formed from the combustion. These considerations are illustrated in the example on combusting fuels in section 2.1.1 of Chapter 2.

[10] Memorandum dated June 21, 2001 from John Dombrowski, US EPA, Toxics Release Inventory Program Division, Washington DC, to Mr. Stephen J. Axtell of Thompson Hine & Flory, LLP, Dayton, Ohio.

CHAPTER 5
RELEASE AND OTHER WASTE MANAGEMENT CALCULATIONS

The release and other waste management calculations provided in this section demonstrate some available techniques you can use to calculate your facility's releases and other waste management quantities of lead and the lead portion of lead compounds. You should determine the best information available for your operation and decide which calculation method works best for you.

Section 5.1 Lead and Lead Compound Air Emissions

In lieu of actual test data, the use of process-specific air emission factors is the most common way to estimate the amount of lead released to air. If your process uses an air pollution control device, you can use its capture and control efficiency to determine the quantity of point source emissions. Depending on the type of device, the controlled lead air emissions may become part of a wastewater stream (e.g., lead collected in scrubber wastewater) or baghouse dust. Sources of air emission factors include U.S. EPA's Compilation of Air Emission Factors, AP-42 (27) and Factor Information Retrieval (FIRE) Data System (28), the California Air Resources Board's Air Toxics Database (29), and chemical- and industry-specific factors determined by trade associations, and other factors published in the literature. In your consideration of air emissions, keep in mind the activity use exemption (40 CFR 372.38(c)) that makes an allowance for chemicals contained in intake air.

One example of industry-specific air emission factors determined by a trade association can be found in the *Ferrous Foundry Air Emissions Study - Final Report* (30). This report describes the development of an industry-specific database that can be downloaded from the Internet to assist facilities in estimating air emissions of Hazardous Air Pollutants, many of which are reportable as EPCRA section 313 chemicals or chemical categories. As always, for purposes of TRI reporting, if you have other means of estimating air emissions that are more applicable to your operations, they should be used in place of generally-available air emission factors.

In May 1998, the U.S. EPA Office of Air Quality Planning and Standards published *Locating and Estimating Air Emissions From Lead and Lead Compounds* (EPA-454/R-98-006) (2). This document (referred to as the L&E document below) identifies most of the major industrial process sources of lead air emissions (for all processes listed in Table 5-1), and provides descriptions of these processes and the associated lead emission factors. Facilities that must report lead air emissions under the TRI Program are encouraged to use the L&E document. This document is similar to the Compilation of Air Emission Factors (AP-42) but focuses only on lead air emissions.

Emission factors discussed in AP-42 and the L&E document are also contained in U.S. EPA's FIRE Data System (28). The FIRE Data System is a database of EPA-developed emission factors; it lists only the emission factors whereas the Compilation of Air Emission Factors (AP-42) and the L&E document provide written descriptions of the processes for which each emission factor was developed, in addition to presenting the emission factors. To prepare this TRI guidance document, the FIRE Data System was searched and all emission factors for lead were extracted. These emission factors are shown in Appendix C. Readers already familiar with the use of emission factors may find the factors

they need in Appendix C, while readers not as familiar with emission factors should consult AP-42 and/or the L&E document (rather than Appendix C alone) to read the process descriptions and basis of each emission factor. Appendix C also contains lead emission factors contained in the California Air Resources Board's Air Toxics Database (29). Note that EPA periodically updates AP-42 and the FIRE Data System as additional data become available. You should refer to EPA's Internet site for the Clearinghouse for Inventories and Emission Factors (CHIEF) for updates to these documents and development of new air emission source materials (http://www.epa.gov/ttn/chief).

The following example shows how to calculate lead air emissions using an emission factor.

Example - Point Source Emission Estimate Using an Emission Factor

Your facility uses 100 million gallons of No. 6 fuel oil to generate electricity during the reporting year. You have determined that you exceeded the 100 pound reporting threshold for lead and must calculate all releases and other waste management activity quantities.

After evaluating your options, you decide to use a FIRE Data System emission factor for your calculation for uncontrolled lead air emissions from your boiler (0.00151 lb lead/1,000 gal No. 6 fuel oil).

Amount of lead air emissions:

100,000,000 gal No. 6 fuel oil/yr × (0.00151 lb lead emitted/1,000 gal No. 6 fuel oil) = 151 lb lead emitted/yr

If you do not have any controls on the boiler, you should report this amount in Part II, Sections 5.2 (Stack or Point Air Emissions) and 8.1 (Quantity Released) of the Form R. If you have emissions controls on your boiler, the amount controlled (if known) should be subtracted from this amount and reported as appropriate depending on the ultimate disposition of the collected waste material. Note that emissions control activities should be reflected in Section 7A of the Form R.

Fuel combustion activities and other heated processes that process or otherwise use lead can generate lead or lead compound emissions. Emissions of lead originate from lead or lead compounds contained in fuels and are emitted during combustion. The lead or lead compounds contained in fuels, and quantities coincidentally manufactured, must be applied toward threshold calculations, and any emissions of lead resulting from combustion of fuels must be included in the release report. During combustion, metals such as lead only change physical state or are converted into a metal compound of the same metal. The metal itself (or metal portion of a metal compound) is never destroyed during combustion. Thus, the amount of lead in the original fuel or waste will be equal to the amount of lead found in the ash and/or emitted in the effluent gas. The type of air emissions control device(s) used at your facility may govern the final destination of the controlled lead (e.g., dust in a baghouse or part of scrubber wastewater).

Table 5-1
Sources of Lead Emissions

Facility/Process Type	Operation Sources of Lead Emissions
Primary and secondary lead smelting	All unit operations
Primary and secondary copper production	Most heated and ore-handling unit operations
Primary zinc smelting	Sintering
Secondary aluminum operations	All unit operations
Coke production	Coal preparation and handling, Fugitive emissions from oven
Iron and steel foundries	Most heated and casting unit operations
Ore mining, crushing, and grinding	Drilling, blasting, loading, conveying, screening, unloading, crushing, and grinding operations
Brass and bronze manufacturing	Most heated unit operations
Combustion of coal, natural gas, oil, or wood	Boiler exhaust gas and bottom and fly ash handling
Municipal waste, industrial, sewage sludge, medical waste, and hazardous waste incinerators	Exhaust stack and bottom and fly ash handling
Other forms of incineration: drum and barrel reclamation, scrap tire incineration and open burning of scrap tires, and crematories	Exhaust stack and bottom and fly ash handling
Pulp and paper industry	Chemical recovery unit operations
Portland cement manufacturing	Raw material handling and kiln exhaust gases
Pressed and blown glass	Raw material blending and transport, melting, and forming and finishing
Lead-acid battery production	Grid casting, lead reclamation, slitting, small parts casting, and three-process operation
Lead oxides in pigments	Exhaust gas
Lead cable coating	Melting kettle
Frit manufacturing	Frit smelting operation
Ceramics and glazes	Glaze firing and spraying phases
Miscellaneous lead products: ammunition, type metal, bearing metals, pipe and sheet lead, and abrasive grain manufacturers	Heated unit operations and dust-handling operations
Solder manufacturing	Lead melting and solder paste production
Electroplating (including printed circuit boards)	Plating process
Stabilizers in resins	Materials (powder) handling
Asphalt concrete (hot mix asphalt)	Drying process (combustion)
Application of paints	Spraying, brushing, dipping, blending, drying, curing
Shooting ranges and explosive ordnance disposal sites	Firing of small arms ammunition with lead projectiles and/or lead primers
Rubber products	Material handling
Fuel production	While being phased out, some fuels still contain lead

Source: U.S. EPA. *Locating and Estimating Air Emissions from Sources of Lead and Lead Compounds.* EPA-454/R-98-006. Office of Air Quality Planning and Standards (OAQPS). May 1998.

U.S. EPA's FIRE Data System (28) includes emission factors for fuel oil and wood combustion. Lead emissions from distillate fuel oil combustion can be calculated using an emission factor of 8.9 lb/10^{12} BTU (uncontrolled). The average lead emission factor from No. 6 fuel oil combustion is 0.00151 lb/1,000 gal (uncontrolled). Lead emission factors for wood combustion operations include: 0.0029 lb/ton (uncontrolled); 0.00032 lb/ton (using a mechanical collector as the control device); 0.00035 lb/ton (using a wet scrubber as the control device); and 0.000016 lb/ton (using an electrostatic precipitator as the control device). After determining the quantity of lead released to the air, facilities must also determine the quantity of lead in the bottom ash and collected by the control device (see Section 5.3 for an example).

A mass balance calculation using the total amount of lead in the fuel may be used to determine these quantities if you do not have site-specific data. The release, including disposal, of lead in bottom ash or from the control device (e.g., effluent from a wet scrubber) must be reported on the Form R. The following example shows how you can use Table 4-8 and Appendix C to estimate lead emissions from coal combustion.

Example - Fugitive Emission Estimate Using a Mass Balance

Your facility manufactures a lead-containing product. Based on purchase and import records, the amount of lead brought on-site totals 200,000 pounds per year. The amount of lead in the final product is calculated to be 198,500 pounds per year.

Your facility wastewater from washdowns, tank cleanings, and scrubber operations is discharged to a POTW. You monitor the wastewater to comply with the POTW pretreatment permit. The concentration of lead in the water is 34.0 mg/L. The volume of water discharged to the POTW during the reporting year is 250,000 gallons.

The amount of lead discharged to the POTW is calculated below:

(34.0 mg/L lead) × (250,000 gal water) × (3.785 L/gal) × (1 lb/453,592 mg) = 70.9 lb lead

This quantity should be reported in Part II, Section 6.1 (Discharges to POTWs) and Section 8.1 (Quantity released) of the Form R.

No solid waste sources of lead were identified at your facility, therefore, you assume the remaining quantity of lead is released as fugitive emissions. The lead fugitive emissions are calculated using the following mass balance:

$[200{,}000\ \text{lb}]_{in} = [198{,}500\ \text{lb} + 70.9\ \text{lb} + \text{fugitive emissions lb}]_{out}$

Fugitive lead emissions = [200,000-198,500-70.9] lbs = 1,429.1 lb/yr

This quantity should be reported in Part II, Section 5.1 (Fugitive or non-point air emissions) and Section 8.1 (Quantity released) of the Form R. Note that the data precision discussion in Section 1.4.4 states that lead releases should be reported to one-tenth of a pound. In this example, 1,429.1 or 1,429 or 1,430 pounds could all be reported based on the precision of the data available for this calculation.

Lead emissions may also be calculated using monitoring data. For instance, your facility might continuously monitor stack emissions, or data might be available from short-term testing performed at the facility. Engineering calculations, for example Raoult's law, may also be used for calculations.

Mass balances are not typically used to calculate emissions, but can be used if all other quantities (e.g., lead in the final product, released with wastewater, disposed with solid waste) are known, as demonstrated in the above example.

While the preceding discussion focused on the use of emission factors to calculate estimates of air emissions, emission factors may not be available for all processes. Emission factors are generally available for large industrial processes subject to air emission standards. The following example illustrates another way to calculate air emissions using industrial hygiene data.

Example - Point Source Emission Estimate Using Industrial Hygiene Data

Your electronic component manufacturing facility applies well over 200 pounds of a 50:50 lead-tin solder to your product and you have determined that you exceeded the 100 pound reporting threshold for processing lead. You must now calculate all releases and other waste management activity quantities (which likely includes air, water, and solid waste releases but this example discusses only air emissions). While you do not have an emission factor available to you for the release of lead from your operation, you have worker exposure data. The OSHA Permissible Exposure Limit (PEL) for lead is 0.05 mg/m^3 on an 8-hour time-weighted average (TWA) basis, and you know from testing performed at your facility that the workers performing the soldering were exposed to lead at a concentration of no more than 0.025 mg/m^3 (TWA basis). From this value, your number of soldering work stations (assume 5 separate work stations for this example), your soldering room ventilation rate (assume an air flow of 28.3 m^3/min [1,000 ft^3/min] through a dedicated but uncontrolled exhaust system at each work station for this example) and your soldering process hours of operation (assume 24 hours/day, 7 days/week, and 50 weeks/year for this example), your lead emissions from this soldering process can be calculated.

Time of operation: 60 minutes/hour × 24 hours/day × 7 days/week × 50 weeks/year = 504,000 minutes/year

Amount of lead air emissions:

0.025 mg lead/m^3 air × 28.3 m^3 air/min × 504,000 min/year × 1 gram/1,000 mg × 1 lb/454 grams × 5 work stations = 3.9 lb lead emitted/yr

You should report this amount in Part II, Sections 5.2 (Stack or Point Air Emissions) and 8.1 (Quantity Released) of the Form R.

Note: A study by the School of Public Health at the University of Illinois (available from the NIOSH web site via a search at http://outside.cdc.gov/BASIS/niotic/public/tic/SF) measured an average of 86 mg/hour for uncontrolled lead emissions from three wave soldering lines. Using the other data provided in the example above (i.e., the same hours of operation and 5 work stations or "lines"), 8.0 lbs/yr of lead would be emitted.

Section 5.2 Lead in Wastewater

Wastewater sources of lead include process wastewater, and area washdowns and tank clean outs from processes in which lead or lead compounds are manufactured, processed, or otherwise used. If a wet air pollution control device (e.g., scrubber) is used in a process generating lead emissions, lead can be transferred from the air stream to the water stream. This wastewater may be treated on site, discharged to surface water or a POTW, or transferred off site for other waste management activities. In addition to the sources listed above, spills and one-time events may also generate a lead-containing wastewater stream. In your consideration of water releases, keep in mind the otherwise use exemption (40 CFR 372.38(c)) that makes an allowance for chemicals contained in intake water.

If your facility discharges to surface water, you most likely have a NPDES or state discharge permit. This permit may require you to monitor for lead. You can use this information to calculate the amount of lead discharged to surface water. Discharges to POTWs may also require lead monitoring. Table 5-2 shows the industries required to monitor their effluents for lead due to EPA effluent limitations guidelines for lead (31). Monitoring data that are collected to comply with permits or effluent limitations guidelines may be useful for estimating water discharges. Alternatively, if you have not conducted monitoring but a regulatory limit for lead discharges exists, it may be appropriate to use the regulatory limit as a reasonable "worst-case" scenario to estimate your yearly discharges of lead.

Table 5-2
Industries With Effluent Limitations For Lead

The Regulations Are Described at 40 CFR Part	Point Source Category
415	Inorganic Chemicals Manufacturing
420	Iron and Steel
421	Non-Ferrous Metals Manufacturing
426	Glass Manufacturing
428	Rubber Manufacturing
437	Centralized Waste Treatment
440	Ore Mining and Dressing
442	Transportation Equipment Cleaning
444	Waste Combustors
461	Battery Manufacturing
464	Metal Molding and Casting
466	Porcelain Enameling
468	Copper Forming
471	Non-Ferrous Metals Forming and Metal Powders

The example below shows an approach to calculating lead discharges using monitoring information.

Example - Lead Discharged to a POTW Using Monitoring Information

Your facility exceeds a lead reporting threshold. Additionally, you are required to perform monitoring for wastewater that is discharged to your local POTW for certain chemicals, including lead, two times each year. The results of the monitoring were:

April 4: 2.0 ppm lead (representative of the 6-month period for January through June)
October 5: 2.4 ppm lead (representative of the 6-month period for July through December)

For the reporting year, the following water volumes were discharged to the POTW:

January through March: 425,000 gal
April through June: 555,000 gal
July through September: 345,000 gal
October through December: 390,000 gal

First, convert the water flows to pounds, using the standard density for water of 8.345 lb/gal:
425,000 gal × (8.345 lb/gal) = 3,546,625 lb for January through March
555,000 gal × (8.345 lb/gal) = 4,631,475 lb for April through June
345,000 gal × (8.345 lb/gal) = 2,879,025 lb for July through September
390,000 gal × (8.345 lb/gal) = 3,254,550 lb for October through December

Using the appropriate lead concentrations measured during the monitoring periods, the amount of lead discharged to the POTW is:

$$[(2 \text{ lb lead} / 1\times 10^6 \text{ lb water}) \times (3{,}546{,}625 + 4{,}631{,}475) \text{ lb water}]_{\text{Jan - June}} +$$

$$[(2.4 \text{ lb lead} / 1 \times 10^6 \text{ lb water}) \times (2{,}879{,}025 + 3{,}254{,}550) \text{ lb water}]_{\text{Jul - Dec}}$$

$$= 31.1 \text{ lb/yr lead}$$

This quantity should be reported in Part II, Section 6.1 (Discharge to POTW) and included in Part II, Section 8.1 (Quantity Released) of the Form R. Note that the data precision discussion in Section 1.4.4 states that lead releases should be reported to one-tenth of a pound. In this example, 31.1 or 31 lbs/yr could be reported based on the precision of the data available for this calculation.

Mass balances and engineering calculations can also be used to determine the amount of lead in the wastewater. If your facility treats wastewater on site, you may need to perform engineering calculations to determine how much lead becomes part of the waste sludge and how much is discharged. In this case, Part II, Section 7 (on-site treatment, energy recovery, and recycling) of the Form R should be completed as appropriate.

Section 5.3 Lead Solid Waste Calculations

Solid wastes that contain lead and lead compounds include dust or solid raw materials spilled during transfer or process operations. Lead contained in a solution, such as petroleum products, may also be splashed or spilled on the ground and, after evaporation or if cleaned with absorbent materials, may result in solid waste generation. Other solid waste sources include sludge from on-site treatment, spent bags or filters from air pollution control devices, and ash from combustion operations. Solid material spills and ash may also contribute to fugitive emissions of particulate matter. The amount of lead in solids is commonly calculated using mass balances from records (such as spill reports and hazardous waste manifests). Monitoring data on sludge may be available, but as mentioned in the previous wastewater section, engineering calculations can be performed to determine the lead content in the sludge.

Facility-specific information, such as waste analyses and process knowledge, can be used to estimate amounts of lead in combustion wastes. In the absence of site-specific data, facilities can use the default values for concentrations of lead in ash presented in Table 5-3.

Table 5-3
Lead Concentration in Ash Combustion Residuals

Combustion Residual	Concentration (ppm)	Reference[1]
Coal Fly Ash	2,120	32
Coal Bottom Ash	1,082	32
Oil Ash	100,000	32

[1]Number corresponds to the references listed in the reference section at the end of this document.

If your facility produces lead-containing wastes, you can use a mass balance to determine the quantity of lead released or otherwise managed as waste. Using facility concentrations, or literature concentrations if facility-specific concentrations are not available, you can determine the quantity of lead processed at your facility from the amount in the raw material. From process and engineering knowledge, the destination of the lead releases and other waste management activity quantities can be determined.

The mass balance approach can also be applied to a combustion process where, after determining the quantity of lead released to the air, facilities must also determine the quantity of lead in the bottom ash and collected by the control device(s). A mass balance calculation using the total amount of lead in the fuel may be used to determine these quantities if you do not have site-specific data. The release or waste management of lead in bottom ash or from the control device(s) (e.g., effluent from a wet scrubber) must be reported on the Form R. The following example shows how you can use Table 4-8 and Appendix C to estimate lead emissions from coal combustion.

Example - Lead Release and Other Waste Management Calculations from Coal Combustion

Your facility combusts lignite coal in a boiler with a Source Classification Code #10300305, and you have installed an electrostatic precipitator as the air pollution control device for this boiler. You fed 0.5 million tons of lignite coal into the boiler during the reporting year and collected 1.0 million pounds of bottom ash for disposal (note that this example assumes lead is released only to air through a stack, to bottom ash, or to ESP dust whereas other releases such as to wastewater may occur at your site). The task is to determine if a threshold has been exceeded and to estimate the reportable amounts of lead for the applicable sections of the Form R. Assuming you do not have site-specific test data, it may be appropriate to use default values from Table 4-8 to determine the amount of lead in the coal and Table 5-3 to estimate the amount of lead in the bottom ash, and an emission factor from Appendix C to estimate air releases.

Threshold Determination:
First, you must determine if you exceed a threshold for lead or lead compounds. Any TRI chemical or chemical compounds that are present in fuel are considered to be otherwise used. Table 4-8 lists the average lead concentration in lignite coal as 7 ppm. Therefore:

$$(0.5 \times 10^6 \text{ tons coal}) \times (2{,}000 \text{ lb/ton}) \times (7 \text{ lb lead}/ 1 \times 10^6 \text{ lb coal}) = 7{,}000 \text{ lb lead}$$

This is the amount of elemental lead in the coal. The mass of lead in the coal exceeds 100 lbs; therefore, your facility exceeds the otherwise use reporting threshold for lead and you must file a Form R.

Stack Air Release:
EPA's FIRE system contains an emission factor for lead from combustion of lignite coal in a boiler with SCC #10300305 and an ESP (Appendix C): 4.2×10^{-4} pounds of lead are emitted per ton lignite coal burned.

$(0.5 \times 10^{6}$ tons coal) × $(4.2 \times 10^{-4}$ lb of lead/ton coal) = 210 lb lead

This quantity should be reported in Part II, Section 5.2 (Stack or Point Air Emissions) and included in Section 8.1 (Quantity Released) of the Form R.

Quantities Otherwise Managed As Waste:
The lead that is not emitted is either collected in the ESP dust, or contained in bottom ash. You should estimate the amount of lead to each of these waste streams and report the quantities in the applicable sections of the Form R. At your site, you may also collect some or all of these wastes for on-site recycle (Part II Sections 7C and 8.4), or you may transfer them off site (in which case Part II, Section 6.2 and applicable sections of Part II, Section 8 should be completed). Additionally, since the flue gases have been sent through an on-site air pollution control system, Sections 7A and 8.6 (Quantity Treated On Site) should be completed as appropriate.

Based on the default concentration listed in Table 5-3 (1,082 ppm), the quantity of lead in the bottom ash is:
$(1.0 \times 10^{6}$ lb bottom ash) × (1,082 lb lead/1×10^{6} pound bottom ash) = 1,082 lb lead

A mass balance around the boiler can now be used to estimate the amount of lead collected in the ESP dust:
(lead in coal) = (lead released to air) + (lead in bottom ash) + (lead in control devices)
(7,000 lb lead in coal) - (210 lb to air) - (1,082 lb in bottom ash) = 5,708 lb lead is ESP dust

CHAPTER 6
REFERENCES

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APPENDIX A

Additional Information About Stainless Steel, Brass, and Bronze Alloys

The discussions below were excerpted from the EPA document "Report on the Corrosion of Certain Alloys" [EPA report # EPA-260-R-01-002 (July 2001)], which was made available to the public in July, 2001. The interested reader should consult this report for additional and more detailed discussions on alloys, and references pertaining to alloys.

Stainless Steel Alloys

Identification of Stainless Steel Alloys

Stainless steels produced in the United States can be identified in three general ways: (1) by the Unified Numbering System (UNS) numbers developed by the American Society for Testing and Materials (ASTM) and the Society of Automotive Engineers (SAE) for all commercial metals and alloys; (2) by the American Iron and Steel Institute (AISI) numbering system; and (3) by the names based on compositional abbreviations, proprietary designations, and trademarks. The UNS number comprises six symbols (i.e., a letter followed by five numbers) that are difficult to recognize instantly and memorize for the 180 stainless steels. Therefore, technical journals allow each alloy to be initially identified by the lengthy UNS number and then subsequently the better-known AISI or another designation may be used. The AISI number designates the wrought standard grades of stainless steels by three-digit numbers. Three groups of wrought stainless steels, series 200, 300, and 400, have composition limits standardized by the AISI. Steels in the AISI 400 series contain a minimum of 11.5% chromium and usually not more than 2.5% of any other alloying element. Steels in the AISI 300 series contain a minimum of 16% chromium and 6% nickel; the relative amounts of these elements are balanced to give an austenitic structure. Austenitic structures have face-centered cubic lattices, while ferritic structures have body-centered cubic lattices and martensitic structures have body-centered tetragonal or cubic lattices. Stainless steels containing both austenite and ferrite, usually in roughly equal amounts, are known as duplex. Duplex stainless steels, precipitation-hardening stainless steels, and higher alloys containing less than 50% iron (Fe) do not have AISI designations and are generally known by names based on compositional abbreviations and trademarks, as well as UNS numbers.

The many grades of stainless steel are due to the crystal structure of the iron-rich matrix. The austenite field in iron exists over an increasingly small temperature range as chromium is added, and disappears at about 12% chromium. To make the martensitic grades, it is important to be able to form 100% austenite first. Fortunately carbon extends the austenite range so it is possible to have all austenite prior to quenching in a 12% chromium carbon steel, or if the carbon content is high enough, even in a 17% chromium steel. Adding several percent of nickel to an iron-chromium alloy can allow austenite to exist as metastable or stable forms down to ambient temperature. A body-centered cubic phase, or sometimes a hexagonal close-packed phase, can then form martensitically, and can give very high strengths to the stainless steel. For the ferrite grades, it is necessary to have at least 12% chromium and only very small amounts of elements that stabilize austenite. For these materials, the structure is body-centered cubic from room temperature to the melting point. Some elements, such as molybdenum, niobium, titanium, and aluminum, which encourage the body-centered cubic structure, may also be in these steels.

Compositions of some stainless steels are listed in the following table, Table A-1.

Table A-1

Typical Composition of some Stainless Steels, wt%

(Sulfur (S) and Phosphorus (P) are held below 0.03 and 0.04% max, respectively, balance is Fe)

AISI #	C	Mn	Si	Cr	Ni	Mo	N	Ti	Nb
201	0.15	6.50	0.75	17.0	4.50		0.20		
202	0.15	8.75	0.75	18.0	5.00		0.20		
205	0.12	15.0	0.50	17.0	1.75		0.35		
304	0.06	1.50	0.75	19.0	10.0				
309	0.16	1.50	0.75	23.0	13.5				
310	0.20	1.50	1.00	25.0	20.5				
316	0.06	1.50	0.75	17.0	12.0	2.50			
321	0.06	1.50	0.75	18.0	10.5			0.50	
330	0.08	2.00	1.00	18.0	35.0				
347	0.06	1.50	0.75	18.0	11.0				1.00
410	0.12	0.75	0.75	12.5					
430	0.10	0.75	0.50	16.0	0.30				
446	0.30	1.00	0.75	25.0			0.20		

Classes of Stainless Steel Alloys

There are four major classes of stainless steel: 1) austenitic; 2) martensitic; 3) ferritic; and 4) age-hardened or precipitation-hardening steels. A brief description of each is provided below.

1) ***Austenitic stainless steels***, these are essentially non-magnetic and cannot be hardened by heat treatment. They are hardenable only by cold-working. As a group, these stainless steels have greater corrosion resistance than the other three groups. At the same time there is a wide range in the corrosion resistance among the austenitic types. Most of these steels contain nickel as the principal austenite former, and some contain substantial amounts, 2-4%, of manganese and less nickel. These steels possess better corrosion resistance than the straight chromium steels. Chromium content is generally between 16-26%, with the nickel content generally between 4-22%. The 300 series represents by far the largest category of stainless steels produced in the United States. For the sake of discussion, the austenitic alloys can be divided into four subclasses.

Class A: AISI types 301, 302, 303, 304, 304L, 304N, 321, 347, and 348 are all contained within class A. Each of the types in this group can be considered an 18-8 stainless steel (i.e., 18% chromium content and 8% nickel content). Within this class, there is no great difference in the general corrosion resistance of the individual types. Those that have a higher alloy content are slightly more corrosion resistant than those with a lower alloy content. Types 321, 347, and 348 are carbide stabilized with titanium and/or niobium. Although their general corrosion resistance may be no higher than types 302 or 304, they are essentially immune to sensitization and the possible attendant intergranular corrosion under specific conditions.

Class B: Only types 305 and 384 are contained within class B. These have relatively high nickel contents (12.0% and 15.0%) nominally and respectively. While they both have greater corrosion resistance than the 18-8 steels, they were principally designed for extra-deep drawing and cold heading operations, as allowed by the higher nickel content

Class C: AISI types 302B, 308, 309, 309S, 310, 310S, and 314 are examples of the class C group. Type 302B is a modified 18-8 and has a silicon addition (2.5%) that increases oxidation resistance at elevated temperatures. Type 314 represents a higher alloy version (25% chromium-20% nickel) of an 18-8 steel. It has a silicon addition that is more corrosion resistant, especially to sulfuric acid, than type 302B and also has a high resistance to scaling at elevated temperatures. Types 308, 309, 309S, 310, and 310S are all higher in chromium and nickel and are commonly called 20-11 (20% chromium-11% nickel, type 308), 24-12 (24% chromium-12% nickel, types 309 and 309S) and 25-20 (25% chromium-20% nickel, types 310 and 310S). They have a very high resistance to corrosion and oxidation at elevated temperatures.

Class D: AISI types 316, 316L, 316F, 316N, 317 and 317L are part of this class. They contain at a minimum 16% chromium and at least 2% molybdenum. The ferrite-forming influence of the molybdenum requires an increase in nickel, as an austenite former, to at least 10%. The presence of molybdenum specifically enhances corrosion resistance to chloride pitting and crevice corrosion and also increases general resistance to specific chemicals (e.g., organic acids, amines, phosphoric acid, dilute sulfuric acid).

2) ***Martensitic stainless steels***, these are iron-chromium alloys which are hardened by heat treatment. Heat treatment results in higher strength, with a corresponding proportional diminution of ductility with increasing hardness. Corrosion resistance is less than in the other two groups. In the hardened condition there may be a greater resistance to general corrosion but there is increasingly less resistance to hydrogen-induced cracking. Martensitic steels can be heat-treated to obtain high tensile strengths. The heat treatment results in higher strengths, with a corresponding proportional diminution of ductility with increasing hardness. Corrosion resistance is less than in the other two groups. In the hardened condition, there may be a greater resistance to general corrosion, but there is increasingly less resistance to hydrogen-induced cracking. Chromium content is generally between 11.5-18% with carefully controlled carbon content. Some of the AISI types that make up this group are 403, 410, 414, 416, 420, 420F, 431, 440A, 440B, and 440C.

Types 403, 410, and 416 are known as "turbine quality." Type 403 is virtually identical to type 410, except that it is made from specially processed and rigorously inspected ingots, as is required for steam turbine blades. Both types contain just enough chromium to maintain "stainlessness" (nominally 12.5%), but there are no significant amounts of other alloying elements. Type 416 is simply 410 with the addition of free-machining additives. Although offering improved machining characteristics, there is a sacrifice in corrosion resistance.

Types 414 and 431 provide better corrosion resistance than type 410, largely because they contain a nominal amount (2.0%) of nickel. These steels have been commonly known as 12-2 (12% chromium-2% nickel) and 16-2 (16% chromium-2% nickel), respectively.

Types 420 and 420F, despite having a higher chromium content than type 410, do not have an appreciably higher corrosion resistance level. Type 420F is almost identical to type 420, except that there is an addition of sulfur to improve machinability. This results in a slight sacrifice of corrosion resistance.

Types 440A, 440B, and 440C are all high-carbon stainless steels and are sometimes called "stainless tool steels." These types have the highest chromium range of any of the martensitic types, yet their corrosion resistance levels are among the lowest because of their higher carbon content. There is a gradual decrease in corrosion resistance from the A to C subtypes. This is due to the increase in carbon content.

3) ***Ferritic stainless steels***, these are nonhardenable steels so designated because they cannot be hardened by heat treatment. They are hardenable only by cold-working. Chromium content is generally between 11.5-27% with low carbon content. Examples of AISI types that make up this group are 405, 409, 429, 430, 430F, 434, 436, 442, and 446. As a group the ferritic stainless steels do not closely approach the austenitic types with respect to corrosion resistance. There are, however, some ferritic types that may nearly equal the corrosion resistance levels of the austenitics in some environments, but these are exceptions. One of the most interesting aspects of this group of stainless steels is their resistance to stress corrosion.

Type 405, while meeting the minimum requirements for a stainless steel, is actually relatively low in its resistance to corrosion. The carbon level is 0.08% maximum and it has a nominal chromium content of 12.5%. An addition of 0.10 to 0.30% aluminum (a powerful ferritizer) prevents the formation of any appreciable amount of austenite at any temperature. It is thus the ideal grade for welding. Of all the stainless steels, type 409 is generally considered to have the lowest degree of corrosion resistance. It contains very nearly the minimum amount of chromium to qualify as a stainless steel (10.5-11.75%) and is stabilized with titanium.

Types 430, 430F, 434, and 436 represent the old and well-known 17-chrome stainless steel grade, which is the original type 430. Type 430 shows a high resistance against attack by practically all types of atmospheres and also by many types of chemicals, notably oxidizing acids. At times, type 430 replaces the more expensive 18-8 austenitic types. Type 430F is a machinable grade of type 430. The additives contained in it reduce the corrosion resistance of the basic type 430. Type 434 has the same chromium content as type 430, but it has a nominal 1.0% molybdenum content, which adds greatly to its resistance to certain types of corrosion, notably pitting corrosion. Type 436 is essentially type 434, but it contains up to 0.70% niobium plus tantalum for carbide stabilization. Therefore, it is suited for elevated temperature applications as well as for room-temperature corrosion resistance. Types 442 and 446 are frequently called "chrome-irons." They differ in composition only in chromium content 18.0-20.0% for type 442 and 23.0-27.0% for type 446. Neither is used to any great extent for corrosion resistance at room temperatures. Their principal uses are in heat processing equipment where resistance to scaling is important. Types 442 and 446 are capable of sustained operation at temperatures of 980 °C and 1095 °C respectively, without experiencing destructive scaling. A need for a higher degree of weldability than that provided by type 430 resulted in the development of type 429. Both alloys have the same carbon content; however, 429 has a lower chromium content (14.0-16.0%). This carbon-chromium ratio allows type 429 to retain its ferritic status.

4) The fourth group consists of the ***age-hardened or precipitation-hardening steels***. They are hardened and strengthened by solution-quenching followed by heating for substantial times at temperatures in the range of 800-1000 degrees Fahrenheit. Precipitation-hardened stainless steels can have a microstructure consisting of ferrite, martensite, or austenite depending on the heat treatment

performed. The precipitation hardening process is thought to involve the formation of very fine intermetallics that impede dislocation motion during deformation, producing higher strength. Prolonged aging cause these intermetallics to coarsen, enabling dislocations to bypass them during deformation, and their strength to begin to decline. In this condition, the material is said to be overaged. AISI types that make up this group include 630, 631, 632, 633, 634, and 660. It is generally considered that the average corrosion resistance of this group approaches that of the 18-8 austenitic grades and that it is usually superior to the corrosion resistance of the martensitic and ferritic types.

Copper is the principal hardening agent in type 630. Its corrosion resistance approaches that of types 302 and 304. In the heat treated condition, type 631 has a duplex structure. Stainless steels that have a duplex structure have a two phase microstructure that exhibits improved strength and high resistance to stress corrosion cracking. With the exception of an addition of molybdenum, type 632 is very much like type 630. There is an improvement in strength and resistance to pitting corrosion due to the addition of molybdenum.

Type 633 is also a duplex-structure grade, but has a slightly higher alloy content than types 631 and 632. Thus, its corrosion resistance is better than types 631 or 632. Type 634 is semiaustenitic (duplex), but it has an alloy content slightly less than type 633. The duplex stainless steels are currently popular for withstanding high chloride environments. These alloys have a two-phase microstructure that exhibits improved strength and high resistance to stress corrosion. Most duplex stainless steels contain high chromium (usually about 25%), low nickel (generally about 8% maximum), and 2-4% molybdenum for enhanced resistance to chloride induced phenomena and to promote general corrosion resistance, specifically pitting corrosion.

The super-austenitic stainless steels include such alloys as 904L and 254MO. These alloys have increased resistance over the austenitic stainless steels due to the addition of 6% molybdenum or other elements.

Brass and Bronze Alloys

Brass, bronze, and other copper alloys have been widely used for centuries in many applications because of their excellent corrosion resistance. Despite the formation of the common green patina in natural environments, copper and its alloys corrode at negligible rates in unpolluted water or air and in deaerated nonoxidizing acids. Copper roofing in rural atmospheres, where there is little if any pollution, has been found to corrode at rates of less than 0.4 mm (15 mils) in 200 years. Some copper alloy artifacts have been found in nearly perfect condition, with only small amounts of corrosion on the surface, after having been buried in the earth for thousands of years.

Although classed as corrosion resistant, neither copper nor its alloys form the truly passive corrosion-resistant film that characterizes most true corrosion-resistant alloys. In aqueous environments at ambient temperatures, cuprous oxide or cupric carbonate forms the protective scale on copper and copper alloys. The film is adherent and follows parabolic growth kinetics. For the corrosion reaction to proceed, copper ions and electrons must migrate through the cuprous oxide or cupric carbonate layer. Consequently, reducing the ionic or electronic conductivity of the film by doping with divalent or trivalent cations should improve corrosion resistance. In practice alloying additions of aluminum, zinc, tin (Sn), iron, and nickel are used to dope the corrosion product films, resulting in a significant reduction in corrosion rate.

Copper alloys can be quite susceptible to stress-corrosion cracking. While high-zinc yellow brasses are the most susceptible to stress-corrosion cracking, small amounts of phosphorus, arsenic (As), antimony (Sb), silicon, aluminum, or nickel as constituents in other copper-base alloys render them also susceptible to stress-corrosion cracking in ammoniacal environments. Other nitrogenous environments, such as nitrite or nitrate solutions, as well as nitric acid vapors, can also cause stress-corrosion cracking. As for other elements, the corrosion-resistant behavior of copper is best revealed by considering its alloy systems. The basic systems for copper are copper-tin (bronze), copper-zinc (brass), copper-nickel (cupro-nickels), and variations of these, including aluminum-bronzes, phosphor-bronzes, and nickel-silvers.

Copper and its alloys are classified in the United States by composition according to Copper Development Association (CDA) designations which have been incorporated into the Unified Numbering System (UNS) for metals and alloys. Wrought copper materials are assigned five digit numerical designations which range from C10100 through C79999, but only the first three or sometimes four numerals are frequently used for brevity. Designations that start with 8 or 9 are reserved for cast copper alloys.

Most wrought alloys are provided in conditions that have been strengthened by various amounts of cold work or heat treatment. Cold worked alloys are the result of cold rolling or drawing by prescribed amounts of plastic deformations from the annealed condition. Alloys that respond to strengthening by heat treatment are referred to as precipitation or age hardenable. The designations and principal alloying elements of wrought copper alloys are given in Table A-2.

Table A-2

UNS (CDA) Designations for Brass and Bronze Alloys

Alloy group	UNS (CDA) designation	Principal alloy elements
Brasses	C20500-C28580	Zn
Leaded brasses	C31200-C38590	Zn-Pb
Tin brasses	C40400-C40980	Sn, Zn
Phosphor bronzes	C50100-C52400	Sn-P
Leaded bronzes	C53200-C54800	Sn-P, Pb
Phosphorus-silver	C55180-C55284	Ag-P
Aluminum bronze	C60600-C64400	Al, Fe, Ni, Co, Si
Silicon bronze	C64700-C66100	Si, Sn
Modified brass	C66400-C69950	Zn, Al, Si, Mn

Nickel and copper are mutually soluble or miscible. In commercial alloys known as copper-nickels or cupronickels, where copper is the dominant element, the copper content ranges from about 54% to over 90%. Nickel provides the best general resistance to aqueous corrosion of all the commercially important alloy elements. It promotes resistance to impingement or erosion corrosion and to stress corrosion cracking. The addition of 10-25 wt% nickel to copper-zinc alloys produces alloys called nickel-silvers. Most commonly these have about 18% nickel and 55-65% copper. Such alloy

additions promote good resistance to corrosion in both fresh and salt waters. The nickel inhibits dezincification. Nickel-silvers are much more corrosion resistant in saline solutions than brasses of similar copper content.

Elements are added to copper alloys in varying amounts to enhance corrosion resistance. For example, the addition of arsenic, antimony, or phosphorus improves resistance of Admiralty Metals (72% copper, 26% zinc, 1% tin) to dezincification. Also, 2% aluminum is added to 76% copper-22% zinc solutions to produce aluminum brass, and a small amount of arsenic (less than 0.10%) is added to the alloy to inhibit dezincification.

Brass and bronze can be grouped according to how the principal elemental additions affect properties. This grouping depends primarily on whether the additions that dissolve in the liquid copper can form discrete second phases during melting/casting or in-process thermal treatment.

Brass and bronze are considered to be solid solution alloys when copper dissolves other elements to varying degrees to produce a single-phase alloy that is strengthened relative to unalloyed copper. The contribution to strengthening from an element depends on the amount of the element in solution and by its particular physical characteristics, such as atom size and valency. Tin, silicon, and aluminum show the highest strengthening efficiency of the common elemental additives, whereas nickel and zinc are the least efficient. The limiting factor in their alloy range is the extent to which the elements, either singly or in combination, remain dissolved in the copper during processing. Table A-3 gives the designations and compositions of some specific brass and bronze wrought alloys. More details on these specific alloys are provided below.

Table A-3
UNS (CDA) Designation and Compositions of some Brass and Bronze Wrought Alloys

Alloy group	UNS designation	Elemental composition, wt% [a]
Zinc brass	C260	30 Zn
Leaded brass	C360	35 Zn, 3 Pb
Tin brass	C425	9.5 Zn, 2.0 Sn
Phosphor bronze	C510	5.0 Sn, 0.1 P
Aluminum bronze	C638	2.8 Al, 1.8 Si
Silicon bronze	C654	3.0 Si, 1.5 Sn, 0.1 Cr
Silicon bronze	C655	3.3 Si, 0.9 Mn
Modified Cu-Zn	C688	22.7 Zn, 3.4 Al, 0.4 Co

[a]Remaining percentage is copper.

The presence of finely dispersed second-phase particles in copper alloys contributes to strength, through refined grain size and increased response to hardening from cold working. A dispersion of fine particles can be incorporated into the alloy through thermomechanical processing where the alloy content is above the solid state solubility limit. Precipitation and coarsening of the excess solute by an in-process anneal is used in high copper alloys, such as C194 and C195, to form iron or iron-cobalt dispersions.

Copper-Zinc (Cu-Zn) Brasses

Copper-zinc alloys have been the most widely used of the copper alloys during the 1990's. Brass alloys fall within the designation C205 to C280 and cover the entire solid solution range up to 35 wt% zinc in the Cu-Zn alloy system. Zinc, which is generally less expensive than copper, does not impair conductivity and ductility to any appreciable extent. The alloys have a yellow “brass” color at zinc levels above 20 wt%. By far the best known and most used composition is the 30 wt% zinc alloy, called Cartridge brass, which is best known for its applications as door knobs and bullet cartridges.

The series of brasses, C312 to C385, contain from 0.25-5.0 wt% lead (Pb) for the purpose of improving machinability. C360, having the composition of 61.5 wt% copper, 35.4 wt% zinc, and 3.1 wt% lead, has become the industry standard for machinability performance.

Tin Brasses

The tin brass series of alloys consists of various copper-zinc (2.5-35 wt%) alloys to which up to about 4 wt% tin has been added. These are the C40000 series of alloys. Tin provides better general corrosion resistance and strength without greatly reducing electrical conductivity. Several tin brasses have lead additions to enhance machinability. Naval Brass C485 contains 60.5 wt% copper, 37 wt% zinc, 0.7 wt% tin, and 1.8 wt% lead. Resistance to dezincification is increased with the addition of tin. In brasses that contain a high zinc content, it is common to use other alloying additives to enhance corrosion resistance. C443 contains 0.02-0.10 wt% arsenic, C444 contains 0.02-0.10 wt% antimony, and C445 contains 0.02-0.10 wt% phosphorus, which is added to control dezincification. When any of these elements are used, the alloy is referred as being "inhibited."

Tin Bronzes

Tin bronzes may be the most familiar of copper alloys with roots going back into ancient times. They are essentially solid solutions of tin in copper. Phosphorus at 0.03-0.35 wt% is commonly used as a deoxidizer, and the residual phosphorus content gives rise to the term "phosphor bronze." The addition of tin to copper promotes good resistance to fresh and sea water. Under some conditions, when more than 5% tin is present, the corrosion resistance in marine applications is enhanced. Strength, corrosion resistance, and stress relaxation resistance increases with tin content. Where the water velocity is high, the tin content in copper alloys for marine applications should exceed 5%. Alloys containing between 8-10% tin have high resistance to impingement or erosion attack. Tin bronzes tend to have intermediate pitting resistance. One of the most highly used specialty tin bronzes is C544, containing 88 wt% copper-4 wt% tin-4 wt% zinc-4 wt% lead. Zinc provides increased strength to this tin bronze, whereas the lead addition provides good machinability.

Aluminum Bronzes

Aluminum bronze alloys comprise a series of alloys (C606 to C644) based on the copper-aluminum (2-15 wt%) binary system, to which iron, nickel, and/or manganese are added to increase strength. Corrosion resistance results from the formation of an adherent aluminum oxide layer that protects the surface from further oxidation. Mechanical damage to the surface is readily healed by the redevelopment of this oxide. The aluminum bronzes are resistant to sulfuric or hydrochloric acids, but not nitric acid. These alloys must be properly heat treated to be resistant to dealloying and general corrosion.

Two single-phase, binary alloys are used commercially: C606, containing 5 wt% aluminum and C610, containing 8 wt% aluminum. Most of the available aluminum bronzes contain additional alloy elements. C608 contains 5 wt% aluminum to which 0.02-0.35 wt% arsenic has been added to improve corrosion resistance. Alloy C614, in addition to having 7 wt% aluminum and 2.5 wt% iron, also has a 0.3 wt% tin addition for improved resistance to stress corrosion.

Most of the aluminum bronzes contain substantial iron, nickel, or manganese additions. These alloying elements increase strength by forming second phases during heat treatment. Iron, the most commonly added element, separates as an iron-rich particle that controls grain size while it enhances strength. Nickel also reacts with aluminum to form NiAl precipitate during heat treatment with the same result as the iron addition.

Silicon Bronzes

Silicon bronzes have long been available for use in electrical connectors, heat exchange tubes, and marine and pole line hardware because of their high solution hardened strength and resistance to general and stress corrosion. Their compositions are limited to below 4.0 wt% silicon because above this level, an extremely brittle phase is developed that prevents cold processing. The three most popular alloys in this series are C651, C654, and C655.

Modified Copper-Zinc Alloys

The series of brass alloys C664 to C698 have been modified by additions of manganese (manganese brasses and manganese bronzes), aluminum, silicon, nickel, and cobalt. Each of the modifying additions provides some property improvement to the already workable, formable, and inexpensive Cu-Zn brass base alloy. Aluminum and silicon additions improve strength and corrosion resistance. Nickel and cobalt form aluminide precipitates for grain size control and dispersion strengthening by the presence of finely dispersed second-phase particles in the copper alloy.

Specific Properties of Cast Brass and Bronze Alloys

Cast copper alloys can be classified into two main groups: single-phase alloys, characterized by moderate strength, high ductility (except for leaded varieties), moderate hardness and good impact strength; and polyphase alloys, having high strength, moderate ductility, and moderate impact strength. The tolerance for impurities is normally greater in cast copper alloys than in wrought copper alloy because the cast alloys are not mechanically formed. However, in those cast alloys likely to be repaired or joined by welding, some impurities can be very detrimental. On the basis of consumption, red brass alloys, C83600 (85 wt% copper, 5 wt% tin, 5 wt% lead, and 5 wt% zinc), C84400 (81 wt% copper, 3 wt% tin, 7 wt% lead, and 9 wt% zinc), and C93200 (83 wt% copper, 7 wt% tin, 7 wt% lead, and 3 wt% zinc) are the most important of the cast copper alloys.

The mechanical properties of cast copper alloys (e.g., brass, bronze) are a function of alloying elements and their concentrations. The nominal chemical composition and identification of some copper casting alloys are listed in Table A-4.

Table A-4
Nominal Composition by wt% of Some Casting Brass and Bronze Alloys

Common name	UNS (CDA) designation	Cu	Sn	Pb	Zn	Fe	Al	Others
high strength yellow brass	C86300	63.0			25.0	3.0	6.0	3.0 Mn
gun metal	C 90500	88.0	10.0		2.0			
tin bronze 84:16	C 91100	84.0	16.0					
high leaded tin bronze	C 93700	80.0	10.0	10.0				
steam bronze	C 92200	88.0	6.0	1.5	4.5			
phosphorus bronze	C 94400	81.0	8.0	11.0				0.35 P
high leaded tin bronze	C 93800	78.0	7.0	15.0				
journal bronze	C 94100	70.0	5.5	18.0	3.0			
aluminum bronze 9D	C 95500	81.0				4.0	11.0	4.0 Ni
Al-Silicon bronze	C 95600	91.0					7.0	2.0 Si
Mn-Al bronze	C 95700	75.0				3.0	8.0	12.0 Mn, 2.0 Ni
Ni-Al bronze	C 95800	81.0				4.0	9.0	1.0 MN, 5.0 Ni
die-casting yellow brass	C 85800	58.0	1.0	1.0	40.0			
die-cast silicon brass	C 87800	82.0			14.0			4.0 Si
commercial no. 1 yellow brass	C 85400	67.0	1.0	3.0	29.0			
yellow brass	C 85700	63.0	1.0	1.0	34.7		0.3	
high strength yellow brass	C 86200	64.0			26.0	3.0	4.0	3.0 Mn
leaded high strength yellow brass	C 86400	59.0		1.0	40.0	2.0	1.5	1.5 Mn
silicon bronze	C 87200	89.0	1.0	0.5	5.0	2.5	1.5	1.5 Mn, 4.0 Si
silicon brass	C 87400	83.0			14.0			3.0 Si
silicon brass	C 87500	82.0			14.0			4.0 Si
tin bronze	C 90300	88.0	8.0		4.0			
leaded tin bronze	C 92300	87.0	8.0	1.0	4.0			
high leaded tin bronze	C 93200	83.0	7.0	7.0	3.0			
nickel-tin bronze	C 94700	88.0	5.0		2.0			5.0 Ni
leaded nickel-tin bronze	C 94800	87.0	5.0	1.0	2.5			5.0 Ni

APPENDIX B

Selected Questions and Answers

Part 1: Relevant Questions and Answers Extracted from the *Revised 1998 EPCRA Section 313 Questions and Answers (December 1998)* and *EPCRA Section 313 Questions and Answers Addendum for Federal Facilities (Revised 1999 Version)*

Part 2: Selected Questions Received by EPA Since Promulgation of the Lead Rule, and EPA's Answers

Appendix B is comprised of two parts: Part 1 and Part 2. Part 1 includes relevant questions and answers about metal and metal compounds extracted from EPA's *Revised 1998 EPCRA Section 313 Questions and Answers (December 1998)* and *EPCRA Section 313 Questions and Answers Addendum for Federal Facilities (Revised 1999 Version)* documents. In Part 1 of Appendix B the numbers in parentheses refer to the number of the question in the *Revised 1998 EPCRA Section 313 Questions and Answers (December 1998)* or *EPCRA Section 313 Questions and Answers Addendum for Federal Facilities (Revised 1999 Version)* documents. Questions from the Federal Facilities document will be distinguished with an additional "FF" within the parentheses. Note that some of the questions have been modified (since publication of the 1998 Q&A document) to reflect the new reporting requirements for lead and lead compounds. Questions that have been modified are noted as such.

Part 2 of Appendix B contains selected questions received by EPA since promulgation of the Lead Rule, and EPA's answers.

Appendix B, Part 1:
Relevant Questions and Answers Extracted from the *Revised 1998 EPCRA Section 313 Questions and Answers (December 1998)* and *EPCRA Section 313 Questions and Answers Addendum for Federal Facilities (Revised 1999 Version)*

Article Exemption – Lead

Question (Modified 376) – *A covered manufacturing facility produces neon signs by bending leaded glass tubing. The facility uses enough tubing annually to process in excess of 100 pounds of lead, an EPCRA Section 313 toxic chemical. When signs are formed from glass tubing, the diameter of the tubes remains unchanged and lead is not released during the heating or bending process, qualifying the tubes for the article exemption. If a discrete number of glass tubes are broken and discarded during the year, under what circumstances would disposal of the broken tubes constitute a release that negates the article exemption, and how would the facility calculate the amount of lead used in their operation?*

Answer: *Disposal* of the glass does not necessarily constitute a release which automatically negates the *article* exemption. For the tubing to meet the definition of an *article* when discarded, the diameter of the tubing must remain intact and unchanged. As a result, shards of glass no longer qualify as *article*s. If more than 0.5 pounds of lead is released and not recycled, then the *article* exemption would not apply to this glass tubing.

Article Exemption – Lead Bricks

Question (370) – *A ship building facility incorporates lead bricks as ballast into the ships it distributes in commerce. The lead bricks remain permanently with the ship. They could be considered articles and therefore be exempt from reporting. However, the facility infrequently cuts some of the bricks, generating lead dust, which it collects and sends to an off-site lead reprocessor. How should the facility report? What should be counted towards the threshold if the lead bricks are not considered articles?*

Answer: If all of the lead is recycled or reused then the lead dust does not have to be counted as a release. Therefore, the cut bricks retain their *article* status. If while cutting the bricks, there are *releases* which are not recycled and that exceed 0.5 pounds for a year, then the cut bricks would not be considered *article*s. In this case, count only the lead in bricks actually *processed* toward the threshold determination. Any amounts of *toxic chemicals* sent off-site for recycling would be reported appropriately on the Form R.

Lead and Lead Compounds

Question (419) – *For Section 313 reporting requirements and threshold determinations, if a covered facility uses lead, lead chromate, and other chromium compounds, can they be considered separately or must they be combined into categories? When reporting releases and other waste management activities, must quantities of categories be determined as well?*

Answer: Threshold determinations for metal containing compounds are made separately from parent-metal threshold determinations because they are listed separately under Section 313. In the scenario presented in the question, the *facility* would apply the quantity of the lead metal *manufactured, processed*, or *otherwise used* to the appropriate threshold for lead. The *facility* would apply the quantities of the lead chromate *manufactured, processed*, or *otherwise used* to the appropriate threshold for lead compounds and would apply the quantities of the lead chromate and other chromium compounds *manufactured, processed,* or *otherwise used* to the appropriate threshold for chromium compounds. However, a *facility* may, once a threshold has been met individually, combine the parent metal and its metal compounds for reporting. In completing the Form R, only the weight of the parent metal (not the entire compound weight) is to be considered.

Question (Modified 421) – *A covered facility processes both elemental lead and lead compounds. The facility exceeds the 100 pounds per year processing threshold for lead compounds, but not for elemental lead, and must submit a report for lead compounds only. When calculating releases and other waste management activities from the lead compounds, the owner/operator is only required to account for the weight of the parent metal released (40 CFR Section 372.25(h)). Should the facility account for both releases of lead from activities involving lead compounds and releases of lead from activities involving elemental lead?*

Answer: No. In the case when an activity threshold is exceeded only for lead compounds, the report is only required to be based on the *releases* and other *waste management* estimates of lead, the parent metal, from lead compounds only. *Releases* and other *waste management* estimates of lead resulting from activities involving elemental lead need not be included in the *release* and other *waste management* calculations. Conversely, if the *facility* were to exceed an activity threshold for only elemental lead, the report would only have to be based on *releases* and other *waste management* estimates from activities involving elemental lead only.

Question (422) – *A covered facility has determined that it needs to report under EPCRA Section 313 for both elemental lead and lead compounds. Can this facility file one Form R that takes into account both the releases and other waste management activities of lead and lead compounds, or is it required to report separately?*

Answer: If a *covered facility* exceeds thresholds for both the parent metal and compounds of that same metal, it is allowed to file one joint Form R (e.g., one report for both lead compounds and

elemental lead). EPA allows this because the *release* and other *waste management* information reported in connection with metal compounds will be the total pounds of the parent metal *released* and otherwise managed as a waste.

Lead Deposits

Question (160) – *A remanufacturer of auto engines cleans the engine parts and thereby produces a lead-containing waste (from gasoline lead deposits) which it sends off-site for disposal. Does the facility manufacture, process, or otherwise use lead compounds?*

Answer: None of the EPCRA Section 313 activities apply. Neither lead nor lead compounds are *manufactured*. Lead is not incorporated into products for distribution in commerce nor is it a manufacturing aid or a processing aid as those terms are defined. Lead in the waste would not be included for a threshold determination. The *facility* does not *manufacture*, *process*, or *otherwise use* lead compounds.

Metal Alloys

Question (Modified 107) – *How does a facility determine the threshold for reporting of a listed toxic chemical (such as lead) in a solid piece of steel which it processes?*

Answer: Since steel is a *mixture* (and not a compound), the *processing* threshold determination is made based on the total amount of each *toxic chemical* present in the steel. If the *toxic chemical* is present in a known concentration, the amount present can be calculated by multiplying the weight of the steel by the weight percent of the listed *toxic chemical*. The threshold for *processing* is 25,000 pounds, for lead contained in stainless steel, brass, or bronze alloys.

Question (Modified 109) – *Regarding metals in mixtures, such as lead in an alloy (stainless steel), how are thresholds and releases and other waste management activities accounted for in a foundry type operation where all of the metals are melted down? Could the de minimis and article exemptions be applied?*

Answer: For threshold purposes, if the listed *toxic chemicals* in the metals are *processed*, *otherwise used*, *manufactured* as an impurity (that remains with the product), or *imported* below the de minimis levels, then the de minimis exemption may be taken for that metal in the alloy. However, the *article* exemption cannot be taken for this type of foundry operation since in founding, a metal is melted down and poured into a mold. Consequently, the resulting metal is not recognizable as its original form. Note that the *de minimis* exemption may apply for lead in stainless steel, brass, or bronze alloys.

Question (Modified 464) – *How is galvanized sheet metal considered for EPCRA Section 313 reporting? Are metals in alloys subject to Section 313 reporting?*

Answer: Galvanized sheet metal is an alloy of several different metals. An alloy is considered a *mixture* for Form R reporting because the individual metals in the alloy retain their chemical identities. Like all other listed *toxic chemicals* in *mixture*s, alloys are subject to Form R reporting. When determining whether a *facility* meets an activity threshold, the owner/operator should only consider the weight percent of the listed chemical in the alloy.

For lead contained in stainless steel, brass or bronze alloy the 25,000 pound threshold for manufacturing and processing, and the 10,000 pound threshold for otherwise use, is applied. It is important to note, however, for facilities that manufacture, process, or otherwise use lead and stainless steel, brass, or bronze alloys that contain lead, that all quantities of lead (regardless of whether they are in an alloy) must still be applied to the 25,000 pound threshold for manufacturing and processing or the 10,000 pound threshold for otherwise use. When conducting threshold evaluations a facility must consider the amount of lead not in stainless steel, brass, or bronze alloy toward both the 100 pound threshold AND the 25,000 and 10,000 pound thresholds.

Metal Compounds

Question (108) – *How are threshold determinations made for metal-containing compounds?*

Answer: Threshold quantities for metal compounds are based on the total weight of the metal compound, not just the metal portion of the metal compound. The threshold quantities are determined by adding up the total weight of all metal compounds containing the same parent metal. However, *release* and other *waste management* calculations are based solely on the weight of the parent metal portion of the metal compounds. Note that there are a few metal compounds that are separately listed and are not counted in the metal compounds categories. For example, maneb (CAS number 12427-38-2) is a manganese compound that is a separately listed chemical and is not reportable under the manganese compounds category.

Question (112) – *A covered facility manufactures specialty glass products. The starting materials are primarily metal silicates which are ground into a powder, mixed, and heated. The resulting mixture, the specialty glass, has all the metal silicates melted together in a non-crystalline structure. Since the metal silicates do not exist by themselves in the mixture, how should a threshold determination be made?*

Answer: The metal silicates are *processed* since they become incorporated into a product (the specialty glass) that is distributed in commerce. If the metal silicates still exist as the original metal silicates but just mixed together then each metal silicate that belongs to a particular metal compound category is included in the *processing* threshold calculations for that category. If the metal silicates have been reacted to produce another compound (i.e., if the specialty glass is not just a *mixture* of individual metal silicates but is another new metal compound) then the metal silicates have still been *processe*d,

but a new metal compound has also been *manufactured* and its weight (i.e., the whole weight of the glass) must be included in the *manufacturing* threshold calculations.

Question (137) – *In an electroplating operation, a facility uses an elemental copper anode and an electrolyte solution containing a copper compound. During the electrolytic process, elemental copper is deposited at the cathode (the item being plated). As elemental copper is plated out at the cathode, copper goes into solution at the anode forming a copper compound. For purposes of EPCRA Section 313, how would the facility make threshold determinations for copper and copper compounds?*

Answer: The electroplating of copper is a two step process in which the elemental copper from the anode is converted into a copper compound in solution and the copper compound in solution is converted to elemental copper. A constant concentration of copper compounds is thus maintained in the electrolytic solution surrounding the electrodes. In such an electrolytic cell, four separate thresholds are applicable for purposes of EPCRA Section 313:

a. The amount of copper anode consumed counts towards a *processing* threshold for elemental copper (since its purpose is to provide copper to the cathode, via the bath);

b. The amount of copper compound generated in the electrolytic solution (as a result of oxidation of elemental copper at the anode) would count towards a *manufacturing* threshold for copper compounds;

c. The amount of copper compound converted to elemental copper in the electrolytic solution counts toward a *processing* threshold for copper compounds (since it is available for reduction at the cathode);

d. Finally, the amount of copper deposited at the cathode would count towards a *manufacturing* threshold for elemental copper (since elemental copper is being produced from a copper compound).

For example, a *facility* uses up 15,000 pounds of copper anode per year (the anode is composed of elemental copper). The elemental copper is *processed* by *manufacturing* 37,000 pounds of copper sulfate (copper sulfate ($CuSO_4$) is 40 percent copper by weight and, in this example, is the form in which copper exists in the electroplating bath). The copper sulfate is then *processed* by *manufacturing* 15,000 pounds of elemental copper.

The following threshold quantities were calculated in this example:

	Manufacture	*Process*
Elemental Copper	15,000 pounds	15,000 pounds
Copper Compounds	37,000 pounds	37,000 pounds ($CuSO_4$)

The *facility* would file a Form R for "Copper Compounds" because it exceeds the *manufacturing* and *processing* thresholds for a copper compound.

Question (138) – *A covered electroplating facility uses copper cyanide as its source of copper in plating baths in their electroplating operation. Are they manufacturing, processing, or otherwise using this compound? How do they determine whether they meet the activity threshold and how are releases and other waste management activities reported for this chemical?*

Answer: In this process the copper cyanide is both *manufactured* and *processed*. The copper cyanide is created in the plating solution, and the amount created should be counted towards the 25,000 pound *manufacturing* threshold. The copper cyanide is also being *processed* since the copper from the copper cyanide is plated onto an object that is to be distributed in commerce. Thus, the copper cyanide used in this process should be counted towards the *processing* threshold for both copper and cyanide compounds. The copper cyanide is both a copper compound and a cyanide compound and is reportable under both the copper compounds category and the cyanide compounds category. The total weight of the copper cyanide is to be counted towards the thresholds for both categories. However, for reporting *releases* and other *waste management* activities, the total weight of the copper cyanide is to be reported under the cyanide compounds category, but only the weight of the copper is to be reported under the copper compounds category.

Question (154) – *Do covered facilities need to consider the inadvertent conversion of one metal compound to another as manufacturing? For example, a pulp and paper mill inadvertently converts metal carbonates and oxides in wood to metal sulfides during pulping. Is this a covered manufacturing activity?*

Answer: Yes. *Manufacturing* is not limited to intentional *manufacturing*; it also includes coincidental *manufacture* or, inadvertent *manufacture*. In general, anytime one metal compound has been converted to another metal compound, the *facility* must count the new metal compound towards the *manufacturing* threshold. The fact that the parent metal is the same in both compounds does not negate the fact that a new metal compound has been *manufactured*.

Question (162) – *A glass manufacturer uses brick in its refractory kiln that contains chromium (III) compounds. During the manufacturing process, the chromium reacts to generate chromium (VI) compounds. The chromium compounds, while being used in the kiln, become part*

of the glass being manufactured. All the brick in the kiln is replaced every four to five years. What activity thresholds apply to chromium in this situation?

Answer: The brick, and thus the chromium (III) compounds in the brick, are being *otherwise used* based on the quantity of the bricks installed within a reporting year. The chromium compounds in the bricks are also considered *processed*, because the chromium compounds in the brick are incorporated as an impurity into the final product (the glass) which is distributed in commerce. However, for this *processing* step, the de minimis exemption may be taken. The chromium (VI) compounds generated from the chromium (III) compounds are considered *manufacture*d. Thus, threshold calculations should be made for all three EPCRA Section 313 activity thresholds. The thresholds would be calculated based on the total weight of the chromium compounds being *manufactured, processed,* or *otherwise use*d. However, only the weight of the chromium in the chromium compounds are used in *release* and other *waste management* calculations. Any *releases* that go up the stack or are sent off-site for *waste management* must be included. When the brick is replaced and *disposed* of, the amount of chromium that remains in the brick would also need to be included in *release* and other *waste management* calculations.

Question (391) – *How are toxic chemical categories handled under Section 313 threshold determinations and release and other waste management calculations?*

Answer: All *toxic chemicals* in the category that are *manufactured, processed*, or *otherwise used* at a *covered facility* must be totaled and compared to the appropriate thresholds. A threshold determination for *toxic chemical* categories is based on the total weight of the compound. Except for metal compound categories and nitrate compounds, the total weight of the compound *released* or otherwise managed as waste must be reported. *Releases* and other *waste management* quantities of metal compounds are reported as the parent metal portion of the compounds. If the metal and corresponding metal compounds exceed thresholds, a joint report for metal compounds, including the parent metal, can cover both reporting requirements. Similarly, *releases* and other *waste management* quantities of nitrate compounds are reported as the nitrate portion of the compound.

Question (395) – *Do we count the nonmetal portion of metal compounds?*

Answer: The nonmetal portion of metal compounds is included in threshold determinations but not in *release* and other *waste management* calculations.

Question (398) – *A covered facility has a coal-fired boiler. The combustion of the coal generates aerosol forms of hydrochloric acid as a byproduct. Should the aerosol forms of the HCl emissions be reported under EPCRA Section 313?*

Answer: Yes. In the combustion of coal, the *facility* will be coincidentally *manufacturing* aerosol forms of hydrochloric acid, as well as hydrofluoric acid and sulfuric acid. The combustion of

coal will also result in the coincidental *manufacture* of new metal compounds. The *facility* must submit a Form R if it *manufactures* more than 25,000 pounds of any of these listed *toxic chemical*s.

Question (412) – *For Section 313 reporting, a catalyst contains 61 percent total nickel, which includes 26 percent nickel metal and 35 percent nickel contained in compounds. Should the threshold determination be based on the 61 percent total nickel?*

Answer: No. The 61 percent total nickel cannot be used in the threshold determinations. Nickel compounds are a listed *toxic chemical* category; therefore, the full weight of nickel compounds (not just the 35 percent nickel contained in the compounds) must be used in the threshold determination for nickel compounds. A separate threshold determination is required for the nickel metal since nickel is a separately listed *toxic chemical* under Section 313.

Question (414) – *A covered facility uses chromium compounds in its electroplating operation, and as a result, a hexavalent chromate compound is generated. Are the hexavalent chromate compounds reportable under Section 313?*

Answer: The hexavalent chromate compounds are members of a reportable *toxic chemical* category, chromium compounds, and have been *manufactured* by the oxidation/reduction reaction that occurred in the electroplating operation. As a result, the total amount of the hexavalent chromate compounds produced must be included in the *manufacturing* threshold for chromium compounds.

Question (415) – *Is the conversion from one metal compound to another metal compound within the same metal compound category considered manufacturing for purposes of threshold determinations and release, and other waste management calculations?*

Answer: Yes. The conversion of one metal compound to another metal compound within the same metal compound category is considered the *manufacture* of a metal compound, which must be considered toward threshold determinations. This is identical to how threshold calculations are derived for listed *toxic chemicals* in non-metal compound categories. The unique aspect for metal compounds, as compared to non-metal compounds within a listed compound category, is how amounts *released* and otherwise managed as waste are reported. As stated in the final rule (62 FR 23850; May 1, 1997), "if a metal is converted to a metal compound or if a metal compound is converted to another metal compound,..., a metal compound has been *manufactured* as defined under EPCRA Section 313." However, provided that thresholds are exceeded, *covered facilities* are instructed to report only the amount of the parent metal contained in the metal compound for amounts *released* or otherwise managed as waste. If thresholds for both the elemental metal and its metal compounds have been exceeded, *covered facilities* have the option to submit one Form R that includes on their report the amounts of the elemental metal from the parent metal along with amounts of the metal portion from the metal compounds.

Question (416) – *An electroplating facility uses metal cyanide compounds in their electroplating operations. Are they processing or otherwise using those cyanide compounds? How do they determine whether they meet the threshold, and which threshold applies?*

Answer: The parent metal is plated onto a substance electrochemically. The metal compounds are *processed,* and the cyanide compounds are *processed* because the metal cyanide is the source of the metal that is plated and subsequently distributed in commerce. Metal cyanides are reportable as both cyanide compounds and metal cyanides. The total compound weight is applied for threshold determinations for both categories.

Question (417) – *We manufacture and use copper wire. We also use copper compounds in various parts of our processes. The Section 313 list contains both copper and copper compounds. Should we combine these categories for our determination of thresholds and reporting? Do we report the release and other waste management of copper compounds as copper metal?*

Answer: Copper and copper compounds are separate entries on the Section 313 list, and therefore threshold determinations should be made separately. Copper compounds are a listed category and will include the aggregate of all copper compounds (other than the free metal). For copper compounds, report *releases* and other *waste management* activities as copper (e.g., as the copper ion in wastewater), not as the total mass of copper compounds. If a *facility* exceeds thresholds for both the parent metal and compounds of the same metal, EPA allows the *facility* to file a combined report (e.g., one report for copper compounds and copper metal).

Question (420) – *Are chromium compounds (e.g., chromic acid, CAS number 11115-74-5, or chromic acetate CAS number 1066-30-4) reportable under Section 313?*

Answer: All chromium compounds are reportable. They must be aggregated together for purposes of threshold and maximum amount on-site calculations. However, *release* and other *waste management* amounts should be for the chromium metal portion only.

Question (423) – *An oxidation/reduction reaction that occurs as part of a waste treatment operation results in the formation of 2,500 pounds of lead chromate. How must a threshold determination be made for this compound?*

Answer: Lead chromate meets the criteria for both a lead compound and a chromium compound. In such cases, the total amount of the compound *manufactured, processed,* or *otherwise used* must be applied to the threshold determination for both metal compound categories. The weight of the entire compound, not the weight of the parent metal, is applied for the threshold determination of each metal compound category.

Question (584) – *In Part II, Section 7A of the Form R, should covered facilities report the influent concentration to a treatment system for metal compounds in a wastestream for the parent metal only? How do I consider treatment efficiencies for metal compounds?*

Answer: For metal compounds, the calculation of the reportable concentration and waste treatment efficiency must be based on the weight of the parent metal, not on the weight of the metal compounds. Metals are not destroyed, only physically removed or chemically converted from one form to another. The waste treatment efficiency reported must represent only the physical removal from the wastestream (except for incineration) not the percent conversion from one form to another. If a listed waste treatment method converts but does not remove a metal (e.g., chrome reduction), the method must be reported with a waste treatment efficiency of zero.

Metals

Question (382) – *Are there recommended methods for determining if the 0.5 pound release limit is exceeded from a metal stamping operation?*

Answer: EPA recommends that *facilities* use one or more of the following for performing *release* and other *waste management* calculations of EPCRA Section 313 chemicals: monitoring data, mass balance, emission factors, and engineering calculations. If all wastes generated from stamping operations (including fume, dust, sludge and scrap pieces) are recycled or reused and the *facility's* total *releases* will be equal to or less than 0.5 pound limit for each *toxic chemical* per year, the *article* exemption may apply. If *releases* (including *disposa*l) of a *toxic chemical* are more than 0.5 pound, the *article* exemption is negated for that chemical and all quantities of that chemical in the metal sheets should be included in threshold determinations and *release* and other *waste management* calculations.

Question (494) – *Why does EPA not allow covered facilities to use the efficiency of a combustion unit (e.g., incinerator, industrial furnace or boiler) to calculate releases of metals from the unit?*

Answer: Metals cannot be destroyed by combustion. Therefore, the efficiency of a combustion unit has no relation to the *releases* of metals from the unit.

Question (568) – *A covered facility sends a toxic chemical in a paint thinner waste to a firm for fuel blending purposes. Should the amount of toluene and xylene in the waste be reported on the Form R, Part II, Section 6 as a transfer off-site?*

Answer: A *toxic chemical* in a wastestream sent off-site for waste fuel blending is considered combusted for energy recovery if the listed *toxic chemical* has a significant heat value and is combusted in an energy recovery device. EPA believes that waste blended into fuel will be combusted in an integrated energy recovery device. Where both elements are met, the quantity of the *toxic*

chemical must be reported as an off-site transfer for purposes of energy recovery on the Form R. However, other reportable *toxic chemicals* in the waste (e.g., metal pigments) that are incombustible or that do not add significant heat value to energy recovery upon combustion must be reported as off-site transfers for purposes of waste treatment or *disposa*l, as appropriate. Please note that metals cannot be treated or combusted for energy recovery purposes and, therefore, should be reported as *disposed* in Section 8 of the Form R, unless the *facility* has knowledge the metals are being recycled.

Question (588) – *If a covered facility sends metal scraps containing chromium off-site to be remelted and subsequently reused, does it report the amount of toxic chemical in the metal as recycled off-site?*

Answer: Assuming no contaminants are removed during the melting process, the chromium in the metal scraps is not actually being recovered but merely melted and reused. Therefore, the amount of the *toxic chemical* in the metal scraps would not be reportable in Part II, Sections 6.2 or 8 of the Form R. However, because the *facility* is repackaging and distributing the *toxic chemicals* in commerce, it should consider these amounts of the *toxic chemical* towards the *facility*'s *processing* threshold. If the *covered facility* exceeds a chemical activity threshold, it is required to file a TRI Report for that chemical.

Question (590) – *If I send ten pounds of chromium (or any metal) to a POTW or other wastewater treatment facility where should I report the ten pounds in Section 8 of the Form R?*

Answer: Because metals cannot be destroyed, they should not be reported as treated in Part II, Section 8.6 or 8.7 of the Form R. If you do not know what the POTW does with the metal constituents they receive, you should assume they are *released* and report the ten pounds sent to a POTW in Part II, Section 8.1 on the Form R.

Welding

Question (347)- *A covered facility uses sheet metal to manufacture metal desks. When manufacturing the desks, the operator welds and solders some of the sheet metal together. Must the facility include the toxic chemicals in the welding rods, solders, and the metals being joined for its threshold determination? Does the metal desk meet the article exemption?*

Answer: If 0.5 pounds or less of the toxic chemical is released from all like articles in the reporting year and the overall thickness or diameter of the sheet metal is not changed when ***processed*** into the desk, the sheet metal would retain its article status. The desk itself would not meet the criteria for the article exemption because the exemption does not apply to the ***manufacture*** of articles. Also, because air emissions are generated from the welding and soldering rods when they are used, the owner/operator must assess the entire amount of the toxic chemical in the rods for processing threshold purposes.

Question (371)- *During the construction and repair of ships, small quantities of a listed toxic chemical are emitted in the form of fumes when steel plates are being welded together. The steel plates are formed to a specific shape during manufacture and their end use function is dependent upon their shape. Are these steel plates articles and should the amount of toxic chemical (fumes from the steel plates) emitted from the steel plates during the welding process be included in determining the threshold?*

Answer: If the processing or ***otherwise use*** of all like manufactured items results in the release of 0.5 pounds or less of a toxic chemical, EPA will allow this quantity to be rounded to zero and the steel plates may be exempt as articles. If the listed toxic chemical that is released exceeds 0.5 pounds over a calender year and is completely recycled or reused, on-site or off-site, then these steel plates may also be exempt as articles. Any amount that is not recycled or reused will count toward the 0.5 pound per year cut-off value.

Firing Ranges, Fugitive Releases, Lead Bullets

Question (Modified 124 - FF): *Military sites have firing ranges for their personnel. The bullets used by the military personnel are made out of lead. How would lead released from the use of bullets in a firing range be reported on the Form R?*

Answer: There are two types of releases that take place during the firing of bullets from firearms. One type of release is the lead bullet itself coming to rest after it has been fired. That is, during firing the bullets are released to the environment (land or water) as they impact with their targets or otherwise come to rest. The other type of release is the emission of trace amounts of lead vapor to air. This type of release results from the burning of the cartridge powder during firing, which causes volatilization of trace amounts of lead from the bullets, and subsequent emission of lead vapors to air from the gun muzzle as the bullets leave the muzzle. Lead in fired, unrecovered bullets would be reported as *releases* to land: other *disposal* -- Part II, Section 5.5.4 of Form R. Lead in fired bullets that are recovered and sent off-site for *disposal* or recycling would be reported in the appropriate sections of the Form R. *Releases* of lead vapor from the firing of the bullets would be reported as fugitive *releases* to air – Part II, Section 5.1 of Form R. According to the EPA document, *Compilation of Air Emission Factors (AP.42),* approximately 1.2 pounds of lead is *released* as fugitive air emission for every 2,000 pounds of lead bullets fired. (See Chapter 11, Section 3: Explosives Detonation).

It should be noted that private (i.e., non-governmental) shooting ranges are not within covered SIC codes for EPCRA section 313 reporting. The following lists the SIC codes for private shooting ranges:

SIC code 7997 - Shooting clubs, memberships; and

SIC code 7999 - Shooting galleries; Operation of shooting ranges.

Appendix B Part 2:
Selected Questions (with Answers) Received Since Promulgation of the Lead Rule
[and not previously published in EPA's EPCRA Section 313 Questions and Answers [Q&As] - Revised 1998 Version" (December 1998, EPA 745-B-98-004)]

Question 1: *Under this new rule, are private dental offices or manufacturers of dental equipment now required to report releases and other waste management activities of lead? That is, are private dental offices required to submit EPCRA section 313 release (Form R) reports to the U.S. EPA and state and tribal governments? Is there a specific exemption for dental offices?*

Answer: A facility is required to file Form R reports if it meets all three of the following criteria: 1) it is included in certain Standard Industrial Classification (SIC) codes; 2) it has 10 or more full-time employee equivalents (i.e., the equivalent of 20,000 hours per year); and 3) it manufactures (includes imports), processes, or otherwise uses any of the toxic chemicals (e.g., lead, lead compounds) listed on the EPCRA Section 313 list in amounts greater than the threshold quantities. While private dental offices have been assigned an SIC code (SIC code 8021), this SIC code is not covered under EPCRA section 313 and, therefore, private dental offices do not have to report their releases and other waste management quantities of chemicals listed on the EPCRA section 313 list of toxic chemicals. If, however, a dental office is part of a facility that is covered under EPCRA section 313, activities involving listed toxic chemicals within that dental office may need to be applied to threshold determinations and release and other waste management quantities for the facility as a whole, depending upon whether the activities involving the listed chemicals are for personal use by employees of the facility. If the activities within the dental office are for the personal use of the employees at the facility then those activities would be exempt from the reporting requirements under the personal use exemption (see 40 CFR 372.38(c)(3)). If the activities within such a dental office are not for the personal use of the employees at the facility then these activities would be subject to threshold determinations and the reporting of releases and waste management quantities for the facility.

To determine if a given facility (including dental offices and manufacturers of dental equipment) is subject to the reporting requirements of EPCRA section 313 one should first determine the facility's primary SIC code, and if the SIC code is regulated under EPCRA section 313. A listing of the SIC groups (with codes) subject to EPCRA section 313 reporting requirements is provided below, as well as in Chapter 1, section 1.2 of this document. For a facility that meets the SIC code requirement one should then determine whether the facility meets the employee threshold before they determine if they exceed the manufacturing, processing, and otherwise use activity thresholds of a listed chemical.

Standard Industrial Classification (SIC) groups subject to EPCRA section 313 reporting requirements:

Metal mining (SIC code in the 1000s, except for SIC codes 1011, 1081, and 1094)

Coal mining (SIC codes in the 1200s, except for 1241 and extraction activities)

Primary codes 2000-3900 (Manufacturing Industries including: 2000 Food, 2100 Tobacco, 2200 Textiles, 2300 Apparel, 2400 Lumber and Wood, 2500 Furniture, 2600 Paper, 2700 Printing and Publishing, 2800 Chemicals, 2900 Petroleum and Coal, 3000 Rubber and Plastics, 3100 Leather, 3200 Stone, Clay, and Glass, 3300 Primary Metals, 3400 Fabricated Metals, 3500 Machinery (excluding electrical), 3600 Electrical and Electronic Equipment, 3700 Transportation Equipment, 3800 Instruments, 3900 Miscellaneous Manufacturing)

Electrical utilities that combust coal and/or oil (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)

Hazardous waste treatment and disposal facilities (SIC code 4953, limited to facilities regulated under the Resource Conservation and Recovery Act, Subtitle C, 42 U.S.C. section 6921 et seq.)

Chemicals and allied products wholesale distributors (SIC code 5169)

Petroleum bulk plants and terminals (SIC code 5171)

Solvent recovery services (SIC code 7389, (limited to facilities primarily engaged in solvent recovery services on a contract or fee basis)

Question 2: *Will facilities affected by the new TRI lead rule have to consider their manufacturing, processing, and usage of lead and lead compounds for ALL of 2001, or just the portion of 2001 subsequent to April 17, the date the rule finally became effective?*

Answer: The first reporting year for the new TRI lead rule began January 1, 2001 and ended December 31, 2001. Facilities will have to report to EPA their release and other waste management quantities for the entire 2001 calendar year no later than July 1, 2002. This means that any facility affected by the new TRI lead rule must consider manufacturing, processing and otherwise use activities involving lead and lead compounds that took place at their facility from January 1, 2001 through December 31, 2001, to determine whether they have exceeded the activity threshold for reporting and calculating releases and other waste management quantities of lead and lead compounds.

Question 3: *Does the new TRI lead rule encompass leaded glass in computer screens after they are disposed of by a company from a typical office environment? [Assume the*

company receives the computers intact and simply uses them as computers, as opposed to actually manufacturing computers, and then disposes of the computers.] Would this "use" of lead be considered exempt from the regulation for the normal user of computers/screens? Also, would the solder used on the computer circuit cards be exempt for the user of computers and hence not reportable, after proper disposal by the user?

Answer: In the scenario described in this question the computers would likely qualify as articles eligible for the articles exemption. That is, chemicals included on the EPCRA section 313 list of toxic chemicals that are contained in articles (e.g., computers, pipes) are exempt from both threshold determinations *and* release and other waste management calculations (i.e., exempt from inclusion on a Form R report) provided that the item meets the criteria of the articles exemption. However, if a facility were to take the computers and modify them in a way such that they are no longer articles (e.g., crush them), the facility may be subject to EPCRA section 313 reporting requirements. For additional information on article exemptions see Directive 1, Article Exemptions in "EPCRA Section 313 Questions and Answers [Q&As] - Revised 1998 Version" (EPA 745-B-98-004) (The Q&A document is available at http://www.epa.gov/tri/guid_docs).

Question 4: *Does the new TRI lead rule encompass plumbing that is being removed from service in a building during renovations or modifications?*

Answer: In this scenario the pipes would likely qualify as articles eligible for the articles exemption. That is, chemicals included on the EPCRA section 313 list of toxic chemicals that are contained in articles (e.g., computers, pipes) are exempt from both threshold determinations *and* release and other waste management calculations (i.e., exempt from inclusion on a Form R report) provided that the items meets the criteria of the articles exemption. However, if a facility were to take the pipes and modify them in a way such that they are no longer articles (e.g., melt them), the facility may be subject to EPCRA section 313 reporting requirements. For additional information on article exemptions see Directive 1, Article Exemptions in "EPCRA Section 313 Questions and Answers [Q&As] - Revised 1998 Version" (EPA 745-B-98-004) (The Q&A document is available at http://www.epa.gov/tri/guid_docs).

Question 5: *The following questions pertain to facilities that use lead as a source of protection from radioactive materials.*

5a). <u>Facility # 1</u> is a pharmaceutical manufacturing facility. They manufacture radioactive materials that are used in medical treatments. Lead shields are used to protect workers from the radioactive materials. No lead is released from the use of the shields. Would this qualify for the "personal use" exemption?

5b). <u>Facility # 2</u> uses lead bricks as a barrier to protect workers and other people from radioactivity. The bricks are permanent, they are never removed or replaced, but they are not built into the facility (i.e., they are not part of the facility). No lead is released from the bricks.

[This question is similar to Q & A # 277, of the "EPCRA Section 313 Questions and Answers [Q&As] - Revised 1998 Version"] Does this qualify for any exemptions, i.e. structural components exemption or articles exemption? Please answer the question in two ways:

(i) as it applies to lead in bricks used at the facility before the enactment of the lead rule;

(ii) if and how the lead rule would change the answer to (i).

Answer: With regard to **Facility #1**, it appears that the lead shields would meet the definition of an article and qualify for the articles exemption. These shields, however, would not qualify for the personal use exemption because the shields are process related. (See Q&A 243 in "EPCRA Section 313 Questions and Answers [Q&As] - Revised 1998 Version". The Q&A document is available at http://www.epa.gov/tri/guid_docs).

With regard to **Facility #2**, if in fact no lead is released from the bricks then, again, the articles exemption may apply. The structural component exemption would not apply because these bricks are facility-process related. (See Q&A 277 of "EPCRA Section 313 Questions and Answers [Q&As] - Revised 1998 Version". The Q&A document is available at http://www.epa.gov/tri/guid_docs). Lastly, per sub-questions (i) and (ii), the lead rule did not change the articles exemption.

Question 6: *The following questions pertain to lead in stainless steel, brass or bronze alloys.*

6a) With regard to alloys of stainless steel, brass and bronze that contain lead ----- does this mean that these alloys in whatever form, solid or molten, are exempt from the 100 pound activity threshold for reporting releases and other waste management quantities for lead ?

6b) Does this also mean that any fumes from these alloys as a result, for example, of welding are also exempt?

6c) Does this also mean that these alloys do not have a 25,000 or 10,000 pound threshold for lead?

Answer: The final TRI lead rule states that the 25,000 pound manufacturing, processing, and 10,000 pound otherwise use activity thresholds for reporting releases and other waste management quantities of lead and lead compounds have been lowered to 100 pounds. The final TRI lead rule further states that the reporting threshold of 100 pounds applies to all lead compounds and to lead except for lead contained in stainless steel, brass, and bronze alloys. There is no "exemption" for lead contained in stainless steel, brass, and bronze alloys: lead in these alloys are still subject to the manufacture and process threshold of 25,000 pounds, and an otherwise use threshold of 10,000 pounds.

Regarding stainless steel, brass or bronze alloys that contain lead, EPA's interpretation is that the 100 pound threshold does not apply while the lead is literally in (i.e., a component of) the alloy. While the 100 pound threshold does not apply to lead while it is in stainless steel, brass and bronze alloys, there may be certain activities that involve these alloys in which the 100 pound threshold will apply. Below is a brief logic tree that can help one to determine whether the 100 pound threshold applies and/or 25,000 pound/10,000 pound threshold applies. You may also find Section 3.1 of Chapter 3 of this document helpful.

a) If a facility uses lead or a lead compound in the manufacture of a stainless steel alloy, bronze alloy, or brass alloy that contains lead, the 100 pound threshold applies to the lead or lead compound(s) used in the manufacture of the alloy. Thus, in this scenario, the facility is using lead to manufacture the alloy and the 100 pound threshold applies to that amount of lead being used in the manufacture of the alloy.

b) If a facility is processing a lead-containing stainless steel, bronze, or brass alloy in such a way that lead is removed / released from the alloy, the 100 pound threshold applies to that amount of lead that has been removed /released. For example, a facility obtains a stainless steel alloy that contains lead. The stainless steel alloy is melted, and while in a molten state some lead fumes are generated. Some of these fumes are released into the environment via stacks. The facility must apply the 100 pound threshold to that amount of lead that volatilized from the molten, stainless steel alloy, and report if a threshold is exceeded that amount of lead that has been released through a stack in section 5.2 of Form R. In addition, because the stainless steel alloy is being processed, the lead contained in the alloy must be applied to the 25,000 pound processing threshold. Thus, in this scenario, there are two thresholds that need to be applied: the 100 pound threshold for that quantity of the lead that has been removed/released from the alloy; and the 25,000 pound processing threshold for lead in the alloy itself. The 100 pound threshold also applies to fumes of lead that are generated from welding of stainless steel, bronze or brass alloys that contain lead.

c) If a facility is processing a lead-containing stainless steel, bronze, or brass alloy in such a way that the lead is **not** removed/released from the alloy, the 100 pound threshold **does not** apply. For example, a facility obtains 100,000 pounds of a stainless steel alloy that contains lead. The stainless steel alloy is processed in such a way that no lead is removed/released from the alloy. The facility need only apply the 25,000 pound threshold to the processing of stainless steel alloy.

d) If a facility is otherwise using a stainless steel, bronze or brass alloy that contains lead, the 10,000 pound threshold applies to the entire amount of lead in the alloy. If any lead is removed/released from the alloys during the otherwise use activity, the 100 pound threshold also applies to that amount of lead that was removed/released.

Some important guidelines to use are:

i) quantities of lead "in stainless steel, brass or bronze alloy," are only applied toward the 25,000/10,000 pound thresholds;

ii) quantities of lead not in stainless steel, brass or bronze alloys are applied to both the 100 pound threshold and the 25,000/10,000 pound thresholds;

iii) a facility may take the *de minimis* exemption (i.e., threshold variable) for those quantities of lead in stainless steel, brass, or bronze alloys that meet the *de minimis* exemption requirements (*e.g.*, manufactured as an impurity). The *de minimis* exemption applies to threshold determinations addressing numerous activities at a facility. However, the *de minimis* exemption does not include listed substances that are manufactured as byproducts. More details on this point are available. (See Appendix A, Directive 2 of "EPCRA Section 313 Questions and Answers [Q&As] - Revised 1998 Version". The Q&A document is available at http://www.epa.gov/tri/guid_docs). Accordingly, EPA will allow the *de minimis* exemption to be considered for all quantities of lead in stainless steel, brass, or bronze alloy even though this exemption will not be applied to lead not in stainless steel, brass, or bronze alloy.

iv) The Form A certification statement and range reporting for Sections 5 and 6 of Part II of the Form R) cannot be applied to lead reporting if the lower, 100 pound threshold has been exceeded. Therefore, if a facility exceeds the 25,000/10,000 pound threshold but does not exceed the 100 pound threshold, the facility may consider the reporting variables. If the 100 pound threshold is exceeded, the facility may not use the Form A certification statement or range reporting option on the Form R even if the 25,000/10,000 pound threshold is also exceeded.

v) consolidated reporting between lead and lead compounds is allowed.

6d) Why is lead in stainless steel, brass or bronze alloy not a PBT chemical while lead in any other alloy is a PBT chemical?

Answer: Lead is a PBT chemical, regardless of whether it is in an alloy or in the form of a compound or its metallic (i.e., pure metal) form. The form or mixture that lead is in does not determine whether it is a PBT chemical. Lead in any alloy, including stainless steel, brass or bronze is a PBT chemical. EPA has deferred on a decision to lower the 25,000 pound and 10,000 pound thresholds for lead when contained in stainless steel, brass, and bronze alloys. EPA's deferral for the lower threshold for lead when contained in stainless steel, brass, and bronze alloys was based on the fact that the Agency is currently evaluating a petition, as well as comments received in response to previous petition denials, that requested the Agency to revise the EPCRA section 313 reporting requirements for certain metals contained in stainless steel, brass, and bronze alloys. In light of the ongoing scientific review, EPA has decided to defer the lower thresholds for lead when contained in these alloys until the

review is complete. Other alloys are not part of this review since the Agency did not receive any information or data from commenters that would allow the Agency to conclude that lead in all other alloys are similarly situated.

6e) A facility processed 200 pounds of lead in alloys other than stainless steel, brass or bronze alloy. In doing so the facility has exceeded the 100 pound reporting threshold for lead and, therefore, must file a Form R for lead. In the same calendar year the facility processed 24,000 pounds of lead in stainless steel, brass or bronze alloy. Does the facility need to include releases and waste management quantities of the lead in stainless steel, brass, or bronze alloy on the Form R?

Answer: No, because the 25,000 pound processing threshold is not exceeded in this scenario. There are two thresholds to consider in this scenario: the 100 pound threshold for lead **not** in stainless steel, brass or bronze alloys, and the 25,000 pound processing threshold for all lead, including lead in stainless steel, brass and bronze alloys (i.e., the qualified alloys). In this scenario the 100 pound reporting (activity) threshold is exceeded, but the 25,000 pound activity threshold is not exceeded. The 100 pound threshold is exceeded because of the processing of 200 pounds of lead in alloys other than stainless steel, brass or bronze. The 25,000 pound threshold is not exceeded because the combined weight of lead in the qualified alloys and non-qualified alloys does not meet or exceed 25,000 pounds (24,000 pounds + 200 pounds = 24,200 pounds). If, however, in this scenario the amount of processed lead in stainless steel, brass, or bronze were 24,850 pounds, then both the 100 pound threshold and the 25,000 pounds thresholds are exceeded.

Some important guidelines to use are:

i) quantities of lead "in stainless steel, brass or bronze alloy," are only applied toward the 25,000/10,000 pound thresholds;

ii) quantities of lead <u>not</u> in stainless steel, brass or bronze alloys are applied to both the 100 pound threshold and the 25,000/10,000 pound thresholds;

iii) a facility may take the *de minimis* exemption (i.e., threshold variable) for those quantities of lead in stainless steel, brass, or bronze alloys that meet the *de minimis* exemption requirements (*e.g.*, manufactured as an impurity). The *de minimis* exemption applies to threshold determinations addressing numerous activities at a facility. However, the *de minimis* exemption does not include listed substances that are manufactured as byproducts. More details on this point are available. (See Appendix A, Directive 2 of "EPCRA Section 313 Questions and Answers [Q&As] - Revised 1998 Version". The Q&A document is available at http://www.epa.gov/tri/guid_docs). Accordingly, EPA will allow the *de minimis* exemption to be considered for all quantities of lead in stainless steel, brass, or bronze alloy even though this exemption will not be applied to lead <u>not</u> in stainless steel, brass, or bronze alloy.

iv) The Form A certification statement and range reporting for Sections 5 and 6 of Part II of the Form R) cannot be applied to lead reporting if the lower, 100 pound threshold has been exceeded. Therefore, if a facility exceeds the 25,000/10,000 pound threshold but does not exceed the 100 pound threshold, the facility may consider the reporting variables. If the 100 pound threshold is exceeded, the facility may not use the Form A certification statement or range reporting option on the Form R even if the 25,000/10,000 pound threshold is also exceeded.

v) because there is only one listing for lead, consolidated reporting between lead and lead compounds is required.

6f) If a facility processes 95 pounds of lead in alloys other than stainless steel, brass or bronze alloys, and processes 24,910 pounds of lead in stainless steel, brass or bronze alloy, does the facility need to prepare a Form R?

Answer: Yes, because the 25,000 pound threshold for lead in stainless steel, brass or bronze has been exceeded. The 100 pound threshold for lead has not been exceeded. In this scenario the facility may consider the *de minimis* exemption for quantities of lead in stainless steel, brass, or bronze alloy and the facility may consider the use of the Form A certification statement, range reporting, and pre-PBT significant digit reporting requirement options.

6g) I use cold rolled steel that contains lead and stainless steel that contains lead. I exceed the 100 pound threshold for lead in the cold rolled steel, but I do not exceed the 10,000 pound threshold for otherwise using lead when contained in stainless steel. Do I have to consider when preparing my Form R report the releases and other waste management of lead from both the stainless and the cold rolled steel, or just the releases from the cold rolled steel?

Answer: If a facility meets or exceeds a threshold for lead of 25,000 pounds manufactured, 25,000 pounds processed, or 10,000 pounds otherwise used, then all lead (except for specific quantities qualifying for one of the exemptions) at the facility is reportable. However, if only the 100 pound threshold for manufacturing, processing or otherwise use is exceeded for "lead (except when contained in stainless steel, brass, or bronze alloy)" then all releases and other waste management quantities of lead is reportable, except for the lead when contained in the qualified alloys. Thus, in the scenario described in *question 6g* above, the releases and other waste management activities (quantities) of lead from the stainless steel that contains lead does not have to be considered for preparing the Form R report.

Question 7. *Where can I see specifics about Form R and what information is required to complete Form R for lead.*

Answer: A good place to start is to go to EPA's Toxic Release Inventory Program's internet home page: http://www.epa.gov/tri/. Once you are at this site look for "Reporting Forms and Instructions" for information about Form R, how to complete a Form R report, as well as other related information. You may also want to browse the Toxics Release Inventory Public Data Release report, which is published annually by the EPA's Office of Environmental Information. Information pertaining to obtaining a copy of this report is also available from the above internet address.

Question 8. *Piston-powered aircraft currently use leaded aviation fuel (AVGAS). There seems to be some question as to whether the new 100 pound reporting threshold for lead and lead compounds would apply to businesses that transport, store, and sell leaded AVGAS. There is also some concern that the new reporting requirements may also apply to businesses that consume leaded AVGAS through the operation of their aircraft. What is the applicability of the new reporting requirements for lead and lead compounds to the general aviation industry?*

Answer: To address this question concerning the reporting of lead contained in leaded gasoline used in aviation fuels several factors need to be considered. The first is whether the facility is in a Standard Industrial Classification (SIC) code covered under section 313 of the Emergency Planning and Community Right-to-Know Act (EPCRA). In addition, under EPCRA section 313 there is a motor vehicle exemption that exempts the otherwise use of fuel in motor vehicles (including aircraft). Also, while petroleum bulk terminals (SIC code 5171) are covered facilities, not all facilities that transport, store, and sell AVGAS are in covered SIC codes. (The complete list of SIC codes covered by section 313 of EPCRA is listed in the answer to question 1 above.)

Below are excerpts from the Response-to-Comments document from the final TRI lead rule that lowered the EPCRA section 313 reporting thresholds for lead and lead compounds. These excerpts contain EPA's responses to comments pertaining to the SIC code issue. Also provided below are: 1) some questions and answers from EPA's document "EPCRA Section 313 Questions and Answers [Q&As] - Revised 1998 Version"; and 2) the directive on the motor vehicle exemption from the Q&A document. The Q&As below mention aircraft specifically but there are additional Q&As on fuels and motor vehicles (e.g., Q&As 285-291), the Q&A document is available at http://www.epa.gov/tri/guid_docs.

EPA does not expect that aviation businesses would be affected by lower reporting thresholds for lead and lead compounds. As a group, establishments engaged in furnishing transportation by air and in operating airports and flying fields are found in major SIC code 4500 (Transportation by air). This is not an SIC code that is subject to reporting under EPCRA section 313. In addition, many of the commenter's examples of lead and lead compound uses in aviation–ballasts, flight controls, wheels, and propellers–are likely to be covered by the article exemption in their use.

The following two questions and answers and directive are from the "EPCRA Section 313 Questions and Answers - Revised 1998 Version" (December 1998, EPA-745-B-98-004).

"192. A covered facility manufactures and repairs airplanes. Prior to beginning any repair work, any fuel remaining in the airplane's fuel tanks is emptied by service personnel at the facility. After the repairs are completed, the airplane is refueled with fuel removed from the airplane's fuel tanks and/or new fuel. Should the owner/operator of the manufacturing and repair facility consider the toxic chemicals present in the fuel when making Section 313 threshold and release and other waste management calculations?

Yes. For purposes of EPCRA Section 313 threshold determinations and release and other waste management calculations, the listed toxic chemicals present in the fuel are considered to be processed because they are being repackaged and further distributed in commerce."

"290. An airplane manufacturer uses JP4, a jet fuel, to move the planes around the facility. Can this fuel be considered exempt under the "maintenance of motor vehicles used at the facility" exemption?

Amounts of fuel used only at the facility to transport vehicles on the facility's property do not have to be counted towards thresholds and can be included under the motor vehicle exemption. If the jet fuel is in the planes when they leave the site to be sold or distributed in commerce, then the facility is considered to be processing the jet fuel and the listed chemicals in the fuel are subject to threshold determinations and release and other waste management calculations."

Motor Vehicle Exemptions

The use of "products containing toxic chemicals for the purpose of maintaining motor vehicles operated by the facility" is exempt from threshold determinations and release and other waste management reporting under Section 313. This exemption includes toxic chemicals found in gasoline, diesel fuel, brake and transmission fluids, oils and lubricants, antifreeze, batteries, cleaning solutions, and solvents in paint used for touch up, as long as the products are used to maintain the vehicle operated by the facility. Motor vehicles include cars, trucks, some cranes, forklifts, locomotive engines, and aircraft.

1. Motor Vehicle Use Exemption Applies Only to Otherwise Use of Chemical

The exemption applies only to the otherwise use of these chemicals, not their manufacturing or processing for distribution in commerce. For example, manufacturing gasoline is not exempt from reporting. Similarly, an automobile manufacturer who places transmission fluids in automobiles before shipping the automobiles would be processing the listed toxic chemical because the fluid is being incorporated into an item that the facility distributes in commerce.

Releases from the storage of fuel or motor vehicle maintenance products are exempt from reporting by virtue of the fact that their use is exempt. For example, releases of listed toxic chemicals in gasoline stored on-site for use in company owned vehicles are exempt from inclusion in facility-wide release and other waste management determinations for those chemicals.

2. Motor Vehicle Use Exemption Does Not Apply to Stationary Equipment

The motor vehicle exemption does not apply to the use of lubricants for stationary process equipment such as pumps or compressors. Likewise, fuels used for furnaces, boilers, heaters, or any stationary source of energy are not exempt.

Question 9. *Could EPA provide clarification on the applicability of the new TRI lead rule to stained glass manufacturers, stained glass studios, stained glass glaziers (window manufacturers), stained glass businesses that manufacture lamps, boxes, etc., studios that restore architectural stained glass, and glass blowing studios ?*

Answer: A facility is required to file Form R reports under the new TRI lead rule if it meets all three of the following criteria: 1) it is included in certain Standard Industrial Classification (SIC) codes; 2) it has 10 or more full-time employee equivalents (i.e., the equivalent of 20,000 hours per year); and 3) it manufactures (includes imports), processes, or otherwise uses more than 100 pounds of lead or lead compounds annually, or manufactures or processes 25,000 pounds or otherwise uses 10,000 pounds of lead in stainless steel, brass or bronze alloys. There are SIC codes that pertain to glass blowing and the manufacture of stained or colored glass that are covered under EPCRA section 313. These are: SIC code 3231, stained glass, manufactured from purchased glass; SIC code 3211, manufacture of colored glass, cathedral and antique; SIC codes 3229 and 3231, decorative glass; SIC code 3559, glass making machinery, glass blowing, molding, forming, grinding, etc. There are other SIC codes that pertain to the manufacture, processing or otherwise use of glass products and that are covered under EPCRA section 313. There is a SIC code (8999) that pertains to stained glass artists, but this SIC code is not covered under EPCRA section 313.

Question 10: *A facility exceeds a reporting threshold for lead metal. The facility also has lead piping in its operations. The natural degradation of the lead piping causes lead to be released in wastewater. Does the facility need to report this lead as released to water on the Form R required to be submitted?*

Answer: Yes. While the release of lead from the pipes is not related to a threshold activity (i.e., a release activity by itself does not constitute the manufacture, processing, or otherwise use of lead or a lead compound), if the threshold for lead has been exceeded as result of manufacturing, processing, or otherwise use of lead elsewhere at the facility all other non-exempt releases and other waste management quantities of lead must be included on the Form R. Such releases are not

considered, however, in determining whether an activity threshold has been exceeded. For example, in the above scenario the release of lead from degradation of the pipes would not be added to the quantity that is being applied to the threshold determination. Pipes used in a non-process related activity may qualify for the structural component exemption. It is important to note that the answer provided here is based on the scenario provided in the question that the lead is being released from the pipe as lead itself (i.e., Pb^0), not as a lead compound, such as lead oxide. If in this example the lead released from the pipe were in the form of a lead compound, the release of the lead from the piping would not have to be included on the Form R.

Question 11. *Our company is a decorator of decorative plates for major marketing companies, such as the Franklin Mint and Bradford Exchange. A lead-bearing ceramic decal is sent to us by customers. We hand apply the decal on porcelain and kiln fire. (We're fairly certain that lead contained in the decal processed per annum weighs more than 100 pounds) We apply 100's of different decals per year, sent to us from all over the world. Accordingly, we think it almost impossible to get an MSDS for each decal.*

In determining lead processing and it's waste stream… we are not sure how to approach this. Is it necessary to measure lead in the air above our stack? Is it necessary to measure lead in water in which the decal is soaked?

Answer: The total quantity of a TRI chemical going into/through a facility's manufacturing/processing operations and that becomes incorporated into the product to be distributed in commerce is counted toward the processing activity threshold even though a portion of that TRI chemical may not become part of the product and would be released into the environment or be managed as a waste via recycling, energy recovery or treatment.

In the case of material being recycled, any recycled on-site would ***not*** be counted as new material when reentering the facility's manufacturing/processing operations. But material recycled off-site would be counted as new material when entering the facility's manufacturing/processing operations.

Metallic decals applied to glass via heat could remain articles, if they do not change totally in thickness or diameter and less than 0.5 pounds of the TRI chemical from all like items is released into the environment over the calender year. The separation of the decal from its backing does ***not*** change its article status.

Small amounts of lead in a raw material (either as an impurity or as a necessary ingredient) must be counted toward the processing activity threshold.

APPENDIX C

Emission Factors Compiled from Various Sources

Appendix C contains emission factors compiled from various sources including version 6.23 of EPA's Factor Information Retrieval (FIRE) Data System, and the California Air Resource Board's (CARB) California Air Toxic Emission Factors for Lead. The FIRE database can be accessed through the Clearinghouse for Inventories and Emissions Factors (CHIEF) website at http://www.epa.gov/air/ttn/chief. Mouse-over the "Software and Tools" link, select "FIRE", and choose "Download FIRE Software" or "FIRE FAQ" to view information on the FIRE database.

The data fields shown in Table C-1 in this appendix are as follows:

1) *Material* - The substance being manufactured, processed, or combusted.
2) *Source Classification Code* - A numeric code related to the material and controls.
3) *Primary Control* - The primary air pollution control device used on the tested source if applicable.
4) *Secondary Control* - The secondary air pollution control device used on the tested source if applicable.
5) *Emission Factor* - The numerical result of the source test, usually an average of many tests.
6) *Unit* - The measurement of the air emissions, usually in pounds of lead.
7) *Measure* - The measurement of the amount of material manufactured, processed, or combusted.
8) *Action* - Whether the material was manufactured, processed, or combusted.
9) *Notes* - Any qualifications that must be reported regarding the use or interpretation of the emission factor.
10) *Formula* - Any equation that must be reported regarding the use or interpretation of the emission factor.
11) *Reference* - The document describing the development of the emission factor.
12) *Quality* - A data quality rating (e.g., A, B, C, D, E, or U) as defined below.

Data quality ratings for the source tests and the number of source tests available for a given emission point were used to create the emission factor quality ratings shown in the FIRE database.

Because of the difficult task of assigning a meaningful confidence limit to industry-specific variables (e.g., sample size vs. sample population, industry and facility variability, method of measurement), the use of a statistical confidence interval for establishing a representative emission factor for each source category was not practical. Therefore, some subjective quality rating was necessary. The following quality ratings were used in the emission factor tables in the FIRE Data System:

A Excellent. Emission factor is developed primarily 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. Emission factor is developed primarily from A- or B-rated test data from a moderate 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.

C Average. Emission factor is developed primarily from A-, B-, and 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. Emission factor is developed primarily from A-, B-, and 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- rated and D-rated test data from a very few number of facilities, and there may be reasons 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.

U Unrated (Only used in the *Locating and Estimating Air Toxic Emissions* report series - Reference 4). Emission factor is developed from source tests that have not been thoroughly evaluated, research papers, modeling data, or other sources that may lack supporting documentation. The data are not necessarily "poor," but there is not enough information to rate the factors according to the rating protocol.

Table C-1

Lead Emission Factors Compiled from Version 6.23 of the Factor Information Retrieval (FIRE) Data System

Material	Source Classification Code	Primary Control	Secondary Control	Emission Factor	Unit	Measure	Action	Notes	References	Quality
Air-Dried Unbleached Pulp	30700106	Uncontrolled		1.09E-04	Lb	Tons	Produced	Detection Limits Used for Non-detects.	ECOSERVE, Inc. Environmental Services. November 27, 1990. In: Pooled Air Toxics Source Test Program for Kraft Pulp Mills, Report Number 2. Report #1249A. Simpson Paper Company. Anderson, California.	U
Anthracite	10200104	Uncontrolled		8.90E-03	Lb	Tons	Burned		EPA. 1995. Section 1.2, Anthracite Coal Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	E
Anthracite	10200107	Uncontrolled		8.90E-03	Lb	Tons	Burned		EPA. 1995. Section 1.2, Anthracite Coal Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	E
Anthracite	10300101	Uncontrolled		8.90E-03	Lb	Tons	Burned		EPA. 1995. Section 1.2, Anthracite Coal Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	E
Anthracite	10100101	Uncontrolled		8.90E-03	Lb	Tons	Burned		EPA. 1995. Section 1.2, Anthracite Coal Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	E
Anthracite	10300103	Uncontrolled		8.90E-03	Lb	Tons	Burned		EPA. 1995. Section 1.2, Anthracite Coal Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	E
Anthracite	10200101	Uncontrolled		8.90E-03	Lb	Tons	Burned		EPA. 1995. Section 1.2, Anthracite Coal Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	E

Table C-1 (Continued)

Lead Emission Factors Compiled from Version 6.23 of the Factor Information Retrieval (FIRE) Data System

Material	Source Classification Code	Primary Control	Secondary Control	Emission Factor	Unit	Measure	Action	Notes	References	Quality
Anthracite	10300102	Uncontrolled		8.90E-03	Lb	Tons	Burned		EPA. 1995. Section 1.2, Anthracite Coal Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	E
Anthracite	10100102	Uncontrolled		8.90E-03	Lb	Tons	Burned		EPA. 1995. Section 1.2, Anthracite Coal Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	E
Bark	10300901	Uncontrolled		4.45E-04	Lb	Tons	Burned	Emission Factors Are Based on Wet, As-fired Wood Waste with Average Properties of 50 Weight Percent Moisture and 2,500 Kcal/kg (4,500 Btu/lb) Higher Heating Value.	EPA. October, 1996. Section 1.6, Table 5, Wood Waste Combustion in Boilers. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42, Supplement B. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	B
Bark	10200901	Uncontrolled		4.45E-04	Lb	Tons	Burned	Emission Factors Are Based on Wet, As-fired Wood Waste with Average Properties of 50 Weight Percent Moisture and 2,500 Kcal/kg (4,500 Btu/lb) Higher Heating Value.	EPA. October, 1996. Section 1.6, Table 5, Wood Waste Combustion in Boilers. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42, Supplement B. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	B
Bark	10300901	Uncontrolled		2.90E-03	Lb	Tons	Burned	Units Are Lb of Pollutant/ton of Wood Waste Burned. Emission Factors Are Based on Wet, As-fired Wood Waste with Average Properties of 50 Weight% Moisture and 4500 Btu/lb Higher Heating Value.	EPA. February, 1999. Section 1.6, Wood Waste Combustion In Boilers. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42, Supplement E. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	D

Table C-1 (Continued)

Lead Emission Factors Compiled from Version 6.23 of the Factor Information Retrieval (FIRE) Data System

Material	Source Classification Code	Primary Control	Secondary Control	Emission Factor	Unit	Measure	Action	Notes	References	Quality
Bark	10100901	Uncontrolled		2.90E-03	Lb	Tons	Burned	Units Are Lb of Pollutant/ton of Wood Waste Burned. Emission Factors Are Based on Wet, As-fired Wood Waste with Average Properties of 50 Weight% Moisture and 4500 Btu/lb Higher Heating Value.	EPA. February, 1999. Section 1.6, Wood Waste Combustion In Boilers. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42, Supplement E. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	D
Bark	10200904	Uncontrolled		4.45E-04	Lb	Tons	Burned	Emission Factors Are Based on Wet, As-fired Wood Waste with Average Properties of 50 Weight Percent Moisture and 2,500 Kcal/kg (4,500 Btu/lb) Higher Heating Value.	EPA. October, 1996. Section 1.6, Table 5, Wood Waste Combustion in Boilers. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42, Supplement B. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	B
Bark	10200904	Uncontrolled		2.90E-03	Lb	Tons	Burned	Units Are Lb of Pollutant/ton of Wood Waste Burned. Emission Factors Are Based on Wet, As-fired Wood Waste with Average Properties of 50 Weight% Moisture and 4500 Btu/lb Higher Heating Value.	EPA. February, 1999. Section 1.6, Wood Waste Combustion In Boilers. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42, Supplement E. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	D
Bark	10200901	Uncontrolled		2.90E-03	Lb	Tons	Burned	Units Are Lb of Pollutant/ton of Wood Waste Burned. Emission Factors Are Based on Wet, As-fired Wood Waste with Average Properties of 50 Weight% Moisture and 4500 Btu/lb Higher Heating Value.	EPA. February, 1999. Section 1.6, Wood Waste Combustion In Boilers. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42, Supplement E. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	D

Table C-1 (Continued)

Lead Emission Factors Compiled from Version 6.23 of the Factor Information Retrieval (FIRE) Data System

Material	Source Classification Code	Primary Control	Secondary Control	Emission Factor	Unit	Measure	Action	Notes	References	Quality
Bark	10200901	Miscellaneous Control Devices		4.45E-04	Lb	Tons	Burned	Units Are Lb of Pollutant/ton of Wood Waste Burned. Emission Factors Are Based on Wet, As-fired Wood Waste with Average Properties of 50 Weight% Moisture and 4500 Btu/lb Higher Heating Value. Emission Factor Represents Measurements from Wood Waste Combustors Equipped with Pm Controls (I.e., Fabric Filters, Multi-cyclones, Esp, and Wet Scrubbers).	EPA. February, 1999. Section 1.6, Wood Waste Combustion In Boilers. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42, Supplement E. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	B
Bark	10300901	Miscellaneous Control Devices		4.45E-04	Lb	Tons	Burned	Units Are Lb of Pollutant/ton of Wood Waste Burned. Emission Factors Are Based on Wet, As-fired Wood Waste with Average Properties of 50 Weight% Moisture and 4500 Btu/lb Higher Heating Value. Emission Factor Represents Measurements from Wood Waste Combustors Equipped with Pm Controls (I.e., Fabric Filters, Multi-cyclones, Esp, and Wet Scrubbers).	EPA. February, 1999. Section 1.6, Wood Waste Combustion In Boilers. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42, Supplement E. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	B

Table C-1 (Continued)

Lead Emission Factors Compiled from Version 6.23 of the Factor Information Retrieval (FIRE) Data System

Material	Source Classification Code	Primary Control	Secondary Control	Emission Factor	Unit	Measure	Action	Notes	References	Quality
Bark	10200904	Miscellaneous Control Devices		4.45E-04	Lb	Tons	Burned	Units Are Lb of Pollutant/ton of Wood Waste Burned. Emission Factors Are Based on Wet, As-fired Wood Waste with Average Properties of 50 Weight% Moisture and 4500 Btu/lb Higher Heating Value. Emission Factor Represents Measurements from Wood Waste Combustors Equipped with Pm Controls (I.e., Fabric Filters, Multi-cyclones, Esp, and Wet Scrubbers).	EPA. February, 1999. Section 1.6, Wood Waste Combustion In Boilers. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42, Supplement E. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	B
Bark	10100901	Miscellaneous Control Devices		4.45E-04	Lb	Tons	Burned	Units Are Lb of Pollutant/ton of Wood Waste Burned. Emission Factors Are Based on Wet, As-fired Wood Waste with Average Properties of 50 Weight% Moisture and 4500 Btu/lb Higher Heating Value. Emission Factor Represents Measurements from Wood Waste Combustors Equipped with Pm Controls (I.e., Fabric Filters, Multi-cyclones, Esp, and Wet Scrubbers).	EPA. February, 1999. Section 1.6, Wood Waste Combustion In Boilers. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42, Supplement E. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	B
Bark	10100901	Uncontrolled		4.45E-04	Lb	Tons	Burned	Emission Factors Are Based on Wet, As-fired Wood Waste with Average Properties of 50 Weight Percent Moisture and 2,500 Kcal/kg (4,500 Btu/lb) Higher Heating Value.	EPA. October, 1996. Section 1.6, Table 5, Wood Waste Combustion in Boilers. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42, Supplement B. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	B

Table C-1 (Continued)

Lead Emission Factors Compiled from Version 6.23 of the Factor Information Retrieval (FIRE) Data System

Material	Source Classification Code	Primary Control	Secondary Control	Emission Factor	Unit	Measure	Action	Notes	References	Quality
Batteries	30400506	Uncontrolled		7.70E-01	Lb	1000 Each	Produced		EPA. 1995. Section 12.15, Storage Battery Production. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	B
Batteries	30400509	Uncontrolled		1.06E+01	Lb	1000 Each	Produced		EPA. 1995. Section 12.15, Storage Battery Production. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	B
Batteries	30400508	Baghouse		1.10E-01	Lb	1000 Each	Produced		EPA. 1995. Section 12.15, Storage Battery Production. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	C
Batteries	30400505	Uncontrolled		1.53E+01	Lb	1000 Each	Produced		EPA. 1995. Section 12.15, Storage Battery Production. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	U
Batteries	30400504	Uncontrolled		8.15E-01	Lb	Tons	Produced			U
Batteries	30400503	Uncontrolled		1.92E-01	Lb	Tons	Produced			U
Batteries	30400502	Uncontrolled		5.90E-02	Lb	Tons	Produced			U

Table C-1 (Continued)

Lead Emission Factors Compiled from Version 6.23 of the Factor Information Retrieval (FIRE) Data System

Material	Source Classification Code	Primary Control	Secondary Control	Emission Factor	Unit	Measure	Action	Notes	References	Quality
Batteries	30400507	Uncontrolled		1.10E+00	Lb	1000 Each	Produced		EPA. 1995. Section 12.15, Storage Battery Production. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	B
Batteries	30400510	Uncontrolled		7.70E-01	Lb	1000 Each	Produced		EPA. 1995. Section 12.15, Storage Battery Production. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	B
Batteries	30400509	Fabric Filter		3.77E-01	Lb	1000 Each	Produced	Baghouse Average Efficiency of 97.5% - 98.5%. Lack of Supporting Documentation.	Composite. Radian FIRE database 1993 Release.	U
Batteries	30400511	Uncontrolled		1.00E-01	Lb	1000 Each	Produced		EPA. 1995. Section 12.15, Storage Battery Production. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	C
Batteries	30400506	Rotoclone		6.73E-02	Lb	1000 Each	Produced	Lack of Supporting Documentation.	Composite. Radian FIRE database 1993 Release.	U
Batteries	30400501	Uncontrolled		1.18E+00	Lb	Tons	Produced			U
Batteries	30400508	Uncontrolled		1.10E-01	Lb	1000 Each	Produced		EPA. September 1985. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fourth Edition with Supplements A, B, and C, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	U
Bituminous Coal	10200206	Uncontrolled		1.33E-02	Lb	Tons	Burned	Lack of Supporting Documentation.	EPA. March 1982. In: Fossil Fuel Fired Industrial Boilers - Background Information, Volume 1: Chapters 1-9. EPA-450/3-82-006a. U.S. Environmental Protection Agency. Research Triangle Park, North Carolina.	U

Table C-1 (Continued)

Lead Emission Factors Compiled from Version 6.23 of the Factor Information Retrieval (FIRE) Data System

Material	Source Classification Code	Primary Control	Secondary Control	Emission Factor	Unit	Measure	Action	Notes	References	Quality
Bituminous Coal	10100212	Miscellaneous Control Devices		4.20E-04	Lb	Tons	Burned	Esp or Fabric Filter Only & Wet Limestone Scrubber or Spray Dryer W/esp or Fabric Filter	EPA. September, 1998. Section 1.1, Bituminous and Subbituminous Coal Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42, Supplement E. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	A
Bituminous Coal	10300208	Multiple Cyclone W/o Fly Ash Reinjection		3.93E-02	Lb	Tons	Burned	Cem, Flue Gas O2 Averaged 5.2%, Co2 12.9% (Dry), 16% by Weight Mixed Fuel. Lack of Supporting Documentation.	EPA. May 1986. In: Project Summary: Environmental Assessment of a Commercial Boiler Fired with a Coal/Waste Plastic Mixture. EPA-600/S7-86/011. U.S. Environmental Protection Agency, Air and Energy Engineering Research Laboratory. Research Triangle Park, North Carolina.	U
Bituminous Coal	10300208	Multiple Cyclone W/o Fly Ash Reinjection		1.21E-03	Lb	Tons	Burned	Cem, Flue Gas O2 Averaged 7%, Co2 12% (Dry). Lack of Supporting Documentation.	EPA. May 1986. In: Project Summary: Environmental Assessment of a Commercial Boiler Fired with a Coal/Waste Plastic Mixture. EPA-600/S7-86/011. U.S. Environmental Protection Agency, Air and Energy Engineering Research Laboratory. Research Triangle Park, North Carolina.	U
Bituminous Coal	10200201	Uncontrolled		1.33E-02	Lb	Tons	Burned	Based on Literature Review.	EPA. 1995. Section 1.1, Bituminous and Subbituminous Coal Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	E
Bituminous Coal	10300209	Uncontrolled		1.33E-02	Lb	Tons	Burned	Based on Literature Review.	EPA. 1995. Section 1.1, Bituminous and Subbituminous Coal Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	E
Bituminous Coal	10200204	Uncontrolled		1.33E-02	Lb	Tons	Burned	Based on Literature Review.	EPA. 1995. Section 1.1, Bituminous and Subbituminous Coal Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	E

Table C-1 (Continued)

Lead Emission Factors Compiled from Version 6.23 of the Factor Information Retrieval (FIRE) Data System

Material	Source Classification Code	Primary Control	Secondary Control	Emission Factor	Unit	Measure	Action	Notes	References	Quality
Bituminous Coal	10200202	Uncontrolled		1.33E-02	Lb	Tons	Burned	Based on Literature Review.	EPA. 1995. Section 1.1, Bituminous and Subbituminous Coal Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	E
Bituminous Coal	10200205	Uncontrolled		1.33E-02	Lb	Tons	Burned	Based on Literature Review.	EPA. 1995. Section 1.1, Bituminous and Subbituminous Coal Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	E
Bituminous Coal	10100218	Miscellaneous Control Devices		4.20E-04	Lb	Tons	Burned	Esp or Fabric Filter Only & Wet Limestone Scrubber or Spray Dryer W/esp or Fabric Filter	EPA. September, 1998. Section 1.1, Bituminous and Subbituminous Coal Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42, Supplement E. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	A
Bituminous Coal	10300214	Uncontrolled		1.33E-02	Lb	Tons	Burned	Assumed Same as Other Coal Combustion Lead Factors.		E
Bituminous Coal	10300206	Uncontrolled		1.33E-02	Lb	Tons	Burned	Based on Literature Review.	EPA. 1995. Section 1.1, Bituminous and Subbituminous Coal Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	E
Bituminous Coal	10100201	Uncontrolled		1.33E-02	Lb	Tons	Burned	Based on Literature Review.	EPA. 1995. Section 1.1, Bituminous and Subbituminous Coal Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	E

Table C-1 (Continued)

Lead Emission Factors Compiled from Version 6.23 of the Factor Information Retrieval (FIRE) Data System

Material	Source Classification Code	Primary Control	Secondary Control	Emission Factor	Unit	Measure	Action	Notes	References	Quality
Bituminous Coal	10300205	Uncontrolled		1.33E-02	Lb	Tons	Burned	Based on Literature Review.	EPA. 1995. Section 1.1, Bituminous and Subbituminous Coal Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	E
Bituminous Coal	10200203	Uncontrolled		1.33E-02	Lb	Tons	Burned	Based on Literature Review.	EPA. 1995. Section 1.1, Bituminous and Subbituminous Coal Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	E
Bituminous Coal	10100202	Uncontrolled		1.33E-02	Lb	Tons	Burned	Based on Literature Review.	EPA. 1995. Section 1.1, Bituminous and Subbituminous Coal Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	E
Bituminous Coal	10100203	Uncontrolled		1.33E-02	Lb	Tons	Burned	Based on Literature Review.	EPA. 1995. Section 1.1, Bituminous and Subbituminous Coal Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	E
Bituminous Coal	10100204	Uncontrolled		1.33E-02	Lb	Tons	Burned	Based on Literature Review.	EPA. 1995. Section 1.1, Bituminous and Subbituminous Coal Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	E

Table C-1 (Continued)

Lead Emission Factors Compiled from Version 6.23 of the Factor Information Retrieval (FIRE) Data System

Material	Source Classification Code	Primary Control	Secondary Control	Emission Factor	Unit	Measure	Action	Notes	References	Quality
Bituminous Coal	10100205	Uncontrolled		1.33E-02	Lb	Tons	Burned	Based on Literature Review.	EPA. 1995. Section 1.1, Bituminous and Subbituminous Coal Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	E
Bituminous Coal	10300208	Uncontrolled		1.33E-02	Lb	Tons	Burned	Assumed Same as Other Coal Combustion Lead Factors.		E
Bituminous Coal	10300207	Uncontrolled		1.33E-02	Lb	Tons	Burned	Based on Literature Review.	EPA. 1995. Section 1.1, Bituminous and Subbituminous Coal Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	E
Bituminous Coal	10200210	Uncontrolled		1.33E-02	Lb	Tons	Burned			U
Bituminous Coal	10300211	Uncontrolled		1.33E-02	Lb	Tons	Burned			U
Bituminous Coal	10300218	Miscellaneous Control Devices		4.20E-04	Lb	Tons	Burned	Esp or Fabric Filter Only & Wet Limestone Scrubber or Spray Dryer W/esp or Fabric Filter	EPA. September, 1998. Section 1.1, Bituminous and Subbituminous Coal Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42, Supplement E. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	A
Bituminous Coal	10200202	Miscellaneous Control Devices		4.20E-04	Lb	Tons	Burned	Esp or Fabric Filter Only & Wet Limestone Scrubber or Spray Dryer W/esp or Fabric Filter	EPA. September, 1998. Section 1.1, Bituminous and Subbituminous Coal Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42, Supplement E. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	A

Table C-1 (Continued)

Lead Emission Factors Compiled from Version 6.23 of the Factor Information Retrieval (FIRE) Data System

Material	Source Classification Code	Primary Control	Secondary Control	Emission Factor	Unit	Measure	Action	Notes	References	Quality
Bituminous Coal	10200212	Miscellaneous Control Devices		4.20E-04	Lb	Tons	Burned	Esp or Fabric Filter Only & Wet Limestone Scrubber or Spray Dryer W/esp or Fabric Filter	EPA. September, 1998. Section 1.1, Bituminous and Subbituminous Coal Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42, Supplement E. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	A
Bituminous Coal	10300203	Uncontrolled		1.33E-02	Lb	Tons	Burned	Based on Literature Review.	EPA. 1995. Section 1.1, Bituminous and Subbituminous Coal Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	E
Bituminous Coal	10300216	Miscellaneous Control Devices		4.20E-04	Lb	Tons	Burned	Esp or Fabric Filter Only & Wet Limestone Scrubber or Spray Dryer W/esp or Fabric Filter	EPA. September, 1998. Section 1.1, Bituminous and Subbituminous Coal Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42, Supplement E. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	A
Bituminous Coal	10200218	Miscellaneous Control Devices		4.20E-04	Lb	Tons	Burned	Esp or Fabric Filter Only & Wet Limestone Scrubber or Spray Dryer W/esp or Fabric Filter	EPA. September, 1998. Section 1.1, Bituminous and Subbituminous Coal Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42, Supplement E. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	A
Bituminous Coal	10300203	Miscellaneous Control Devices		4.20E-04	Lb	Tons	Burned	Esp or Fabric Filter Only & Wet Limestone Scrubber or Spray Dryer W/esp or Fabric Filter	EPA. September, 1998. Section 1.1, Bituminous and Subbituminous Coal Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42, Supplement E. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	A

Table C-1 (Continued)

Lead Emission Factors Compiled from Version 6.23 of the Factor Information Retrieval (FIRE) Data System

Material	Source Classification Code	Primary Control	Secondary Control	Emission Factor	Unit	Measure	Action	Notes	References	Quality
Bituminous Coal	10100203	Miscellaneous Control Devices		4.20E-04	Lb	Tons	Burned	Esp or Fabric Filter Only & Wet Limestone Scrubber or Spray Dryer W/esp or Fabric Filter	EPA. September, 1998. Section 1.1, Bituminous and Subbituminous Coal Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42, Supplement E. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	A
Bituminous Coal	10200203	Miscellaneous Control Devices		4.20E-04	Lb	Tons	Burned	Esp or Fabric Filter Only & Wet Limestone Scrubber or Spray Dryer W/esp or Fabric Filter	EPA. September, 1998. Section 1.1, Bituminous and Subbituminous Coal Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42, Supplement E. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	A
Bituminous Coal	10100202	Miscellaneous Control Devices		4.20E-04	Lb	Tons	Burned	Esp or Fabric Filter Only & Wet Limestone Scrubber or Spray Dryer W/esp or Fabric Filter	EPA. September, 1998. Section 1.1, Bituminous and Subbituminous Coal Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42, Supplement E. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	A
Bituminous Coal	10300206	Miscellaneous Control Devices		4.20E-04	Lb	Tons	Burned	Esp or Fabric Filter Only & Wet Limestone Scrubber or Spray Dryer W/esp or Fabric Filter	EPA. September, 1998. Section 1.1, Bituminous and Subbituminous Coal Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42, Supplement E. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	A
Body	31502101	Uncontrolled		6.62E-05	Lb	Each	Burned	Wrapping Material = 4 Lbs of Cardboard and 2 Lbs of Wood.	Emissions Testing of a Propane Fired Incinerator at a Crematorium. October 29, 1992. (Confidential Report No. ERC-39)	U
Brick	30500361	Uncontrolled		1.20E-04	Lb	Tons	Produced		EPA. August 1997. Section 11.3, Brick And Structural Clay Product Manufacturing. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42, Supplement C. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	E

Table C-1 (Continued)

Lead Emission Factors Compiled from Version 6.23 of the Factor Information Retrieval (FIRE) Data System

Material	Source Classification Code	Primary Control	Secondary Control	Emission Factor	Unit	Measure	Action	Notes	References	Quality
Brick	30500311	Uncontrolled		1.50E-04	Lb	Tons	Produced		EPA. August 1997. Section 11.3, Brick And Structural Clay Product Manufacturing. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42, Supplement C. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	D
Brick	30500313	Uncontrolled		1.50E-04	Lb	Tons	Produced		EPA. August 1997. Section 11.3, Brick And Structural Clay Product Manufacturing. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42, Supplement C. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	D
Brick	30500310	Uncontrolled		1.50E-04	Lb	Tons	Produced		EPA. August 1997. Section 11.3, Brick And Structural Clay Product Manufacturing. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42, Supplement C. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	D
Bullion	30301002	Baghouse		6.70E-02	Lb	Tons	Processed	This Includes Emissions from Dross Kettles.	EPA. 1995. Section 12.6, Primary Lead Smelting. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	E
Cans	30400109	Venturi Scrubber		2.18E-06	Lb	Pounds	Processed	Cans Are 95% Aluminum by Weight.	Source Emissions Testing of an Aluminum Shredding and Delacquering System. March 26, 1992 and April 10, 1992. (Confidential Report No. ERC-8)	U
Cans	30400109	Multiple Cyclones		1.08E-05	Lb	Pounds	Processed		Emissions Measurements of a Delaquering Unit for AB2588 Toxics. September 7, 1991. (Confidential Report No. ERC-32)	U
Cans	30400109	Baghouse		5.18E-09	Lb	Pounds	Processed	Cans Are 95% Aluminum by Weight.	Source Emissions Testing of an Aluminum Shredding and Delacquering System. March 26, 1992 and April 10, 1992. (Confidential Report No. ERC-8)	U

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Lead Emission Factors Compiled from Version 6.23 of the Factor Information Retrieval (FIRE) Data System

Material	Source Classification Code	Primary Control	Secondary Control	Emission Factor	Unit	Measure	Action	Notes	References	Quality
Cement	30500717	Uncontrolled		2.00E-02	Lb	Tons	Produced		EPA. September 1985. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fourth Edition with Supplements A, B, and C, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	U
Cement	30500606	Uncontrolled		1.20E-01	Lb	Tons	Produced		EPA. September 1985. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fourth Edition with Supplements A, B, and C, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	U
Cement	30500613	Uncontrolled		4.00E-02	Lb	Tons	Produced		EPA. September 1985. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fourth Edition with Supplements A, B, and C, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	U
Cement	30500617	Uncontrolled		4.00E-02	Lb	Tons	Produced		EPA. September 1985. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fourth Edition with Supplements A, B, and C, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	U
Cement	30500706	Uncontrolled		1.00E-01	Lb	Tons	Produced		EPA. September 1985. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fourth Edition with Supplements A, B, and C, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	U
Clinker	30500606	Electrostatic Precipitator		7.10E-04	Lb	Tons	Produced	This Entry Has 4 Scc's: 30500606, 30500706, 30500622, and 30500623.	EPA. 1995. Section 11.6, Portland Cement Manufacturing. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	D

Table C-1 (Continued)

Lead Emission Factors Compiled from Version 6.23 of the Factor Information Retrieval (FIRE) Data System

Material	Source Classification Code	Primary Control	Secondary Control	Emission Factor	Unit	Measure	Action	Notes	References	Quality
Clinker	30500622	Electrostatic Precipitator		7.10E-04	Lb	Tons	Produced	This Entry Has 4 Scc's: 30500606, 30500706, 30500622, and 30500623.	EPA. 1995. Section 11.6, Portland Cement Manufacturing. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	D
Clinker	30500706	Electrostatic Precipitator		7.10E-04	Lb	Tons	Produced	This Entry Has 4 Scc's: 30500606, 30500706, 30500622, and 30500623.	EPA. 1995. Section 11.6, Portland Cement Manufacturing. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	D
Clinker	30500623	Electrostatic Precipitator		7.10E-04	Lb	Tons	Produced	This Entry Has 4 Scc's: 30500606, 30500706, 30500622, and 30500623.	EPA. 1995. Section 11.6, Portland Cement Manufacturing. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	D
Clinker	30500623	Fabric Filter		7.50E-05	Lb	Tons	Produced	This Entry Has 4 Scc's: 30500606, 30500706, 30500622, and 30500623.	EPA. 1995. Section 11.6, Portland Cement Manufacturing. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	D
Clinker	30500622	Fabric Filter		7.50E-05	Lb	Tons	Produced	This Entry Has 4 Scc's: 30500606, 30500706, 30500622, and 30500623.	EPA. 1995. Section 11.6, Portland Cement Manufacturing. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	D
Clinker	30500606	Fabric Filter		7.50E-05	Lb	Tons	Produced	This Entry Has 4 Scc's: 30500606, 30500706, 30500622, and 30500623.	EPA. 1995. Section 11.6, Portland Cement Manufacturing. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	D

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Lead Emission Factors Compiled from Version 6.23 of the Factor Information Retrieval (FIRE) Data System

Material	Source Classification Code	Primary Control	Secondary Control	Emission Factor	Unit	Measure	Action	Notes	References	Quality
Clinker	30500706	Fabric Filter		7.50E-05	Lb	Tons	Produced	This Entry Has 4 Scc's: 30500606, 30500706, 30500622, and 30500623.	EPA. 1995. Section 11.6, Portland Cement Manufacturing. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	D
Concentrated Ore	30300503	Uncontrolled		7.20E-02	Lb	Tons	Processed	The Emission Factor Is Used to Determine Total Process and Fugitive Emissions.	EPA. 1995. Section 12.3, Primary Copper Smelting. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	C
Concentrated Ore	30300504	Uncontrolled		2.70E-01	Lb	Tons	Processed	The Emission Factor Is Used to Determine Total Process and Fugitive Emissions.	EPA. 1995. Section 12.3, Primary Copper Smelting. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	C
Concentrated Ore	30301001	Uncontrolled		1.05E+02	Lb	Tons	Processed			U
Concentrated Ore	30300502	Uncontrolled		1.50E-01	Lb	Tons	Processed	The Emission Factor Is Used to Determine Total Process and Fugitive Emissions.	EPA. 1995. Section 12.3, Primary Copper Smelting. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	C
Concentrated Ore	30301003	Uncontrolled		2.90E+00	Lb	Tons	Processed			U
Concentrated Ore	30301006	Uncontrolled		1.74E+02	Lb	Tons	Processed		EPA. September 1985. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fourth Edition with Supplements A, B, and C, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	U

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Lead Emission Factors Compiled from Version 6.23 of the Factor Information Retrieval (FIRE) Data System

Material	Source Classification Code	Primary Control	Secondary Control	Emission Factor	Unit	Measure	Action	Notes	References	Quality
Distillate Oil	10300502	Uncontrolled		1.25E-03	Lb	1000 Gallons	Burned		EPA. 1995. Section 1.3, Fuel Oil Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	E
Distillate Oil	10200503	Uncontrolled		1.25E-03	Lb	1000 Gallons	Burned		EPA. 1995. Section 1.3, Fuel Oil Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	E
Distillate Oil	10300503	Uncontrolled		1.25E-03	Lb	1000 Gallons	Burned		EPA. 1995. Section 1.3, Fuel Oil Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	E
Distillate Oil	10200502	Uncontrolled		1.25E-03	Lb	1000 Gallons	Burned		EPA. 1995. Section 1.3, Fuel Oil Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	E
Distillate Oil (Diesel)	20100101	Uncontrolled		8.10E-03	Lb	1000 Gallons	Burned		EPA. 1995. Section 3.1, Stationary Gas Turbines for Electricity Generation. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	E
Distillate Oil (No. 1 & 2)	10100501	Uncontrolled		1.25E-03	Lb	1000 Gallons	Burned	Literature Review.	EPA. 1995. Section 1.3, Fuel Oil Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	E

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Lead Emission Factors Compiled from Version 6.23 of the Factor Information Retrieval (FIRE) Data System

Material	Source Classification Code	Primary Control	Secondary Control	Emission Factor	Unit	Measure	Action	Notes	References	Quality
Distillate Oil (No. 1 & 2)	10300501	Uncontrolled		1.25E-03	Lb	1000 Gallons	Burned	Literature Review.	EPA. 1995. Section 1.3, Fuel Oil Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	E
Distillate Oil (No. 1 & 2)	10200501	Uncontrolled		1.25E-03	Lb	1000 Gallons	Burned	Literature Review.	EPA. 1995. Section 1.3, Fuel Oil Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	E
Dried Sludge	50100515	Uncontrolled		1.00E-01	Lb	Tons	Fed		EPA. 1995. Section 2.2, Sewage Sludge Incineration. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	B
Dried Sludge	50100516	Miscellaneous Control Devices		2.00E-06	Lb	Tons	Fed	Control Devices Are Venturi Scrubber, Impingement Type Wet Scrubber, and Esp.	EPA. 1995. Section 2.2, Sewage Sludge Incineration. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	E
Dried Sludge	50100515	Miscellaneous Control Devices		1.00E-01	Lb	Tons	Fed	Control Devices Are Venturi Scrubber, Impingement Type Wet Scrubber, and Afterburner.	EPA. 1995. Section 2.2, Sewage Sludge Incineration. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	E
Dried Sludge	50100515	Single Cyclone		6.00E-02	Lb	Tons	Fed		EPA. 1995. Section 2.2, Sewage Sludge Incineration. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	E

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Lead Emission Factors Compiled from Version 6.23 of the Factor Information Retrieval (FIRE) Data System

Material	Source Classification Code	Primary Control	Secondary Control	Emission Factor	Unit	Measure	Action	Notes	References	Quality
Dried Sludge	50100515	Single Cyclone	Venturi Scrubber	6.00E-03	Lb	Tons	Fed		EPA. 1995. Section 2.2, Sewage Sludge Incineration. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	E
Dried Sludge	50100515	Venturi Scrubber	Wet Electrostatic Precipitator	1.80E-04	Lb	Tons	Fed		EPA. 1995. Section 2.2, Sewage Sludge Incineration. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	E
Dried Sludge	50100516	Venturi Scrubber	Impingement Type Wet Scrubber	1.60E-01	Lb	Tons	Fed		EPA. 1995. Section 2.2, Sewage Sludge Incineration. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	E
Dried Sludge	50100515	Venturi Scrubber	Impingement Type Wet Scrubber	6.00E-02	Lb	Tons	Fed		EPA. 1995. Section 2.2, Sewage Sludge Incineration. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	B
Dried Sludge	50100515	Venturi Scrubber		1.80E-03	Lb	Tons	Fed		EPA. 1995. Section 2.2, Sewage Sludge Incineration. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	E
Dried Sludge	50100516	Uncontrolled		4.00E-02	Lb	Tons	Fed		EPA. 1995. Section 2.2, Sewage Sludge Incineration. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	E

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Lead Emission Factors Compiled from Version 6.23 of the Factor Information Retrieval (FIRE) Data System

Material	Source Classification Code	Primary Control	Secondary Control	Emission Factor	Unit	Measure	Action	Notes	References	Quality
Dried Sludge	50100516	Impingement Type Wet Scrubber		6.00E-03	Lb	Tons	Fed		EPA. 1995. Section 2.2, Sewage Sludge Incineration. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	E
Dried Sludge	50100515	Impingement Type Wet Scrubber		4.00E-02	Lb	Tons	Fed		EPA. 1995. Section 2.2, Sewage Sludge Incineration. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	E
Dried Sludge	50100516	Fabric Filter		1.00E-05	Lb	Tons	Fed		EPA. 1995. Section 2.2, Sewage Sludge Incineration. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	E
Dried Sludge	50100515	Electrostatic Precipitator		2.00E-03	Lb	Tons	Fed		EPA. 1995. Section 2.2, Sewage Sludge Incineration. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	E
Dried Sludge	50100515	Miscellaneous Control Devices		2.20E-02	Lb	Tons	Fed	Control Devices Are Single Cyclone, Venturi Scrubber, and Impingement Scrubber.	EPA. 1995. Section 2.2, Sewage Sludge Incineration. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	E
Electrode	30905152	Uncontrolled		1.62E-01	Lb	1000 Pounds	Consumed	Current = 102 to 225 A; Voltage = 21 to 34 v.	EPA. 1995. Section 12.19, Electric Arc Welding. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	C

Table C-1 (Continued)

Lead Emission Factors Compiled from Version 6.23 of the Factor Information Retrieval (FIRE) Data System

Material	Source Classification Code	Primary Control	Secondary Control	Emission Factor	Unit	Measure	Action	Notes	References	Quality
Electrode	30905116	Uncontrolled		2.40E-02	Lb	1000 Pounds	Consumed	Current = 102 to 225 A; Voltage = 21 to 34 V. Includes E310-15.	EPA. 1995. Section 12.19, Electric Arc Welding. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	C
Energy	30300702	Venturi Scrubber		6.06E+00	Lb	Megawatt-Hour	Consumed	Lack of Supporting Documentation.	EPA. December 1980. In: A Review of Standards of Performance for New Stationary Sources - Ferroalloy Production Facilities. EPA-450/3-80-041. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	U
Fuel	20300102	Uncontrolled		1.40E-05	Lb	Million Btus	Input	Emission Factors Based on an Average Distillate Oil Heating Value of 139 Mmbtu/1000 Gallons. To Convert from (Lb/mmbtu) to (Lb/1000 Gallons), Multiply by 139.	EPA. 2000. Section 3.1, Stationary Gas Turbines for Electricity Generation. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency.	C
Fuel	20100101	Uncontrolled		1.40E-05	Lb	Million Btus	Input	Emission Factors Based on an Average Distillate Oil Heating Value of 139 Mmbtu/1000 Gallons. To Convert from (Lb/mmbtu) to (Lb/1000 Gallons), Multiply by 139.	EPA. 2000. Section 3.1, Stationary Gas Turbines for Electricity Generation. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency.	C
Fuel	20200103	Uncontrolled		1.40E-05	Lb	Million Btus	Input	Emission Factors Based on an Average Distillate Oil Heating Value of 139 Mmbtu/1000 Gallons. To Convert from (Lb/mmbtu) to (Lb/1000 Gallons), Multiply by 139.	EPA. 2000. Section 3.1, Stationary Gas Turbines for Electricity Generation. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency.	C

Table C-1 (Continued)

Lead Emission Factors Compiled from Version 6.23 of the Factor Information Retrieval (FIRE) Data System

Material	Source Classification Code	Primary Control	Secondary Control	Emission Factor	Unit	Measure	Action	Notes	References	Quality
Fuel	20300701	Uncontrolled		3.40E-06	Lb	Million Btus	Input	Compound Was Not Detected. Emission Factor Is Based on One-half of the Detection Limit. Emission Factor Based on an Average Digester Gas Heating Value (Hhv) of 600 Btu/scf at 60 Deg. F. To Convert from (Lb/mmbtu) to (Lb/10^6 Scf) Multiply by 600.	EPA. 2000. Section 3.1, Stationary Gas Turbines for Electricity Generation. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency.	D
Fuel	20200101	Uncontrolled		1.40E-05	Lb	Million Btus	Input	Emission Factors Based on an Average Distillate Oil Heating Value of 139 Mmbtu/1000 Gallons. To Convert from (Lb/mmbtu) to (Lb/1000 Gallons), Multiply by 139.	EPA. 2000. Section 3.1, Stationary Gas Turbines for Electricity Generation. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency.	C
Glaze	30500845	Uncontrolled		3.00E+00	Lb	Tons	Used	Glaze Being Applied Contained about 24% Lead Oxide.	EPA. October, 1996. Section 11.7, Ceramic Clay Manufacturing. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42, Supplement B. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	E
Gray Iron	30400301	Uncontrolled		1.00E-01	Lb	Tons	Produced		EPA. 1995. Section 12.10, Gray Iron Foundries. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	B
Gray Iron	30400303	Uncontrolled		9.00E-03	Lb	Tons	Produced		EPA. 1995. Section 12.10, Gray Iron Foundries. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	B

Table C-1 (Continued)

Lead Emission Factors Compiled from Version 6.23 of the Factor Information Retrieval (FIRE) Data System

Material	Source Classification Code	Primary Control	Secondary Control	Emission Factor	Unit	Measure	Action	Notes	References	Quality
Gray Iron	30400302	Uncontrolled		1.20E-02	Lb	Tons	Produced		EPA. 1995. Section 12.10, Gray Iron Foundries. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	B
Heat	10200204	Uncontrolled		5.07E-04	Lb	Million Btus	Input		EPA. September, 1998. Section 1.1, Bituminous and Subbituminous Coal Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42, Supplement E. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	E
Heat	30600101	Uncontrolled		2.10E-06	Lb	Million Btus	Input	Carb2588 Data.	Pape & Steiner Environmental Services. September 1990. In: AB-2588 Testing at Texaco Trading and Transportation Inc. Panoche Station, Volumes I, II, and III. Report PS-90-2187. Prepared for Texaco Trading and Transportation Inc.	U
Heat	10100501	Uncontrolled		9.00E-06	Lb	Million Btus	Input		EPA. September, 1998. Section 1.3, Fuel Oil Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42, Supplement E. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	E
Heat	10200201	Uncontrolled		5.07E-04	Lb	Million Btus	Input		EPA. September, 1998. Section 1.1, Bituminous and Subbituminous Coal Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42, Supplement E. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	E
Heat	10200203	Uncontrolled		5.07E-04	Lb	Million Btus	Input		EPA. September, 1998. Section 1.1, Bituminous and Subbituminous Coal Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42, Supplement E. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	E

Table C-1 (Continued)

Lead Emission Factors Compiled from Version 6.23 of the Factor Information Retrieval (FIRE) Data System

Material	Source Classification Code	Primary Control	Secondary Control	Emission Factor	Unit	Measure	Action	Notes	References	Quality
Heat	10101201	Electrostatic Precipitator		1.24E-04	Lb	Million Btus	Input		Composite. Radian FIRE database 1994 Release.	U
Heat	10100224	Uncontrolled		5.07E-04	Lb	Million Btus	Input		EPA. September, 1998. Section 1.1, Bituminous and Subbituminous Coal Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42, Supplement E. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	E
Heat	10200206	Uncontrolled		5.07E-04	Lb	Million Btus	Input		EPA. September, 1998. Section 1.1, Bituminous and Subbituminous Coal Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42, Supplement E. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	E
Heat	10300209	Uncontrolled		5.07E-04	Lb	Million Btus	Input		EPA. September, 1998. Section 1.1, Bituminous and Subbituminous Coal Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42, Supplement E. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	E
Heat	10300207	Uncontrolled		5.07E-04	Lb	Million Btus	Input		EPA. September, 1998. Section 1.1, Bituminous and Subbituminous Coal Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42, Supplement E. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	E
Heat	10200222	Uncontrolled		5.07E-04	Lb	Million Btus	Input		EPA. September, 1998. Section 1.1, Bituminous and Subbituminous Coal Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42, Supplement E. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	E

Table C-1 (Continued)

Lead Emission Factors Compiled from Version 6.23 of the Factor Information Retrieval (FIRE) Data System

Material	Source Classification Code	Primary Control	Secondary Control	Emission Factor	Unit	Measure	Action	Notes	References	Quality
Heat	10200903	Multiple Cyclone W/o Fly Ash Reinjection	Electrostatic Precipitator - Medium Efficiency	2.25E-06	Lb	Million Btus	Input	F Factor 9,240 Dscf/mmbtu. Emission Factor Developed from Metal to Pm Ratio in Front-half Sample.	Composite. Radian FIRE database 1993 Release.	U
Heat	10200903	Multiple Cyclone W/o Fly Ash Reinjection	Wet Scrubber - Medium Efficiency	4.00E-05	Lb	Million Btus	Input	F-factor, 9,240 Dscf/mmbtu. Emission Factor Developed from Metal to Pm Ratio in Front-half Sample.	Galston Technical Services. February 1991. In: Source Emission Testing of the Wood-fired Boiler at Catalyst Hudson, Inc., Anderson, California. Performed for the Timber Association of California.	U
Heat	10200906	Scrubber		1.14E-05	Lb	Million Btus	Input	Factors Calculated Using an F-factor for Wood of 9240 Dscf/mmbtu.	Determination of AB 2588 Emissions from a Wood-fired Boiler Exhaust. February 10 - 13, 1992. (Confidential Report No. ERC-63)	U
Heat	31000413	Low Nox Burners		1.94E-06	Lb	Million Btus	Input		Composite. Radian FIRE database 1993 Release.	U
Heat	10200903	Wet Scrubber - Medium Efficiency		1.60E-05	Lb	Million Btus	Input	F-factor 9,420 Dscf/mmbtu. Emission Factor Developed from Metal to Pm Ratio in Front-half Sample.	Galston Technical Services. February 1991. In: Source Emission Testing of the Wood-fired Boiler #3 Exhaust at Georgia Pacific, Fort Bragg, California. Performed for the Timber Association of California.	U
Heat	10100903	Miscellaneous Control Devices		4.49E-06	Lb	Million Btus	Input	Control Devices Were Limestone Injection, Thermal De-nox with Ammonia Injection, Water Treatment, Multi-cyclone Dust Collector, 8 Compartment Fabric Collector.	Results of Source Testing at a Power Production Facility. (Confidential Report No. ERC-83)	U
Heat	10200901	Electrostatic Precipitator - Medium Efficiency		1.50E-06	Lb	Million Btus	Input	F-factor 9,600 Dscf/mmbtu. Emission Factor Developed from Metal to Pm Ratio in Front-half Sample.	Galston Technical Services. February 1991. In: Source Emission Testing of the Wood-fired Boiler C Exhaust at Pacific Timber, Scotia, California. Performed for the Timber Association of California.	U
Heat	10200221	Uncontrolled		5.07E-04	Lb	Million Btus	Input		EPA. September, 1998. Section 1.1, Bituminous and Subbituminous Coal Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42, Supplement E. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	E

Table C-1 (Continued)

Lead Emission Factors Compiled from Version 6.23 of the Factor Information Retrieval (FIRE) Data System

Material	Source Classification Code	Primary Control	Secondary Control	Emission Factor	Unit	Measure	Action	Notes	References	Quality
Heat	10300224	Uncontrolled		5.07E-04	Lb	Million Btus	Input		EPA. September, 1998. Section 1.1, Bituminous and Subbituminous Coal Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42, Supplement E. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	E
Heat	10200223	Uncontrolled		5.07E-04	Lb	Million Btus	Input		EPA. September, 1998. Section 1.1, Bituminous and Subbituminous Coal Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42, Supplement E. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	E
Heat	10200224	Uncontrolled		5.07E-04	Lb	Million Btus	Input		EPA. September, 1998. Section 1.1, Bituminous and Subbituminous Coal Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42, Supplement E. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	E
Heat	10200225	Uncontrolled		5.07E-04	Lb	Million Btus	Input		EPA. September, 1998. Section 1.1, Bituminous and Subbituminous Coal Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42, Supplement E. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	E
Heat	10300221	Uncontrolled		5.07E-04	Lb	Million Btus	Input		EPA. September, 1998. Section 1.1, Bituminous and Subbituminous Coal Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42, Supplement E. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	E

Table C-1 (Continued)

Lead Emission Factors Compiled from Version 6.23 of the Factor Information Retrieval (FIRE) Data System

Material	Source Classification Code	Primary Control	Secondary Control	Emission Factor	Unit	Measure	Action	Notes	References	Quality
Heat	10300203	Uncontrolled		5.07E-04	Lb	Million Btus	Input		EPA. September, 1998. Section 1.1, Bituminous and Subbituminous Coal Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42, Supplement E. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	E
Heat	10300222	Uncontrolled		5.07E-04	Lb	Million Btus	Input		EPA. September, 1998. Section 1.1, Bituminous and Subbituminous Coal Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42, Supplement E. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	E
Heat	10300205	Uncontrolled		5.07E-04	Lb	Million Btus	Input		EPA. September, 1998. Section 1.1, Bituminous and Subbituminous Coal Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42, Supplement E. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	E
Heat	10100223	Uncontrolled		5.07E-04	Lb	Million Btus	Input		EPA. September, 1998. Section 1.1, Bituminous and Subbituminous Coal Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42, Supplement E. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	E
Heat	10300223	Uncontrolled		5.07E-04	Lb	Million Btus	Input		EPA. September, 1998. Section 1.1, Bituminous and Subbituminous Coal Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42, Supplement E. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	E

Table C-1 (Continued)

Lead Emission Factors Compiled from Version 6.23 of the Factor Information Retrieval (FIRE) Data System

Material	Source Classification Code	Primary Control	Secondary Control	Emission Factor	Unit	Measure	Action	Notes	References	Quality
Heat	10100222	Uncontrolled		5.07E-04	Lb	Million Btus	Input		EPA. September, 1998. Section 1.1, Bituminous and Subbituminous Coal Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42, Supplement E. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	E
Heat	10200205	Uncontrolled		5.07E-04	Lb	Million Btus	Input		EPA. September, 1998. Section 1.1, Bituminous and Subbituminous Coal Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42, Supplement E. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	E
Heat	10300206	Uncontrolled		5.07E-04	Lb	Million Btus	Input		EPA. September, 1998. Section 1.1, Bituminous and Subbituminous Coal Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42, Supplement E. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	E
Heat	10100201	Uncontrolled		5.07E-04	Lb	Million Btus	Input		EPA. September, 1998. Section 1.1, Bituminous and Subbituminous Coal Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42, Supplement E. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	E
Heat	10100204	Uncontrolled		5.07E-04	Lb	Million Btus	Input		EPA. September, 1998. Section 1.1, Bituminous and Subbituminous Coal Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42, Supplement E. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	E

Table C-1 (Continued)

Lead Emission Factors Compiled from Version 6.23 of the Factor Information Retrieval (FIRE) Data System

Material	Source Classification Code	Primary Control	Secondary Control	Emission Factor	Unit	Measure	Action	Notes	References	Quality
Heat	10100205	Uncontrolled		5.07E-04	Lb	Million Btus	Input		EPA. September, 1998. Section 1.1, Bituminous and Subbituminous Coal Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42, Supplement E. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	E
Heat	10100202	Uncontrolled		5.07E-04	Lb	Million Btus	Input		EPA. September, 1998. Section 1.1, Bituminous and Subbituminous Coal Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42, Supplement E. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	E
Heat	10100203	Uncontrolled		5.07E-04	Lb	Million Btus	Input		EPA. September, 1998. Section 1.1, Bituminous and Subbituminous Coal Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42, Supplement E. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	E
Heat	10100225	Uncontrolled		5.07E-04	Lb	Million Btus	Input		EPA. September, 1998. Section 1.1, Bituminous and Subbituminous Coal Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42, Supplement E. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	E
Heat	10200799	Uncontrolled		6.66E-06	Lb	Million Btus	Input		Source Test Report, Landfill Boiler and Flare Systems. (Confidential Report No. ERC-3)	U
Heat	10300225	Uncontrolled		5.07E-04	Lb	Million Btus	Input		EPA. September, 1998. Section 1.1, Bituminous and Subbituminous Coal Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42, Supplement E. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	E

Table C-1 (Continued)

Lead Emission Factors Compiled from Version 6.23 of the Factor Information Retrieval (FIRE) Data System

Material	Source Classification Code	Primary Control	Secondary Control	Emission Factor	Unit	Measure	Action	Notes	References	Quality
Heat	10300501	Uncontrolled		9.00E-06	Lb	Million Btus	Input		EPA. September, 1998. Section 1.3, Fuel Oil Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42, Supplement E. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	E
Heat	10200501	Uncontrolled		9.00E-06	Lb	Million Btus	Input		EPA. September, 1998. Section 1.3, Fuel Oil Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42, Supplement E. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	E
Heat	10100221	Uncontrolled		5.07E-04	Lb	Million Btus	Input		EPA. September, 1998. Section 1.1, Bituminous and Subbituminous Coal Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42, Supplement E. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	E
Hot Mix Asphalt	30500258	Fabric Filter		3.30E-06	Lb	Tons	Produced		EPA. 1995. Section 11.1, Hot Mix Asphalt Plants. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	D
Hot Mix Asphalt	30500201	Single Cyclone	Wet Scrubber - Medium Efficiency	1.03E-06	Lb	Tons	Produced	Based on 180, 190, & 170 Tons/hour Concrete Production Rate Respectively During Three 120-min Tests.	Source Emissions Testing of a Dryer. November 13, 1991. (Confidential Report No. ERC-11)	U
Hot Mix Asphalt	30500201	Single Cyclone	Baghouse	2.00E-06	Lb	Tons	Produced		Source Emissions Testing of a Dryer. December 1991. (Confidential Report No. ERC-12)	U
Hot Mix Asphalt	30500201	Multiple Cyclone W/o Fly Ash Reinjection	Baghouse	2.08E-07	Lb	Tons	Produced		Composite. Radian FIRE database 1993 Release.	U

Table C-1 (Continued)

Lead Emission Factors Compiled from Version 6.23 of the Factor Information Retrieval (FIRE) Data System

Material	Source Classification Code	Primary Control	Secondary Control	Emission Factor	Unit	Measure	Action	Notes	References	Quality
Hot Mix Asphalt	30500252	Fabric Filter		7.40E-07	Lb	Tons	Produced		EPA. 1995. Section 11.1, Hot Mix Asphalt Plants. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	D
Hot Mix Asphalt	30500201	Wet Scrubber - Medium Efficiency		3.10E-06	Lb	Tons	Produced	Based on Avg. Of 246 Tons Asphalt During Two 72 Min. Tests. 1 Detection Limit Used.	Eureka Laboratories. January 1991. In: Compilation of Air Toxics Pollutant Emission Factors, Volume II B: Technical Support Information, Asphalt Concrete Plants, 1991 Edition, Appendix E, Plant 50. Prepared for Central Valley Rock, Sand & Gravel Association.	U
Lead	30400414	Miscellaneous Control Devices		2.40E+00	Lb	Tons	Produced	Control Devices Are Afterburner, Fabric Filter, Venturi Scrubber, and Demister. Lack of Supporting Documentation.	EPA. October 1990. In: Assessment of the Controllability of Condensible Emissions. EPA-600/8-90-075. U.S. Environmental Protection Agency, Air and Energy Engineering Research Laboratory. Research Triangle Park, North Carolina.	U
Lead	30400413	Baghouse		1.20E-02	Lb	Tons	Produced		Pacific Environmental Services, Inc. March 15, 1994. In: Draft Final Test Report, East Penn Manufacturing Company, Secondary Lead Smelter, Volume I, Report and Appendices A & B. Research Triangle Park, North Carolina.	U
Lead	30400426	Uncontrolled		1.00E-02	Lb	Tons	Produced	Lead Content of Kettle Refining Emissions Is 40%.	EPA. 1995. Section 12.11, Secondary Lead Processing. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	C
Lead	30400425	Uncontrolled		7.00E-04	Lb	Tons	Produced		EPA. 1995. Section 12.11, Secondary Lead Processing. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	E
Lead	30400510	Scrubber		1.01E-01	Lb	Tons	Processed	Controlled by Cascade Scrubber at Average Efficiency of 98.3%, Lead Acid Batteries. Lack of Supporting Documentation.	EPA. November 1979. In: Lead-acid Battery Manufacture - Background Information for Proposed Standards. EPA-450/3-79-028a. U.S. Environmental Protection Agency. Research Triangle Park, North Carolina.	U

Table C-1 (Continued)

Lead Emission Factors Compiled from Version 6.23 of the Factor Information Retrieval (FIRE) Data System

Material	Source Classification Code	Primary Control	Secondary Control	Emission Factor	Unit	Measure	Action	Notes	References	Quality
Lead	30301002	Uncontrolled		1.00E-04	Lb	Tons	Produced	Lack of Supporting Documentation.	EPA. October 1990. In: Assessment of the Controllability of Condensible Emissions. EPA-600/8-90-075. U.S. Environmental Protection Agency, Air and Energy Engineering Research Laboratory. Research Triangle Park, North Carolina.	U
Lead	30301002	Spray Tower	Fabric Filter	1.70E-02	Lb	Tons	Produced	Lack of Supporting Documentation.	EPA. October 1990. In: Assessment of the Controllability of Condensible Emissions. EPA-600/8-90-075. U.S. Environmental Protection Agency, Air and Energy Engineering Research Laboratory. Research Triangle Park, North Carolina.	U
Lead	30405101	Uncontrolled		1.00E+00	Lb	Tons	Processed		EPA. 1995. Section 12.17, Miscellaneous Lead Products. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	C
Lead	30400413	Uncontrolled		2.00E-01	Lb	Tons	Produced		EPA. 1995. Section 12.11, Secondary Lead Processing. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	E
Lead	30400409	Uncontrolled		1.00E-02	Lb	Tons	Cast	Lead Content of Casting Emissions Is 36%.	EPA. 1995. Section 12.11, Secondary Lead Processing. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	C
Lead	30405103	Uncontrolled		1.50E+00	Lb	Tons	Processed		EPA. 1995. Section 12.17, Miscellaneous Lead Products. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	C

Table C-1 (Continued)

Lead Emission Factors Compiled from Version 6.23 of the Factor Information Retrieval (FIRE) Data System

Material	Source Classification Code	Primary Control	Secondary Control	Emission Factor	Unit	Measure	Action	Notes	References	Quality
Lead	30400414	Uncontrolled		6.00E-04	Lb	Tons	Produced		EPA. 1995. Section 12.11, Secondary Lead Processing. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	E
Lead	30400507	Wet Scrubber - Medium Efficiency		4.00E-04	Lb	Tons	Produced	Uncontrolled Emissions = 3.3e-4 Lb/ton. Lack of Supporting Documentation.	EPA. October 1990. In: Assessment of the Controllability of Condensible Emissions. EPA-600/8-90-075. U.S. Environmental Protection Agency, Air and Energy Engineering Research Laboratory. Research Triangle Park, North Carolina.	U
Lead in Ore	30301004	Baghouse		2.00E-03	Lb	Tons	Crushed		EPA. 1995. Section 12.6, Primary Lead Smelting. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	E
Lead Oxide	30400408	Uncontrolled		4.40E-01	Lb	Tons	Produced			U
Lignite	10200302	Miscellaneous Control Devices		4.20E-04	Lb	Tons	Burned	The Factor Applies 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 Factor Applies to Boilers Using Only an Esp, Ff, or Venturi Scrubber. Emission Factor Equations Are Available in Ap42 Table 1.7-12 for this Pollutant for All Typical Firing Configurations and Control Scenarios	EPA. September, 1998. Section 1.7, Lignite Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42, Supplement E. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	A

Table C-1 (Continued)

Lead Emission Factors Compiled from Version 6.23 of the Factor Information Retrieval (FIRE) Data System

Material	Source Classification Code	Primary Control	Secondary Control	Emission Factor	Unit	Measure	Action	Notes	References	Quality
Lignite	10300306	Miscellaneous Control Devices		4.20E-04	Lb	Tons	Burned	The Factor Applies 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 Factor Applies to Boilers Using Only an Esp, Ff, or Venturi Scrubber. Emission Factor Equations Are Available in Ap42 Table 1.7-12 for this Pollutant for All Typical Firing Configurations and Control Scenarios	EPA. September, 1998. Section 1.7, Lignite Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42, Supplement E. U.S. ENVIRONMENTAL Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	A
Lignite	10200301	Miscellaneous Control Devices		4.20E-04	Lb	Tons	Burned	The Factor Applies 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 Factor Applies to Boilers Using Only an Esp, Ff, or Venturi Scrubber. Emission Factor Equations Are Available in Ap42 Table 1.7-12 for this Pollutant for All Typical Firing Configurations and Control Scenarios	EPA. September, 1998. Section 1.7, Lignite Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42, Supplement E. U.S. ENVIRONMENTAL Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	A

Table C-1 (Continued)

Lead Emission Factors Compiled from Version 6.23 of the Factor Information Retrieval (FIRE) Data System

Material	Source Classification Code	Primary Control	Secondary Control	Emission Factor	Unit	Measure	Action	Notes	References	Quality
Lignite	10100318	Miscellaneous Control Devices		4.20E-04	Lb	Tons	Burned	The Factor Applies 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 Factor Applies to Boilers Using Only an Esp, Ff, or Venturi Scrubber. Emission Factor Equations Are Available in Ap42 Table 1.7-12 for this Pollutant for All Typical Firing Configurations and Control Scenarios	EPA. September, 1998. Section 1.7, Lignite Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42, Supplement E. U.S. ENVIRONMENTAL Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	A
Lignite	10200303	Miscellaneous Control Devices		4.20E-04	Lb	Tons	Burned	The Factor Applies 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 Factor Applies to Boilers Using Only an Esp, Ff, or Venturi Scrubber. Emission Factor Equations Are Available in Ap42 Table 1.7-12 for this Pollutant for All Typical Firing Configurations and Control Scenarios	EPA. September, 1998. Section 1.7, Lignite Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42, Supplement E. U.S. ENVIRONMENTAL Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	A

Table C-1 (Continued)

Lead Emission Factors Compiled from Version 6.23 of the Factor Information Retrieval (FIRE) Data System

Material	Source Classification Code	Primary Control	Secondary Control	Emission Factor	Unit	Measure	Action	Notes	References	Quality
Lignite	10100301	Miscellaneous Control Devices		4.20E-04	Lb	Tons	Burned	The Factor Applies 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 Factor Applies to Boilers Using Only an Esp, Ff, or Venturi Scrubber. Emission Factor Equations Are Available in Ap42 Table 1.7-12 for this Pollutant for All Typical Firing Configurations and Control Scenarios	EPA. September, 1998. Section 1.7, Lignite Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42, Supplement E. U.S. ENVIRONMENTAL Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	A
Lignite	10100303	Miscellaneous Control Devices		4.20E-04	Lb	Tons	Burned	The Factor Applies 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 Factor Applies to Boilers Using Only an Esp, Ff, or Venturi Scrubber. Emission Factor Equations Are Available in Ap42 Table 1.7-12 for this Pollutant for All Typical Firing Configurations and Control Scenarios	EPA. September, 1998. Section 1.7, Lignite Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42, Supplement E. U.S. ENVIRONMENTAL Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	A

Table C-1 (Continued)

Lead Emission Factors Compiled from Version 6.23 of the Factor Information Retrieval (FIRE) Data System

Material	Source Classification Code	Primary Control	Secondary Control	Emission Factor	Unit	Measure	Action	Notes	References	Quality
Lignite	10100302	Miscellaneous Control Devices		4.20E-04	Lb	Tons	Burned	The Factor Applies 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 Factor Applies to Boilers Using Only an Esp, Ff, or Venturi Scrubber. Emission Factor Equations Are Available in Ap42 Table 1.7-12 for this Pollutant for All Typical Firing Configurations and Control Scenarios	EPA. September, 1998. Section 1.7, Lignite Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42, Supplement E. U.S. ENVIRONMENTAL Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	A
Lignite	10300305	Miscellaneous Control Devices		4.20E-04	Lb	Tons	Burned	The Factor Applies 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 Factor Applies to Boilers Using Only an Esp, Ff, or Venturi Scrubber. Emission Factor Equations Are Available in Ap42 Table 1.7-12 for this Pollutant for All Typical Firing Configurations and Control Scenarios	EPA. September, 1998. Section 1.7, Lignite Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42, Supplement E. U.S. ENVIRONMENTAL Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	A
Material	30501305	Fabric Filter		1.00E-05	Lb	Tons	Fed		EPA. June, 1997. Section 11.14, Frit Manufacturing. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42, Supplement C. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	E

Table C-1 (Continued)

Lead Emission Factors Compiled from Version 6.23 of the Factor Information Retrieval (FIRE) Data System

Material	Source Classification Code	Primary Control	Secondary Control	Emission Factor	Unit	Measure	Action	Notes	References	Quality
Material	30400398	Baghouse		3.80E-05	Lb	Tons	Processed		United States Pipe and Foundry Company. August 14 - 16, 1991. In: Stack Emission Tests of the Iron Melting Cupola Dust Collector and the Ductile Treating Dust Collector. Burlington, New Jersey. (Confidential Report No. ERC-116)	U
Material	30103507	Baghouse		5.00E-02	Lb	Tons	Produced		EPA. 1995. Section 12.16, Lead Oxide and Pigment Production. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	E
Material	30501306	Fabric Filter		1.00E-05	Lb	Tons	Fed		EPA. June, 1997. Section 11.14, Frit Manufacturing. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42, Supplement C. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	E
Material	30103510	Uncontrolled		9.00E-01	Lb	Tons	Produced		EPA. 1995. Section 12.16, Lead Oxide and Pigment Production. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	B
Material	30503505	Wet Scrubber		4.40E-03	Lb	Tons	Processed		EPA. 1995. Section 11.31, Bonded Abrasive Products. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	E
Material	30300604	Uncontrolled		3.10E-03	Lb	Tons	Produced		EPA. September 1985. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fourth Edition with Supplements A, B, and C, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	U

Table C-1 (Continued)

Lead Emission Factors Compiled from Version 6.23 of the Factor Information Retrieval (FIRE) Data System

Material	Source Classification Code	Primary Control	Secondary Control	Emission Factor	Unit	Measure	Action	Notes	References	Quality
Material	30300701	Uncontrolled		1.10E-01	Lb	Tons	Produced		EPA. September 1985. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fourth Edition with Supplements A, B, and C, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	U
Material	30103507	Uncontrolled		1.40E+01	Lb	Tons	Produced		EPA. 1995. Section 12.16, Lead Oxide and Pigment Production. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	E
Material	30400522	Uncontrolled		1.39E-01	Lb	Tons	Processed	Lack of Supporting Documentation.	EPA. November 1979. In: Lead-acid Battery Manufacture - Background Information for Proposed Standards. EPA-450/3-79-028a. U.S. Environmental Protection Agency. Research Triangle Park, North Carolina.	U
Material	30400243	Uncontrolled		5.00E+01	Lb	Tons	Produced		EPA. 1995. Section 12.9, Secondary Copper Smelting and Alloying. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	B
Material	30104201	Fabric Filter	Wet Scrubber	5.50E+01	Lb	Tons	Produced		EPA. 1995. Section 6.12, Lead Alkyl. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	B
Material	30400244	Uncontrolled		1.32E+01	Lb	Tons	Produced		EPA. 1995. Section 12.9, Secondary Copper Smelting and Alloying. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	B

Table C-1 (Continued)

Lead Emission Factors Compiled from Version 6.23 of the Factor Information Retrieval (FIRE) Data System

Material	Source Classification Code	Primary Control	Secondary Control	Emission Factor	Unit	Measure	Action	Notes	References	Quality
Material	30104202	Uncontrolled		4.00E+00	Lb	Tons	Produced		EPA. September 1985. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fourth Edition with Supplements A, B, and C, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	U
Material	30104203	Uncontrolled		1.50E+02	Lb	Tons	Produced		EPA. September 1985. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fourth Edition with Supplements A, B, and C, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	U
Material	30104204	Uncontrolled		1.20E+00	Lb	Tons	Produced	Emissions Are Fugitive.	EPA. 1995. Section 6.12, Lead Alkyl. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	B
Material	30103520	Uncontrolled		1.30E-01	Lb	Tons	Produced		EPA. 1995. Section 12.16, Lead Oxide and Pigment Production. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	B
Material	30300605	Uncontrolled		5.70E-03	Lb	Tons	Produced		September 1986. In: National Council on Air and Stream Improvement for the Pulp and Paper Industry (NCASI) Technical Bulletin 504. VOC emission factor averaged from data presented and applies to dryers in the wood panelboard industry. Emissions are reported as loss of carbon.	U
Material	30103506	Uncontrolled		4.40E-01	Lb	Tons	Produced		EPA. 1995. Section 12.16, Lead Oxide and Pigment Production. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	E

Table C-1 (Continued)

Lead Emission Factors Compiled from Version 6.23 of the Factor Information Retrieval (FIRE) Data System

Material	Source Classification Code	Primary Control	Secondary Control	Emission Factor	Unit	Measure	Action	Notes	References	Quality
Material	30300601	Uncontrolled		2.90E-01	Lb	Tons	Produced		EPA. September 1985. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fourth Edition with Supplements A, B, and C, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	U
Material	30104301	Uncontrolled		1.00E+00	Lb	Tons	Produced		EPA. September 1985. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fourth Edition with Supplements A, B, and C, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	U
Material	30103515	Uncontrolled		5.50E-01	Lb	Tons	Produced		EPA. 1995. Section 12.16, Lead Oxide and Pigment Production. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	B
Material	50300203	Uncontrolled		2.00E-04	Lb	Tons	Burned		EPA. 1995. Section 2.5, Open Burning. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	C
Material	30400242	Uncontrolled		5.00E+00	Lb	Tons	Produced		EPA. 1995. Section 12.9, Secondary Copper Smelting and Alloying. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	B
Material	30404001	Uncontrolled		5.00E-01	Lb	Tons	Processed		EPA. 1995. Section 12.17, Miscellaneous Lead Products. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	C

Table C-1 (Continued)

Lead Emission Factors Compiled from Version 6.23 of the Factor Information Retrieval (FIRE) Data System

Material	Source Classification Code	Primary Control	Secondary Control	Emission Factor	Unit	Measure	Action	Notes	References	Quality
Material	36000101	Uncontrolled		2.50E-01	Lb	Tons	Melted		EPA. 1995. Section 12.17, Miscellaneous Lead Products. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	C
Material	30104201	Uncontrolled		5.50E+01	Lb	Tons	Produced		EPA. September 1985. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fourth Edition with Supplements A, B, and C, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	U
Material	30400526	Uncontrolled		5.90E+00	Lb	Tons	Processed	Lack of Supporting Documentation.	EPA. November 1979. In: Lead-acid Battery Manufacture - Background Information for Proposed Standards. EPA-450/3-79-028a. U.S. Environmental Protection Agency. Research Triangle Park, North Carolina.	U
Material	50300203	Uncontrolled		6.70E-04	Lb	Tons	Burned		EPA. 1995. Section 2.5, Open Burning. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	C
Material	30400523	Uncontrolled		1.72E+00	Lb	Tons	Processed	Lead Acid Batteries. Lack of Supporting Documentation.	Letter from C. Hester, Midwest Research Institute, Cary, North Carolina, to D. Michelitsch, U.S. Environmental Protection Agency, Research Triangle Park, North Carolina. May 5, 1989.	U
Material	30104202	Miscellaneous Control Devices		4.00E+00	Lb	Tons	Produced	Controls Are Incinerator and Fabric Filter or Wet Scrubber and Incinerator.	EPA. 1995. Section 6.12, Lead Alkyl. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	B

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Lead Emission Factors Compiled from Version 6.23 of the Factor Information Retrieval (FIRE) Data System

Material	Source Classification Code	Primary Control	Secondary Control	Emission Factor	Unit	Measure	Action	Notes	References	Quality
Material	30104301	Miscellaneous Control Devices		1.00E+00	Lb	Tons	Produced	Controls Are an Elevated Flare and a Liquid Incinerator, While a Scrubber W/toluene as Medium Controls the Blending and Tank Car Loading/unloading Systems.	EPA. 1995. Section 6.12, Lead Alkyl. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	B
Material	30104203	Miscellaneous Control Devices		1.50E+02	Lb	Tons	Produced	Controls Are Incinerator and Fabric Filter, or Wet Scrubber and Incinerator.	EPA. 1995. Section 6.12, Lead Alkyl. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	B
Medical Waste	50200503	Spray Dryer	Miscellaneous Control Devices	7.38E-05	Lb	Tons	Burned	Control Devices Used Were Spray Dryer, Carbon Injection, and Fabric Filter.	EPA. 1995. Section 2.3, Medical Waste Incineration. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	E
Medical Waste	50200501	Wet Scrubber - High Efficiency		6.98E-02	Lb	Tons	Burned		EPA. 1995. Section 2.3, Medical Waste Incineration. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	E
Medical Waste	50200503	Spray Dryer	Fabric Filter	1.89E-04	Lb	Tons	Burned		EPA. 1995. Section 2.3, Medical Waste Incineration. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	E
Medical Waste	50200501	Wet Scrubber - Low Efficiency		7.94E-02	Lb	Tons	Burned		EPA. 1995. Section 2.3, Medical Waste Incineration. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	E

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Lead Emission Factors Compiled from Version 6.23 of the Factor Information Retrieval (FIRE) Data System

Material	Source Classification Code	Primary Control	Secondary Control	Emission Factor	Unit	Measure	Action	Notes	References	Quality
Medical Waste	50200501	Dry Sorbent Injection	Baghouse	5.17E-05	Lb	Tons	Burned	Control Devices Are Dry Sorbent Injection, Baghouse, and Scrubber.	EPA. 1995. Section 2.3, Medical Waste Incineration. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	E
Medical Waste	50200503	Uncontrolled		1.24E-01	Lb	Tons	Burned		EPA. 1995. Section 2.3, Medical Waste Incineration. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	E
Medical Waste	50200501	Fabric Filter		9.92E-05	Lb	Tons	Burned		EPA. 1995. Section 2.3, Medical Waste Incineration. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	E
Medical Waste	50200501	Wet Scrubber - Medium Efficiency	Fabric Filter	1.60E-03	Lb	Tons	Burned		EPA. 1995. Section 2.3, Medical Waste Incineration. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	E
Medical Waste	50200501	Uncontrolled		7.28E-02	Lb	Tons	Burned		EPA. 1995. Section 2.3, Medical Waste Incineration. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	B
Medical Waste	50200501	Dry Sorbent Injection	Fabric Filter	6.25E-05	Lb	Tons	Burned		EPA. 1995. Section 2.3, Medical Waste Incineration. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	E

Table C-1 (Continued)

Lead Emission Factors Compiled from Version 6.23 of the Factor Information Retrieval (FIRE) Data System

Material	Source Classification Code	Primary Control	Secondary Control	Emission Factor	Unit	Measure	Action	Notes	References	Quality
Medical Waste	50200501	Dry Sorbent Injection	Electrostatic Precipitator	4.70E-03	Lb	Tons	Burned		EPA. 1995. Section 2.3, Medical Waste Incineration. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	E
Medical Waste	50200501	Dry Sorbent Injection	Carbon Injection	9.27E-05	Lb	Tons	Burned	Control Devices Used Were Dry Sorbent Injection, Carbon Injection, and Fabric Filter.	EPA. 1995. Section 2.3, Medical Waste Incineration. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	E
Metal	30400301	Baghouse		2.67E-03	Lb	Tons	Charged	Iron Melting Stack Data Exceeded the Standards Specified by the Permit for All Pollutants, Except Sulfur Dioxide.	United States Pipe and Foundry Company. August 14 - 16, 1991. In: Stack Emission Tests of the Iron Melting Cupola Dust Collector and the Ductile Treating Dust Collector. Burlington, New Jersey. (Confidential Report No. ERC-116)	U
Metal	30400403	Miscellaneous Control Devices		2.90E-01	Lb	Tons	Produced	The Controlled Emission Factor Was Estimated from Tests Using Several Control Devices Such as Baghouse, Wet Scrubber, Cyclone, Fabric Filter, Settling Chamber and Demister.	EPA. 1995. Section 12.11, Secondary Lead Processing. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	C
Metal	30400404	Uncontrolled		7.00E+00	Lb	Tons	Produced	The Emissions Are Based on the Assumption That Uncontrolled Reverberatory Furnace Flue Emissions Are 23% Lead.	EPA. 1995. Section 12.11, Secondary Lead Processing. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	E
Metal	30400403	Uncontrolled		1.04E+02	Lb	Tons	Produced		EPA. 1995. Section 12.11, Secondary Lead Processing. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	C

Table C-1 (Continued)

Lead Emission Factors Compiled from Version 6.23 of the Factor Information Retrieval (FIRE) Data System

Material	Source Classification Code	Primary Control	Secondary Control	Emission Factor	Unit	Measure	Action	Notes	References	Quality
Metal	30400402	Uncontrolled		6.50E+01	Lb	Tons	Produced		EPA. 1995. Section 12.11, Secondary Lead Processing. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	C
Metal	30400412	Uncontrolled		4.00E-01	Lb	Tons	Charged	Assumes 23% Lead Content of Uncontrolled Blast Furnace Fire Emissions.	EPA. 1995. Section 12.11, Secondary Lead Processing. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	E
Natural Gas	10100602	Uncontrolled		5.00E-04	Lb	Million Cubic Feet	Burned	Hazardous Air Pollutant (Hap) as Defined by Section 112(b) of the Clean Air Act. Hap Because it Is Polycyclic Organic Matter (Pom). Pom Is a Hap as Defined by Section 112(b) of the Clean Air Act.	EPA. March, 1998. Section 1.4, Natural Gas Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42, Supplement D. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	D
Natural Gas	10300601	Uncontrolled		5.00E-04	Lb	Million Cubic Feet	Burned	Hazardous Air Pollutant (Hap) as Defined by Section 112(b) of the Clean Air Act. Hap Because it Is Polycyclic Organic Matter (Pom). Pom Is a Hap as Defined by Section 112(b) of the Clean Air Act.	EPA. March, 1998. Section 1.4, Natural Gas Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42, Supplement D. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	D
Natural Gas	10300603	Uncontrolled		5.00E-04	Lb	Million Cubic Feet	Burned	Hazardous Air Pollutant (Hap) as Defined by Section 112(b) of the Clean Air Act. Hap Because it Is Polycyclic Organic Matter (Pom). Pom Is a Hap as Defined by Section 112(b) of the Clean Air Act.	EPA. March, 1998. Section 1.4, Natural Gas Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42, Supplement D. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	D

Table C-1 (Continued)

Lead Emission Factors Compiled from Version 6.23 of the Factor Information Retrieval (FIRE) Data System

Material	Source Classification Code	Primary Control	Secondary Control	Emission Factor	Unit	Measure	Action	Notes	References	Quality
Natural Gas	10300602	Uncontrolled		5.00E-04	Lb	Million Cubic Feet	Burned	Hazardous Air Pollutant (Hap) as Defined by Section 112(b) of the Clean Air Act. Hap Because it Is Polycyclic Organic Matter (Pom). Pom Is a Hap as Defined by Section 112(b) of the Clean Air Act.	EPA. March, 1998. Section 1.4, Natural Gas Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42, Supplement D. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	D
Natural Gas	10200602	Uncontrolled		5.00E-04	Lb	Million Cubic Feet	Burned	Hazardous Air Pollutant (Hap) as Defined by Section 112(b) of the Clean Air Act. Hap Because it Is Polycyclic Organic Matter (Pom). Pom Is a Hap as Defined by Section 112(b) of the Clean Air Act.	EPA. March, 1998. Section 1.4, Natural Gas Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42, Supplement D. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	D
Natural Gas	10200601	Uncontrolled		5.00E-04	Lb	Million Cubic Feet	Burned	Hazardous Air Pollutant (Hap) as Defined by Section 112(b) of the Clean Air Act. Hap Because it Is Polycyclic Organic Matter (Pom). Pom Is a Hap as Defined by Section 112(b) of the Clean Air Act.	EPA. March, 1998. Section 1.4, Natural Gas Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42, Supplement D. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	D
Natural Gas	10100601	Uncontrolled		5.00E-04	Lb	Million Cubic Feet	Burned	Hazardous Air Pollutant (Hap) as Defined by Section 112(b) of the Clean Air Act. Hap Because it Is Polycyclic Organic Matter (Pom). Pom Is a Hap as Defined by Section 112(b) of the Clean Air Act.	EPA. March, 1998. Section 1.4, Natural Gas Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42, Supplement D. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	D
Natural Gas	A2104006010	Uncontrolled		5.00E-04	Lb	Million Cubic Feet	Burned	Hazardous Air Pollutant (Hap) as Defined by Section 112(b) of the Clean Air Act. Hap Because it Is Polycyclic Organic Matter (Pom). Pom Is a Hap as Defined by Section 112(b) of the Clean Air Act.	EPA. March, 1998. Section 1.4, Natural Gas Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42, Supplement D. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	D

Table C-1 (Continued)

Lead Emission Factors Compiled from Version 6.23 of the Factor Information Retrieval (FIRE) Data System

Material	Source Classification Code	Primary Control	Secondary Control	Emission Factor	Unit	Measure	Action	Notes	References	Quality
Natural Gas	10100604	Uncontrolled		5.00E-04	Lb	Million Cubic Feet	Burned	Hazardous Air Pollutant (Hap) as Defined by Section 112(b) of the Clean Air Act. Hap Because it Is Polycyclic Organic Matter (Pom). Pom Is a Hap as Defined by Section 112(b) of the Clean Air Act.	EPA. March, 1998. Section 1.4, Natural Gas Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42, Supplement D. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	D
Ore	30303103	Uncontrolled		1.20E-02	Lb	Tons	Processed		EPA. 1995. Section 12.18, Leadbearing Ore Crushing and Grinding. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	B
Ore	30301004	Uncontrolled		3.00E-01	Lb	Tons	Crushed		EPA. September 1985. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fourth Edition with Supplements A, B, and C, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	U
Ore	30303105	Uncontrolled		1.20E-01	Lb	Tons	Processed		EPA. 1995. Section 12.18, Leadbearing Ore Crushing and Grinding. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	B
Ore	30303104	Uncontrolled		1.20E-01	Lb	Tons	Processed		EPA. 1995. Section 12.18, Leadbearing Ore Crushing and Grinding. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	B
Ore	30301028	Baghouse		6.00E-04	Lb	Tons	Processed		EPA. 1995. Section 12.6, Primary Lead Smelting. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	E

Table C-1 (Continued)

Lead Emission Factors Compiled from Version 6.23 of the Factor Information Retrieval (FIRE) Data System

Material	Source Classification Code	Primary Control	Secondary Control	Emission Factor	Unit	Measure	Action	Notes	References	Quality
Ore	30301032	Baghouse		2.00E-03	Lb	Tons	Processed		EPA. 1995. Section 12.6, Primary Lead Smelting. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	E
Ore	30303107	Uncontrolled		1.20E-01	Lb	Tons	Processed		EPA. 1995. Section 12.18, Leadbearing Ore Crushing and Grinding. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	B
Ore	30303102	Uncontrolled		1.20E-02	Lb	Tons	Processed		EPA. 1995. Section 12.18, Leadbearing Ore Crushing and Grinding. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	B
Ore	30303101	Uncontrolled		3.00E-01	Lb	Tons	Processed		EPA. 1995. Section 12.18, Leadbearing Ore Crushing and Grinding. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	B
Ore	30303106	Uncontrolled		1.20E-02	Lb	Tons	Processed		EPA. 1995. Section 12.18, Leadbearing Ore Crushing and Grinding. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	B
Pellets	30302352	Multiple Cyclones		5.00E-04	Lb	Tons	Produced		EPA. February 1997. Section 11.23, Taconite Ore Processing. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42, Supplement C. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	E

Table C-1 (Continued)

Lead Emission Factors Compiled from Version 6.23 of the Factor Information Retrieval (FIRE) Data System

Material	Source Classification Code	Primary Control	Secondary Control	Emission Factor	Unit	Measure	Action	Notes	References	Quality
Pellets	30302351	Multiple Cyclones		5.00E-04	Lb	Tons	Produced		EPA. February 1997. Section 11.23, Taconite Ore Processing. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42, Supplement C. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	E
Pellets	30302382	Multiple Cyclones	Wet Scrubber	6.80E-05	Lb	Tons	Produced		EPA. February 1997. Section 11.23, Taconite Ore Processing. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42, Supplement C. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	E
Pellets	30302381	Multiple Cyclones	Wet Scrubber	6.80E-05	Lb	Tons	Produced		EPA. February 1997. Section 11.23, Taconite Ore Processing. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42, Supplement C. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	E
Pellets	30302388	Multiple Cyclones	Wet Scrubber	7.60E-05	Lb	Tons	Produced		EPA. February 1997. Section 11.23, Taconite Ore Processing. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42, Supplement C. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	E
Pellets	30302387	Multiple Cyclones	Wet Scrubber	7.60E-05	Lb	Tons	Produced		EPA. February 1997. Section 11.23, Taconite Ore Processing. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42, Supplement C. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	E
Raw Material	30303012	Uncontrolled		1.30E-01	Lb	Tons	Processed			U

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Lead Emission Factors Compiled from Version 6.23 of the Factor Information Retrieval (FIRE) Data System

Material	Source Classification Code	Primary Control	Secondary Control	Emission Factor	Unit	Measure	Action	Notes	References	Quality
Refuse Derived Fuel	10301202	Uncontrolled		1.30E-01	Lb	Tons	Burned	Edited 05/19/92	EPA. September 1985. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fourth Edition with Supplements A, B, and C, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	U
Refuse Derived Fuel	10201202	Uncontrolled		1.30E-01	Lb	Tons	Burned	Edited 05/19/92	EPA. September 1985. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fourth Edition with Supplements A, B, and C, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	U
Refuse Derived Fuel	50100103	Electrostatic Precipitator		3.66E-03	Lb	Tons	Burned	Ef Calculated from F-factor of 9570 Dscf/mbtu and Heating Value of 5500 Btu/lb. Ef Should Be Used for Estimating Long-term Emission Levels. This Particularly Applies to Pollutants Measured W/ Continuous Emission Monitoring System (E.g., So2, Nox, Co).	EPA. 1995. Section 2.1, Refuse Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	A
Refuse Derived Fuel	50100103	Spray Dryer	Electrostatic Precipitator	1.16E-03	Lb	Tons	Burned	Ef Calculated from F-factor of 9570 Dscf/mbtu and Heating Value of 5500 Btu/lb. Ef Should Be Used for Estimating Long-term Emission Levels. This Particularly Applies to Pollutants Measured W/ Continuous Emission Monitoring System (E.g., So2, Nox, Co).	EPA. 1995. Section 2.1, Refuse Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	B

Table C-1 (Continued)

Lead Emission Factors Compiled from Version 6.23 of the Factor Information Retrieval (FIRE) Data System

Material	Source Classification Code	Primary Control	Secondary Control	Emission Factor	Unit	Measure	Action	Notes	References	Quality
Refuse Derived Fuel	50100103	Uncontrolled		2.01E-01	Lb	Tons	Burned	Ef Calculated from F-factor of 9570 Dscf/mbtu and Heating Value of 5500 Btu/lb. Ef Should Be Used for Estimating Long-term Emission Levels. This Particularly Applies to Pollutants Measured W/ Continuous Emission Monitoring System (E.g., So2, Nox, Co).	EPA. 1995. Section 2.1, Refuse Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	C
Refuse Derived Fuel	50100103	Spray Dryer	Fabric Filter	1.04E-03	Lb	Tons	Burned	Ef Calculated from F-factor of 9570 Dscf/mbtu and Heating Value of 5500 Btu/lb. Ef Should Be Used for Estimating Long-term Emission Levels. This Particularly Applies to Pollutants Measured W/ Continuous Emission Monitoring System (E.g., So2, Nox, Co).	EPA. 1995. Section 2.1, Refuse Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	D
Residual Oil	31000402	Uncontrolled		2.24E-03	Lb	1000 Gallons	Burned	F-factor, Residual Oil (Calculated) = 9,103 Dscf/mmbtu.	CARNOT. May 1990. In: Emissions Inventory Testing at Huntington Beach Generating Station Fuel Oil Heater No. 2. Prepared for Southern California Edison Company. Rosemead, California.	U
Residual Oil (No. 5)	10100405	Uncontrolled		2.40E-03	Lb	1000 Gallons	Burned	Carb2588 Data.	Hopkins, K.C. and L.A. Green, CARNOT, Tustin, California. May 1990. In: Air Toxics Emissions Testing at Morro Bay Unit 3. CR1109-2088. Prepared for Pacific Gas and Electric Company, San Francisco, California. For inclusion in Air Toxics Hot Spots Inventory Required Under AB-2588.	U
Residual Oil (No. 6)	10100404	Uncontrolled		1.51E-03	Lb	1000 Gallons	Burned		EPA. September, 1998. Section 1.3, Fuel Oil Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42, Supplement E. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	C

Table C-1 (Continued)

Lead Emission Factors Compiled from Version 6.23 of the Factor Information Retrieval (FIRE) Data System

Material	Source Classification Code	Primary Control	Secondary Control	Emission Factor	Unit	Measure	Action	Notes	References	Quality
Residual Oil (No. 6)	10100401	Uncontrolled		1.51E-03	Lb	1000 Gallons	Burned		EPA. September, 1998. Section 1.3, Fuel Oil Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42, Supplement E. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	C
Sinter	30301029	Electrostatic Precipitator	Scrubber	1.90E-02	Lb	Tons	Produced		EPA. 1995. Section 12.6, Primary Lead Smelting. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	E
Sinter	30301025	Electrostatic Precipitator	Scrubber	3.20E-02	Lb	Tons	Processed	This Includes Fugitive Emissions from Sinter Building.	EPA. 1995. Section 12.6, Primary Lead Smelting. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	E
Solid Waste	50300112	Uncontrolled		2.13E-01	Lb	Tons	Burned	Ef Calculated from F-factor of 9570 Dscf/mbtu and Heating Value of 4500 Btu/lb. Ef Should Be Used for Estimating Long-term Emission Levels. This Particularly Applies to Pollutants Measured W/ Continuous Emission Monitoring System (E.g., So2).	EPA. 1995. Section 2.1, Refuse Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	A

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Lead Emission Factors Compiled from Version 6.23 of the Factor Information Retrieval (FIRE) Data System

Material	Source Classification Code	Primary Control	Secondary Control	Emission Factor	Unit	Measure	Action	Notes	References	Quality
Solid Waste	50100104	Uncontrolled		2.13E-01	Lb	Tons	Burned	Ef Calculated from F-factor of 9570 Dscf/mbtu and Heating Value of 4500 Btu/lb. Ef Should Be Used for Estimating Long-term Emission Levels. This Particularly Applies to Pollutants Measured W/ Continuous Emission Monitoring System (E.g., So2).	EPA. 1995. Section 2.1, Refuse Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	A
Solid Waste	50300112	Spray Dryer	Fabric Filter	2.61E-04	Lb	Tons	Burned	Ef Calculated from F-factor of 9570 Dscf/mbtu and Heating Value of 4500 Btu/lb. Ef Should Be Used for Estimating Long-term Emission Levels. This Particularly Applies to Pollutants Measured W/ Continuous Emission Monitoring System (E.g., So2).	EPA. 1995. Section 2.1, Refuse Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	A
Solid Waste	50300111	Spray Dryer	Fabric Filter	2.61E-04	Lb	Tons	Burned	Ef Calculated from F-factor of 9570 Dscf/mbtu and Heating Value of 4500 Btu/lb. Ef Should Be Used for Estimating Long-term Emission Levels. This Particularly Applies to Pollutants Measured W/ Continuous Emission Monitoring System (E.g., So2).	EPA. 1995. Section 2.1, Refuse Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	A

Table C-1 (Continued)

Lead Emission Factors Compiled from Version 6.23 of the Factor Information Retrieval (FIRE) Data System

Material	Source Classification Code	Primary Control	Secondary Control	Emission Factor	Unit	Measure	Action	Notes	References	Quality
Solid Waste	50100106	Uncontrolled		2.13E-01	Lb	Tons	Burned	Ef Calculated from F-factor of 9570 Dscf/mbtu and Heating Value of 4500 Btu/lb. Ef Should Be Used for Estimating Long-term Emission Levels. This Particularly Applies to Pollutants Measured W/ Continuous Emission Monitoring System (E.g., So2).	EPA. 1995. Section 2.1, Refuse Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	A
Solid Waste	50300115	Spray Dryer	Fabric Filter	2.61E-04	Lb	Tons	Burned	Ef Calculated from F-factor of 9570 Dscf/mbtu and Heating Value of 4500 Btu/lb. Ef Should Be Used for Estimating Long-term Emission Levels. This Particularly Applies to Pollutants Measured W/ Continuous Emission Monitoring System (E.g., So2).	EPA. 1995. Section 2.1, Refuse Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	A
Solid Waste	50100105	Uncontrolled		2.13E-01	Lb	Tons	Burned	Ef Calculated from F-factor of 9570 Dscf/mbtu and Heating Value of 4500 Btu/lb. Ef Should Be Used for Estimating Long-term Emission Levels. This Particularly Applies to Pollutants Measured W/ Continuous Emission Monitoring System (E.g., So2).	EPA. 1995. Section 2.1, Refuse Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	A
Solid Waste	10101201	Uncontrolled		2.65E-01	Lb	Tons	Burned		Composite. Radian FIRE database 1994 Release.	U

Table C-1 (Continued)

Lead Emission Factors Compiled from Version 6.23 of the Factor Information Retrieval (FIRE) Data System

Material	Source Classification Code	Primary Control	Secondary Control	Emission Factor	Unit	Measure	Action	Notes	References	Quality
Solid Waste	50300111	Uncontrolled		2.13E-01	Lb	Tons	Burned	Ef Calculated from F-factor of 9570 Dscf/mbtu and Heating Value of 4500 Btu/lb. Ef Should Be Used for Estimating Long-term Emission Levels. This Particularly Applies to Pollutants Measured W/ Continuous Emission Monitoring System (E.g., So2).	EPA. 1995. Section 2.1, Refuse Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	A
Solid Waste	50300115	Electrostatic Precipitator		3.00E-03	Lb	Tons	Burned	Ef Calculated from F-factor of 9570 Dscf/mbtu and Heating Value of 4500 Btu/lb. Ef Should Be Used for Estimating Long-term Emission Levels. This Particularly Applies to Pollutants Measured W/ Continuous Emission Monitoring System (E.g., So2).	EPA. 1995. Section 2.1, Refuse Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	A
Solid Waste	50300113	Uncontrolled		2.13E-01	Lb	Tons	Burned	Ef Calculated from F-factor of 9570 Dscf/mbtu and Heating Value of 4500 Btu/lb. Ef Should Be Used for Estimating Long-term Emission Levels. This Particularly Applies to Pollutants Measured W/ Continuous Emission Monitoring System (E.g., So2).	EPA. 1995. Section 2.1, Refuse Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	A

Table C-1 (Continued)

Lead Emission Factors Compiled from Version 6.23 of the Factor Information Retrieval (FIRE) Data System

Material	Source Classification Code	Primary Control	Secondary Control	Emission Factor	Unit	Measure	Action	Notes	References	Quality
Solid Waste	50300115	Uncontrolled		2.13E-01	Lb	Tons	Burned	Ef Calculated from F-factor of 9570 Dscf/mbtu and Heating Value of 4500 Btu/lb. Ef Should Be Used for Estimating Long-term Emission Levels. This Particularly Applies to Pollutants Measured W/ Continuous Emission Monitoring System (E.g., So2).	EPA. 1995. Section 2.1, Refuse Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	A
Solid Waste	50100102	Uncontrolled		1.80E-01	Lb	Tons	Burned		EPA. September 1985. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fourth Edition with Supplements A, B, and C, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	U
Solid Waste	50300113	Spray Dryer	Fabric Filter	2.61E-04	Lb	Tons	Burned	Ef Calculated from F-factor of 9570 Dscf/mbtu and Heating Value of 4500 Btu/lb. Ef Should Be Used for Estimating Long-term Emission Levels. This Particularly Applies to Pollutants Measured W/ Continuous Emission Monitoring System (E.g., So2).	EPA. 1995. Section 2.1, Refuse Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	A
Solid Waste	50100105	Spray Dryer	Fabric Filter	2.61E-04	Lb	Tons	Burned	Ef Calculated from F-factor of 9570 Dscf/mbtu and Heating Value of 4500 Btu/lb. Ef Should Be Used for Estimating Long-term Emission Levels. This Particularly Applies to Pollutants Measured W/ Continuous Emission Monitoring System (E.g., So2).	EPA. 1995. Section 2.1, Refuse Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	A

Table C-1 (Continued)

Lead Emission Factors Compiled from Version 6.23 of the Factor Information Retrieval (FIRE) Data System

Material	Source Classification Code	Primary Control	Secondary Control	Emission Factor	Unit	Measure	Action	Notes	References	Quality
Solid Waste	50100106	Spray Dryer	Fabric Filter	2.61E-04	Lb	Tons	Burned	Ef Calculated from F-factor of 9570 Dscf/mbtu and Heating Value of 4500 Btu/lb. Ef Should Be Used for Estimating Long-term Emission Levels. This Particularly Applies to Pollutants Measured W/ Continuous Emission Monitoring System (E.g., So2).	EPA. 1995. Section 2.1, Refuse Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	A
Solid Waste	50100104	Spray Dryer	Fabric Filter	2.61E-04	Lb	Tons	Burned	Ef Calculated from F-factor of 9570 Dscf/mbtu and Heating Value of 4500 Btu/lb. Ef Should Be Used for Estimating Long-term Emission Levels. This Particularly Applies to Pollutants Measured W/ Continuous Emission Monitoring System (E.g., So2).	EPA. 1995. Section 2.1, Refuse Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	A
Solid Waste	50300102	Uncontrolled		1.81E-03	Lb	Tons	Burned		Compliance and Toxics Testing of an Incinerator at a Ski Resort. (Confidential Report No. ERC-88)	U
Solid Waste	50300112	Dry Sorbent Injection	Fabric Filter	2.97E-04	Lb	Tons	Burned	Ef Calculated from F-factor of 9570 Dscf/mbtu and Heating Value of 4500 Btu/lb. Ef Should Be Used for Estimating Long-term Emission Levels. This Particularly Applies to Pollutants Measured W/ Continuous Emission Monitoring System (E.g., So2).	EPA. 1995. Section 2.1, Refuse Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	C

Table C-1 (Continued)

Lead Emission Factors Compiled from Version 6.23 of the Factor Information Retrieval (FIRE) Data System

Material	Source Classification Code	Primary Control	Secondary Control	Emission Factor	Unit	Measure	Action	Notes	References	Quality
Solid Waste	50300115	Dry Sorbent Injection	Electrostatic Precipitator	2.90E-03	Lb	Tons	Burned	Ef Calculated from F-factor of 9570 Dscf/mbtu and Heating Value of 4500 Btu/lb. Ef Should Be Used for Estimating Long-term Emission Levels. This Particularly Applies to Pollutants Measured W/ Continuous Emission Monitoring System (E.g., So2).	EPA. 1995. Section 2.1, Refuse Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	E
Solid Waste	50300112	Dry Sorbent Injection	Electrostatic Precipitator	2.90E-03	Lb	Tons	Burned	Ef Calculated from F-factor of 9570 Dscf/mbtu and Heating Value of 4500 Btu/lb. Ef Should Be Used for Estimating Long-term Emission Levels. This Particularly Applies to Pollutants Measured W/ Continuous Emission Monitoring System (E.g., So2).	EPA. 1995. Section 2.1, Refuse Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	E
Solid Waste	50100107	Dry Sorbent Injection	Electrostatic Precipitator	2.90E-03	Lb	Tons	Burned	Ef Calculated from F-factor of 9570 Dscf/mbtu and Heating Value of 4500 Btu/lb. Ef Should Be Used for Estimating Long-term Emission Levels. This Particularly Applies to Pollutants Measured W/ Continuous Emission Monitoring System (E.g., So2).	EPA. 1995. Section 2.1, Refuse Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	E

Table C-1 (Continued)

Lead Emission Factors Compiled from Version 6.23 of the Factor Information Retrieval (FIRE) Data System

Material	Source Classification Code	Primary Control	Secondary Control	Emission Factor	Unit	Measure	Action	Notes	References	Quality
Solid Waste	50100104	Dry Sorbent Injection	Electrostatic Precipitator	2.90E-03	Lb	Tons	Burned	Ef Calculated from F-factor of 9570 Dscf/mbtu and Heating Value of 4500 Btu/lb. Ef Should Be Used for Estimating Long-term Emission Levels. This Particularly Applies to Pollutants Measured W/ Continuous Emission Monitoring System (E.g., So2).	EPA. 1995. Section 2.1, Refuse Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	E
Solid Waste	50100105	Dry Sorbent Injection	Electrostatic Precipitator	2.90E-03	Lb	Tons	Burned	Ef Calculated from F-factor of 9570 Dscf/mbtu and Heating Value of 4500 Btu/lb. Ef Should Be Used for Estimating Long-term Emission Levels. This Particularly Applies to Pollutants Measured W/ Continuous Emission Monitoring System (E.g., So2).	EPA. 1995. Section 2.1, Refuse Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	E
Solid Waste	50100106	Dry Sorbent Injection	Electrostatic Precipitator	2.90E-03	Lb	Tons	Burned	Ef Calculated from F-factor of 9570 Dscf/mbtu and Heating Value of 4500 Btu/lb. Ef Should Be Used for Estimating Long-term Emission Levels. This Particularly Applies to Pollutants Measured W/ Continuous Emission Monitoring System (E.g., So2).	EPA. 1995. Section 2.1, Refuse Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	E

Table C-1 (Continued)

Lead Emission Factors Compiled from Version 6.23 of the Factor Information Retrieval (FIRE) Data System

Material	Source Classification Code	Primary Control	Secondary Control	Emission Factor	Unit	Measure	Action	Notes	References	Quality
Solid Waste	50300111	Dry Sorbent Injection	Electrostatic Precipitator	2.90E-03	Lb	Tons	Burned	Ef Calculated from F-factor of 9570 Dscf/mbtu and Heating Value of 4500 Btu/lb. Ef Should Be Used for Estimating Long-term Emission Levels. This Particularly Applies to Pollutants Measured W/ Continuous Emission Monitoring System (E.g., So2).	EPA. 1995. Section 2.1, Refuse Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	E
Solid Waste	50300113	Dry Sorbent Injection	Electrostatic Precipitator	2.90E-03	Lb	Tons	Burned	Ef Calculated from F-factor of 9570 Dscf/mbtu and Heating Value of 4500 Btu/lb. Ef Should Be Used for Estimating Long-term Emission Levels. This Particularly Applies to Pollutants Measured W/ Continuous Emission Monitoring System (E.g., So2).	EPA. 1995. Section 2.1, Refuse Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	E
Solid Waste	50100107	Dry Sorbent Injection	Fabric Filter	2.97E-04	Lb	Tons	Burned	Ef Calculated from F-factor of 9570 Dscf/mbtu and Heating Value of 4500 Btu/lb. Ef Should Be Used for Estimating Long-term Emission Levels. This Particularly Applies to Pollutants Measured W/ Continuous Emission Monitoring System (E.g., So2).	EPA. 1995. Section 2.1, Refuse Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	C

Table C-1 (Continued)

Lead Emission Factors Compiled from Version 6.23 of the Factor Information Retrieval (FIRE) Data System

Material	Source Classification Code	Primary Control	Secondary Control	Emission Factor	Unit	Measure	Action	Notes	References	Quality
Solid Waste	50100104	Dry Sorbent Injection	Fabric Filter	2.97E-04	Lb	Tons	Burned	Ef Calculated from F-factor of 9570 Dscf/mbtu and Heating Value of 4500 Btu/lb. Ef Should Be Used for Estimating Long-term Emission Levels. This Particularly Applies to Pollutants Measured W/ Continuous Emission Monitoring System (E.g., So2).	EPA. 1995. Section 2.1, Refuse Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	C
Solid Waste	50100105	Dry Sorbent Injection	Fabric Filter	2.97E-04	Lb	Tons	Burned	Ef Calculated from F-factor of 9570 Dscf/mbtu and Heating Value of 4500 Btu/lb. Ef Should Be Used for Estimating Long-term Emission Levels. This Particularly Applies to Pollutants Measured W/ Continuous Emission Monitoring System (E.g., So2).	EPA. 1995. Section 2.1, Refuse Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	C
Solid Waste	50300113	Electrostatic Precipitator		3.00E-03	Lb	Tons	Burned	Ef Calculated from F-factor of 9570 Dscf/mbtu and Heating Value of 4500 Btu/lb. Ef Should Be Used for Estimating Long-term Emission Levels. This Particularly Applies to Pollutants Measured W/ Continuous Emission Monitoring System (E.g., So2).	EPA. 1995. Section 2.1, Refuse Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	A

Table C-1 (Continued)

Lead Emission Factors Compiled from Version 6.23 of the Factor Information Retrieval (FIRE) Data System

Material	Source Classification Code	Primary Control	Secondary Control	Emission Factor	Unit	Measure	Action	Notes	References	Quality
Solid Waste	50100106	Dry Sorbent Injection	Fabric Filter	2.97E-04	Lb	Tons	Burned	Ef Calculated from F-factor of 9570 Dscf/mbtu and Heating Value of 4500 Btu/lb. Ef Should Be Used for Estimating Long-term Emission Levels. This Particularly Applies to Pollutants Measured W/ Continuous Emission Monitoring System (E.g., So2).	EPA. 1995. Section 2.1, Refuse Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	C
Solid Waste	50100101	Uncontrolled		1.20E-01	Lb	Tons	Burned		EPA. September 1985. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fourth Edition with Supplements A, B, and C, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	U
Solid Waste	50300113	Dry Sorbent Injection	Fabric Filter	2.97E-04	Lb	Tons	Burned	Ef Calculated from F-factor of 9570 Dscf/mbtu and Heating Value of 4500 Btu/lb. Ef Should Be Used for Estimating Long-term Emission Levels. This Particularly Applies to Pollutants Measured W/ Continuous Emission Monitoring System (E.g., So2).	EPA. 1995. Section 2.1, Refuse Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	C
Solid Waste	50300111	Dry Sorbent Injection	Fabric Filter	2.97E-04	Lb	Tons	Burned	Ef Calculated from F-factor of 9570 Dscf/mbtu and Heating Value of 4500 Btu/lb. Ef Should Be Used for Estimating Long-term Emission Levels. This Particularly Applies to Pollutants Measured W/ Continuous Emission Monitoring System (E.g., So2).	EPA. 1995. Section 2.1, Refuse Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	C

Table C-1 (Continued)

Lead Emission Factors Compiled from Version 6.23 of the Factor Information Retrieval (FIRE) Data System

Material	Source Classification Code	Primary Control	Secondary Control	Emission Factor	Unit	Measure	Action	Notes	References	Quality
Solid Waste	50100105	Electrostatic Precipitator		3.00E-03	Lb	Tons	Burned	Ef Calculated from F-factor of 9570 Dscf/mbtu and Heating Value of 4500 Btu/lb. Ef Should Be Used for Estimating Long-term Emission Levels. This Particularly Applies to Pollutants Measured W/ Continuous Emission Monitoring System (E.g., So2).	EPA. 1995. Section 2.1, Refuse Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	A
Solid Waste	50100104	Electrostatic Precipitator		3.00E-03	Lb	Tons	Burned	Ef Calculated from F-factor of 9570 Dscf/mbtu and Heating Value of 4500 Btu/lb. Ef Should Be Used for Estimating Long-term Emission Levels. This Particularly Applies to Pollutants Measured W/ Continuous Emission Monitoring System (E.g., So2).	EPA. 1995. Section 2.1, Refuse Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	A
Solid Waste	50100101	Electrostatic Precipitator		2.82E-03	Lb	Tons	Burned	Ef Calculated from F-factor of 9570 Dscf/mbtu and Heating Value of 4500 Btu/lb. Ef Should Be Used for Estimating Long-term Emission Levels. This Particularly Applies to Pollutants Measured W/ Continuous Emission Monitoring System (E.g., Co, Nox).	EPA. 1995. Section 2.1, Refuse Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	C

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Lead Emission Factors Compiled from Version 6.23 of the Factor Information Retrieval (FIRE) Data System

Material	Source Classification Code	Primary Control	Secondary Control	Emission Factor	Unit	Measure	Action	Notes	References	Quality
Solid Waste	50300112	Electrostatic Precipitator		3.00E-03	Lb	Tons	Burned	Ef Calculated from F-factor of 9570 Dscf/mbtu and Heating Value of 4500 Btu/lb. Ef Should Be Used for Estimating Long-term Emission Levels. This Particularly Applies to Pollutants Measured W/ Continuous Emission Monitoring System (E.g., So2).	EPA. 1995. Section 2.1, Refuse Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	A
Solid Waste	50100106	Electrostatic Precipitator		3.00E-03	Lb	Tons	Burned	Ef Calculated from F-factor of 9570 Dscf/mbtu and Heating Value of 4500 Btu/lb. Ef Should Be Used for Estimating Long-term Emission Levels. This Particularly Applies to Pollutants Measured W/ Continuous Emission Monitoring System (E.g., So2).	EPA. 1995. Section 2.1, Refuse Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	A
Solid Waste	50300111	Electrostatic Precipitator		3.00E-03	Lb	Tons	Burned	Ef Calculated from F-factor of 9570 Dscf/mbtu and Heating Value of 4500 Btu/lb. Ef Should Be Used for Estimating Long-term Emission Levels. This Particularly Applies to Pollutants Measured W/ Continuous Emission Monitoring System (E.g., So2).	EPA. 1995. Section 2.1, Refuse Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	A

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Lead Emission Factors Compiled from Version 6.23 of the Factor Information Retrieval (FIRE) Data System

Material	Source Classification Code	Primary Control	Secondary Control	Emission Factor	Unit	Measure	Action	Notes	References	Quality
Solid Waste	50300114	Electrostatic Precipitator		2.82E-03	Lb	Tons	Burned	Ef Calculated from F-factor of 9570 Dscf/mbtu and Heating Value of 4500 Btu/lb. Ef Should Be Used for Estimating Long-term Emission Levels. This Particularly Applies to Pollutants Measured W/ Continuous Emission Monitoring System (E.g., Co, Nox).	EPA. 1995. Section 2.1, Refuse Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	C
Solid Waste	50100107	Uncontrolled		2.13E-01	Lb	Tons	Burned	Ef Calculated from F-factor of 9570 Dscf/mbtu and Heating Value of 4500 Btu/lb. Ef Should Be Used for Estimating Long-term Emission Levels. This Particularly Applies to Pollutants Measured W/ Continuous Emission Monitoring System (E.g., So2).	EPA. 1995. Section 2.1, Refuse Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	A
Solid Waste	50100107	Electrostatic Precipitator		3.00E-03	Lb	Tons	Burned	Ef Calculated from F-factor of 9570 Dscf/mbtu and Heating Value of 4500 Btu/lb. Ef Should Be Used for Estimating Long-term Emission Levels. This Particularly Applies to Pollutants Measured W/ Continuous Emission Monitoring System (E.g., So2).	EPA. 1995. Section 2.1, Refuse Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	A

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Lead Emission Factors Compiled from Version 6.23 of the Factor Information Retrieval (FIRE) Data System

Material	Source Classification Code	Primary Control	Secondary Control	Emission Factor	Unit	Measure	Action	Notes	References	Quality
Solid Waste	50300115	Dry Sorbent Injection	Fabric Filter	2.97E-04	Lb	Tons	Burned	Ef Calculated from F-factor of 9570 Dscf/mbtu and Heating Value of 4500 Btu/lb. Ef Should Be Used for Estimating Long-term Emission Levels. This Particularly Applies to Pollutants Measured W/ Continuous Emission Monitoring System (E.g., So2).	EPA. 1995. Section 2.1, Refuse Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	C
Solid Waste	50300112	Spray Dryer	Electrostatic Precipitator	9.15E-04	Lb	Tons	Burned	Ef Calculated from F-factor of 9570 Dscf/mbtu and Heating Value of 4500 Btu/lb. Ef Should Be Used for Estimating Long-term Emission Levels. This Particularly Applies to Pollutants Measured W/ Continuous Emission Monitoring System (E.g., So2).	EPA. 1995. Section 2.1, Refuse Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	A
Solid Waste	50100107	Spray Dryer	Fabric Filter	2.61E-04	Lb	Tons	Burned	Ef Calculated from F-factor of 9570 Dscf/mbtu and Heating Value of 4500 Btu/lb. Ef Should Be Used for Estimating Long-term Emission Levels. This Particularly Applies to Pollutants Measured W/ Continuous Emission Monitoring System (E.g., So2).	EPA. 1995. Section 2.1, Refuse Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	A

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Lead Emission Factors Compiled from Version 6.23 of the Factor Information Retrieval (FIRE) Data System

Material	Source Classification Code	Primary Control	Secondary Control	Emission Factor	Unit	Measure	Action	Notes	References	Quality
Solid Waste	50100104	Spray Dryer	Electrostatic Precipitator	9.15E-04	Lb	Tons	Burned	Ef Calculated from F-factor of 9570 Dscf/mbtu and Heating Value of 4500 Btu/lb. Ef Should Be Used for Estimating Long-term Emission Levels. This Particularly Applies to Pollutants Measured W/ Continuous Emission Monitoring System (E.g., So2).	EPA. 1995. Section 2.1, Refuse Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	A
Solid Waste	10101201	Miscellaneous Control Devices		2.66E-04	Lb	Tons	Burned	Control Devices Are Spray Dryer, Absorber, and Electrostatic Precipitator. Two Detection Limit Values Were Used to Calculate the Emission Factor Averages.	Camden Resource Recovery Facility, Unit 1 stack emissions tests. Test date: October 18, 1991. (Confidential Report No. ERC-107)	U
Solid Waste	50300111	Spray Dryer	Electrostatic Precipitator	9.15E-04	Lb	Tons	Burned	Ef Calculated from F-factor of 9570 Dscf/mbtu and Heating Value of 4500 Btu/lb. Ef Should Be Used for Estimating Long-term Emission Levels. This Particularly Applies to Pollutants Measured W/ Continuous Emission Monitoring System (E.g., So2).	EPA. 1995. Section 2.1, Refuse Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	A
Solid Waste	50100107	Spray Dryer	Electrostatic Precipitator	9.15E-04	Lb	Tons	Burned	Ef Calculated from F-factor of 9570 Dscf/mbtu and Heating Value of 4500 Btu/lb. Ef Should Be Used for Estimating Long-term Emission Levels. This Particularly Applies to Pollutants Measured W/ Continuous Emission Monitoring System (E.g., So2).	EPA. 1995. Section 2.1, Refuse Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	A

Table C-1 (Continued)

Lead Emission Factors Compiled from Version 6.23 of the Factor Information Retrieval (FIRE) Data System

Material	Source Classification Code	Primary Control	Secondary Control	Emission Factor	Unit	Measure	Action	Notes	References	Quality
Solid Waste	50300113	Spray Dryer	Electrostatic Precipitator	9.15E-04	Lb	Tons	Burned	Ef Calculated from F-factor of 9570 Dscf/mbtu and Heating Value of 4500 Btu/lb. Ef Should Be Used for Estimating Long-term Emission Levels. This Particularly Applies to Pollutants Measured W/ Continuous Emission Monitoring System (E.g., So2).	EPA. 1995. Section 2.1, Refuse Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	A
Solid Waste	50100105	Spray Dryer	Electrostatic Precipitator	9.15E-04	Lb	Tons	Burned	Ef Calculated from F-factor of 9570 Dscf/mbtu and Heating Value of 4500 Btu/lb. Ef Should Be Used for Estimating Long-term Emission Levels. This Particularly Applies to Pollutants Measured W/ Continuous Emission Monitoring System (E.g., So2).	EPA. 1995. Section 2.1, Refuse Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	A
Solid Waste	50100106	Spray Dryer	Electrostatic Precipitator	9.15E-04	Lb	Tons	Burned	Ef Calculated from F-factor of 9570 Dscf/mbtu and Heating Value of 4500 Btu/lb. Ef Should Be Used for Estimating Long-term Emission Levels. This Particularly Applies to Pollutants Measured W/ Continuous Emission Monitoring System (E.g., So2).	EPA. 1995. Section 2.1, Refuse Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	A

Table C-1 (Continued)

Lead Emission Factors Compiled from Version 6.23 of the Factor Information Retrieval (FIRE) Data System

Material	Source Classification Code	Primary Control	Secondary Control	Emission Factor	Unit	Measure	Action	Notes	References	Quality
Solid Waste	50300115	Spray Dryer	Electrostatic Precipitator	9.15E-04	Lb	Tons	Burned	Ef Calculated from F-factor of 9570 Dscf/mbtu and Heating Value of 4500 Btu/lb. Ef Should Be Used for Estimating Long-term Emission Levels. This Particularly Applies to Pollutants Measured W/ Continuous Emission Monitoring System (E.g., So2).	EPA. 1995. Section 2.1, Refuse Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	A
Sprayed Metal	30904001	Uncontrolled		5.00E-01	Lb	Tons	Consumed			U
Steel	30900198	Baghouse		2.94E-03	Lb	Tons	Produced	Emission Factors Are Based on the Sum of the Results of the Front and Back Half Sample Analysis.	Determination of EPA Combined Metals and Cadmium Emissions from an ARC Furnace Baghouse. June 25, 1990. Test dates: May 30 - June 1, 1990. (Confidential Report No. ERC-60)	U
Subbitumino us Coal	10200221	Uncontrolled		1.33E-02	Lb	Tons	Burned	Based on Literature Review.	EPA. 1995. Section 1.1, Bituminous and Subbituminous Coal Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	E
Subbitumino us Coal	10300223	Uncontrolled		1.33E-02	Lb	Tons	Burned	Based on Literature Review.	EPA. 1995. Section 1.1, Bituminous and Subbituminous Coal Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	E
Subbitumino us Coal	10300224	Uncontrolled		1.33E-02	Lb	Tons	Burned	Based on Literature Review.	EPA. 1995. Section 1.1, Bituminous and Subbituminous Coal Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	E

Table C-1 (Continued)

Lead Emission Factors Compiled from Version 6.23 of the Factor Information Retrieval (FIRE) Data System

Material	Source Classification Code	Primary Control	Secondary Control	Emission Factor	Unit	Measure	Action	Notes	References	Quality
Subbitumino us Coal	10300222	Uncontrolled		1.33E-02	Lb	Tons	Burned	Based on Literature Review.	EPA. 1995. Section 1.1, Bituminous and Subbituminous Coal Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	E
Subbitumino us Coal	10200224	Uncontrolled		1.33E-02	Lb	Tons	Burned	Based on Literature Review.	EPA. 1995. Section 1.1, Bituminous and Subbituminous Coal Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	E
Subbitumino us Coal	10300225	Uncontrolled		1.33E-02	Lb	Tons	Burned	Based on Literature Review.	EPA. 1995. Section 1.1, Bituminous and Subbituminous Coal Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	E
Subbitumino us Coal	10100222	Uncontrolled		1.33E-02	Lb	Tons	Burned	Based on Literature Review.	EPA. 1995. Section 1.1, Bituminous and Subbituminous Coal Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	E
Subbitumino us Coal	10300221	Uncontrolled		1.33E-02	Lb	Tons	Burned	Based on Literature Review.	EPA. 1995. Section 1.1, Bituminous and Subbituminous Coal Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	E

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Lead Emission Factors Compiled from Version 6.23 of the Factor Information Retrieval (FIRE) Data System

Material	Source Classification Code	Primary Control	Secondary Control	Emission Factor	Unit	Measure	Action	Notes	References	Quality
Subbitumino us Coal	10100222	Miscellaneous Control Devices		4.20E-04	Lb	Tons	Burned	Esp or Fabric Filter Only & Wet Limestone Scrubber or Spray Dryer W/esp or Fabric Filter	EPA. September, 1998. Section 1.1, Bituminous and Subbituminous Coal Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42, Supplement E. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	A
Subbitumino us Coal	10200222	Uncontrolled		1.33E-02	Lb	Tons	Burned	Based on Literature Review.	EPA. 1995. Section 1.1, Bituminous and Subbituminous Coal Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	E
Subbitumino us Coal	10100224	Uncontrolled		1.33E-02	Lb	Tons	Burned	Based on Literature Review.	EPA. 1995. Section 1.1, Bituminous and Subbituminous Coal Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	E
Subbitumino us Coal	10100223	Uncontrolled		1.33E-02	Lb	Tons	Burned	Based on Literature Review.	EPA. 1995. Section 1.1, Bituminous and Subbituminous Coal Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	E
Subbitumino us Coal	10100221	Uncontrolled		1.33E-02	Lb	Tons	Burned	Based on Literature Review.	EPA. 1995. Section 1.1, Bituminous and Subbituminous Coal Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	E

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Lead Emission Factors Compiled from Version 6.23 of the Factor Information Retrieval (FIRE) Data System

Material	Source Classification Code	Primary Control	Secondary Control	Emission Factor	Unit	Measure	Action	Notes	References	Quality
Subbitumino us Coal	10200225	Uncontrolled		1.33E-02	Lb	Tons	Burned	Based on Literature Review.	EPA. 1995. Section 1.1, Bituminous and Subbituminous Coal Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	E
Subbitumino us Coal	10100225	Uncontrolled		1.33E-02	Lb	Tons	Burned	Based on Literature Review.	EPA. 1995. Section 1.1, Bituminous and Subbituminous Coal Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	E
Subbitumino us Coal	10300223	Miscellaneous Control Devices		4.20E-04	Lb	Tons	Burned	Esp or Fabric Filter Only & Wet Limestone Scrubber or Spray Dryer W/esp or Fabric Filter	EPA. September, 1998. Section 1.1, Bituminous and Subbituminous Coal Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42, Supplement E. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	A
Subbitumino us Coal	10300222	Miscellaneous Control Devices		4.20E-04	Lb	Tons	Burned	Esp or Fabric Filter Only & Wet Limestone Scrubber or Spray Dryer W/esp or Fabric Filter	EPA. September, 1998. Section 1.1, Bituminous and Subbituminous Coal Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42, Supplement E. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	A
Subbitumino us Coal	10300226	Miscellaneous Control Devices		4.20E-04	Lb	Tons	Burned	Esp or Fabric Filter Only & Wet Limestone Scrubber or Spray Dryer W/esp or Fabric Filter	EPA. September, 1998. Section 1.1, Bituminous and Subbituminous Coal Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42, Supplement E. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	A

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Lead Emission Factors Compiled from Version 6.23 of the Factor Information Retrieval (FIRE) Data System

Material	Source Classification Code	Primary Control	Secondary Control	Emission Factor	Unit	Measure	Action	Notes	References	Quality
Subbitumino us Coal	10100226	Miscellaneous Control Devices		4.20E-04	Lb	Tons	Burned	Esp or Fabric Filter Only & Wet Limestone Scrubber or Spray Dryer W/esp or Fabric Filter	EPA. September, 1998. Section 1.1, Bituminous and Subbituminous Coal Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42, Supplement E. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	A
Subbitumino us Coal	10200222	Miscellaneous Control Devices		4.20E-04	Lb	Tons	Burned	Esp or Fabric Filter Only & Wet Limestone Scrubber or Spray Dryer W/esp or Fabric Filter	EPA. September, 1998. Section 1.1, Bituminous and Subbituminous Coal Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42, Supplement E. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	A
Subbitumino us Coal	10100223	Miscellaneous Control Devices		4.20E-04	Lb	Tons	Burned	Esp or Fabric Filter Only & Wet Limestone Scrubber or Spray Dryer W/esp or Fabric Filter	EPA. September, 1998. Section 1.1, Bituminous and Subbituminous Coal Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42, Supplement E. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	A
Subbitumino us Coal	10200226	Miscellaneous Control Devices		4.20E-04	Lb	Tons	Burned	Esp or Fabric Filter Only & Wet Limestone Scrubber or Spray Dryer W/esp or Fabric Filter	EPA. September, 1998. Section 1.1, Bituminous and Subbituminous Coal Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42, Supplement E. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	A
Subbitumino us Coal	10200223	Miscellaneous Control Devices		4.20E-04	Lb	Tons	Burned	Esp or Fabric Filter Only & Wet Limestone Scrubber or Spray Dryer W/esp or Fabric Filter	EPA. September, 1998. Section 1.1, Bituminous and Subbituminous Coal Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42, Supplement E. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	A

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Lead Emission Factors Compiled from Version 6.23 of the Factor Information Retrieval (FIRE) Data System

Material	Source Classification Code	Primary Control	Secondary Control	Emission Factor	Unit	Measure	Action	Notes	References	Quality
Subbitumino us Coal	10100238	Miscellaneous Control Devices		4.20E-04	Lb	Tons	Burned	Esp or Fabric Filter Only & Wet Limestone Scrubber or Spray Dryer W/esp or Fabric Filter	EPA. September, 1998. Section 1.1, Bituminous and Subbituminous Coal Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42, Supplement E. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	A
Subbitumino us Coal	10200223	Uncontrolled		1.33E-02	Lb	Tons	Burned	Based on Literature Review.	EPA. 1995. Section 1.1, Bituminous and Subbituminous Coal Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	E
Waste Oil	10301302	Uncontrolled		2.20E+00	Lb	1000 Gallons	Burned	Formula for this Factor Is 55l Where "L"= Weight% Lead in Fuel. Multiply Numeric Value by L to Obtain Emission Factor. For Example, If Lead Content Is 5%, Then L=5. Std Factor Based on Assumed 0.04 Weight % Lead.	EPA. October, 1996. Section 1.11, Waste Oil Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	D
Waste Oil	10201302	Uncontrolled		2.20E+00	Lb	1000 Gallons	Burned		EPA. 1995. Section 1.11, Waste Oil Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	D
Waste Oil	10500114	Uncontrolled		1.64E-02	Lb	1000 Gallons	Burned	Formula for this Factor Is 0.41l Where "L"= Weight% Lead in Fuel. Multiply Numeric Value by L to Obtain Emission Factor. For Example, If Lead Content Is 5%, Then L=5. Std Factor Based on Assumed 0.04 Weight % Lead.	EPA. October, 1996. Section 1.11, Waste Oil Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	D

Table C-1 (Continued)

Lead Emission Factors Compiled from Version 6.23 of the Factor Information Retrieval (FIRE) Data System

Material	Source Classification Code	Primary Control	Secondary Control	Emission Factor	Unit	Measure	Action	Notes	References	Quality
Waste Oil	10500213	Uncontrolled		2.00E+00	Lb	1000 Gallons	Burned	Formula for this Factor Is 50l Where "L"= Weight% Lead in Fuel. Multiply Numeric Value by L to Obtain Emission Factor. For Example, If Lead Content Is 5%, Then L=5. Std Factor Based on Assumed 0.04 Weight % Lead.	EPA. October, 1996. Section 1.11, Waste Oil Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	D
Waste Oil	10500113	Uncontrolled		2.00E+00	Lb	1000 Gallons	Burned	Formula for this Factor Is 50l Where "L"= Weight% Lead in Fuel. Multiply Numeric Value by L to Obtain Emission Factor. For Example, If Lead Content Is 5%, Then L=5. Std Factor Based on Assumed 0.04 Weight % Lead.	EPA. October, 1996. Section 1.11, Waste Oil Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	D
Waste Oil	10500214	Uncontrolled		1.64E-02	Lb	1000 Gallons	Burned	Formula for this Factor Is 0.41l Where "L"= Weight% Lead in Fuel. Multiply Numeric Value by L to Obtain Emission Factor. For Example, If Lead Content Is 5%, Then L=5. Std Factor Based on Assumed 0.04 Weight % Lead.	EPA. October, 1996. Section 1.11, Waste Oil Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	D
Waste Oil	10101302	Uncontrolled		2.20E+00	Lb	1000 Gallons	Burned		EPA. 1995. Section 1.11, Waste Oil Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	D

Table C-1 (Continued)

Lead Emission Factors Compiled from Version 6.23 of the Factor Information Retrieval (FIRE) Data System

Material	Source Classification Code	Primary Control	Secondary Control	Emission Factor	Unit	Measure	Action	Notes	References	Quality
Wood	10200903	Uncontrolled		4.45E-04	Lb	Tons	Burned	Emission Factors Are Based on Wet, As-fired Wood Waste with Average Properties of 50 Weight Percent Moisture and 2,500 Kcal/kg (4,500btu/lb) Higher Heating Value.	EPA. October, 1996. Section 1.6, Table 5, Wood Waste Combustion in Boilers. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42, Supplement B. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	B
Wood	10200906	Uncontrolled		4.45E-04	Lb	Tons	Burned	Emission Factors Are Based on Wet, As-fired Wood Waste with Average Properties of 50 Weight Percent Moisture and 2,500 Kcal/kg (4,500btu/lb) Higher Heating Value.	EPA. October, 1996. Section 1.6, Table 5, Wood Waste Combustion in Boilers. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42, Supplement B. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	B
Wood	10100903	Multiple Cyclone W/o Fly Ash Reinjection		3.10E-04	Lb	Tons	Burned	Emission Factors Are Based on Wet, As-fired Wood Waste with Average Properties of 50 Weight Percent Moisture and 2,500 Kcal/kg (4,500 Btu/lb) Higher Heating Value.	EPA. February, 1999. Section 1.6, Wood Waste Combustion In Boilers. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42, Supplement E. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	D
Wood	10300903	Multiple Cyclone W/o Fly Ash Reinjection		3.10E-04	Lb	Tons	Burned	Emission Factors Are Based on Wet, As-fired Wood Waste with Average Properties of 50 Weight Percent Moisture and 2,500 Kcal/kg (4,500 Btu/lb) Higher Heating Value.	EPA. February, 1999. Section 1.6, Wood Waste Combustion In Boilers. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42, Supplement E. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	D
Wood	10200906	Multiple Cyclone W/o Fly Ash Reinjection		3.10E-04	Lb	Tons	Burned	Emission Factors Are Based on Wet, As-fired Wood Waste with Average Properties of 50 Weight Percent Moisture and 2,500 Kcal/kg (4,500 Btu/lb) Higher Heating Value.	EPA. February, 1999. Section 1.6, Wood Waste Combustion In Boilers. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42, Supplement E. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	D

Table C-1 (Continued)

Lead Emission Factors Compiled from Version 6.23 of the Factor Information Retrieval (FIRE) Data System

Material	Source Classification Code	Primary Control	Secondary Control	Emission Factor	Unit	Measure	Action	Notes	References	Quality
Wood	10200903	Multiple Cyclone W/o Fly Ash Reinjection		3.10E-04	Lb	Tons	Burned	Emission Factors Are Based on Wet, As-fired Wood Waste with Average Properties of 50 Weight Percent Moisture and 2,500 Kcal/kg (4,500 Btu/lb) Higher Heating Value.	EPA. February, 1999. Section 1.6, Wood Waste Combustion In Boilers. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42, Supplement E. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	D
Wood	10100903	Electrostatic Precipitator		1.10E-03	Lb	Tons	Burned	Emission Factors Are Based on Wet, As-fired Wood Waste with Average Properties of 50 Weight Percent Moisture and 2,500 Kcal/kg (4,500 Btu/lb) Higher Heating Value.	EPA. February, 1999. Section 1.6, Wood Waste Combustion In Boilers. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42, Supplement E. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	D
Wood	10100903	Uncontrolled		4.45E-04	Lb	Tons	Burned	Emission Factors Are Based on Wet, As-fired Wood Waste with Average Properties of 50 Weight Percent Moisture and 2,500 Kcal/kg (4,500btu/lb) Higher Heating Value.	EPA. October, 1996. Section 1.6, Table 5, Wood Waste Combustion in Boilers. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42, Supplement B. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	B
Wood	10200906	Electrostatic Precipitator		1.10E-03	Lb	Tons	Burned	Emission Factors Are Based on Wet, As-fired Wood Waste with Average Properties of 50 Weight Percent Moisture and 2,500 Kcal/kg (4,500 Btu/lb) Higher Heating Value.	EPA. February, 1999. Section 1.6, Wood Waste Combustion In Boilers. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42, Supplement E. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	D

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Lead Emission Factors Compiled from Version 6.23 of the Factor Information Retrieval (FIRE) Data System

Material	Source Classification Code	Primary Control	Secondary Control	Emission Factor	Unit	Measure	Action	Notes	References	Quality
Wood	10200907	Miscellaneous Control Devices		4.45E-04	Lb	Tons	Burned	Units Are Lb of Pollutant/ton of Wood Waste Burned. Emission Factors Are Based on Wet, As-fired Wood Waste with Average Properties of 50 Weight% Moisture and 4500 Btu/lb Higher Heating Value. Emission Factor Represents Measurements from Wood Waste Combustors Equipped with Pm Controls (I.e., Fabric Filters, Multi-cyclones, Esp, and Wet Scrubbers).	EPA. February, 1999. Section 1.6, Wood Waste Combustion In Boilers. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42, Supplement E. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	B
Wood	10300903	Miscellaneous Control Devices		4.45E-04	Lb	Tons	Burned	Units Are Lb of Pollutant/ton of Wood Waste Burned. Emission Factors Are Based on Wet, As-fired Wood Waste with Average Properties of 50 Weight% Moisture and 4500 Btu/lb Higher Heating Value. Emission Factor Represents Measurements from Wood Waste Combustors Equipped with Pm Controls (I.e., Fabric Filters, Multi-cyclones, Esp, and Wet Scrubbers).	EPA. February, 1999. Section 1.6, Wood Waste Combustion In Boilers. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42, Supplement E. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	B

Table C-1 (Continued)

Lead Emission Factors Compiled from Version 6.23 of the Factor Information Retrieval (FIRE) Data System

Material	Source Classification Code	Primary Control	Secondary Control	Emission Factor	Unit	Measure	Action	Notes	References	Quality
Wood	10200906	Miscellaneous Control Devices		4.45E-04	Lb	Tons	Burned	Units Are Lb of Pollutant/ton of Wood Waste Burned. Emission Factors Are Based on Wet, As-fired Wood Waste with Average Properties of 50 Weight% Moisture and 4500 Btu/lb Higher Heating Value. Emission Factor Represents Measurements from Wood Waste Combustors Equipped with Pm Controls (I.e., Fabric Filters, Multi-cyclones, Esp, and Wet Scrubbers).	EPA. February, 1999. Section 1.6, Wood Waste Combustion In Boilers. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42, Supplement E. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	B
Wood	10200903	Miscellaneous Control Devices		4.45E-04	Lb	Tons	Burned	Units Are Lb of Pollutant/ton of Wood Waste Burned. Emission Factors Are Based on Wet, As-fired Wood Waste with Average Properties of 50 Weight% Moisture and 4500 Btu/lb Higher Heating Value. Emission Factor Represents Measurements from Wood Waste Combustors Equipped with Pm Controls (I.e., Fabric Filters, Multi-cyclones, Esp, and Wet Scrubbers).	EPA. February, 1999. Section 1.6, Wood Waste Combustion In Boilers. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42, Supplement E. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	B

Table C-1 (Continued)

Lead Emission Factors Compiled from Version 6.23 of the Factor Information Retrieval (FIRE) Data System

Material	Source Classification Code	Primary Control	Secondary Control	Emission Factor	Unit	Measure	Action	Notes	References	Quality
Wood	10100903	Miscellaneous Control Devices		4.45E-04	Lb	Tons	Burned	Units Are Lb of Pollutant/ton of Wood Waste Burned. Emission Factors Are Based on Wet, As-fired Wood Waste with Average Properties of 50 Weight% Moisture and 4500 Btu/lb Higher Heating Value. Emission Factor Represents Measurements from Wood Waste Combustors Equipped with Pm Controls (I.e., Fabric Filters, Multi-cyclones, Esp, and Wet Scrubbers).	EPA. February, 1999. Section 1.6, Wood Waste Combustion In Boilers. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42, Supplement E. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	B
Wood	10200903	Electrostatic Precipitator		1.10E-03	Lb	Tons	Burned	Units Are Lb of Pollutant/ton of Wood Waste Burned. Emission Factors Are Based on Wet, As-fired Wood Waste with Average Properties of 50 Weight% Moisture and 4500 Btu/lb Higher Heating Value.	EPA. February, 1999. Section 1.6, Wood Waste Combustion In Boilers. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42, Supplement E. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	D
Wood	10300903	Electrostatic Precipitator		1.10E-03	Lb	Tons	Burned	Emission Factors Are Based on Wet, As-fired Wood Waste with Average Properties of 50 Weight Percent Moisture and 2,500 Kcal/kg (4,500 Btu/lb) Higher Heating Value.	EPA. February, 1999. Section 1.6, Wood Waste Combustion In Boilers. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42, Supplement E. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	D
Wood	10300903	Uncontrolled		4.45E-04	Lb	Tons	Burned	Emission Factors Are Based on Wet, As-fired Wood Waste with Average Properties of 50 Weight Percent Moisture and 2,500 Kcal/kg (4,500btu/lb) Higher Heating Value.	EPA. October, 1996. Section 1.6, Table 5, Wood Waste Combustion in Boilers. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42, Supplement B. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	B

Table C-1 (Continued)

Lead Emission Factors Compiled from Version 6.23 of the Factor Information Retrieval (FIRE) Data System

Material	Source Classification Code	Primary Control	Secondary Control	Emission Factor	Unit	Measure	Action	Notes	References	Quality
Wood/Bark	10200905	Multiple Cyclone W/o Fly Ash Reinjection		3.20E-04	Lb	Tons	Burned	Emission Factors Are Based on Wet, As-fired Wood Waste with Average Properties of 50 Weight Percent Moisture and 2,500 Kcal/kg (4,500 Btu/lb) Higher Heating Value.	EPA. 1995. Section 1.6, Wood Waste Combustion in Boilers. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	D
Wood/Bark	10100902	Scrubber		3.50E-04	Lb	Tons	Burned	Emission Factors Are Based on Wet, As-fired Wood Waste with Average Properties of 50 Weight Percent Moisture and 2,500 Kcal/kg (4,500 Btu/lb) Higher Heating Value.	EPA. 1995. Section 1.6, Wood Waste Combustion in Boilers. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	D
Wood/Bark	10200902	Scrubber		3.50E-04	Lb	Tons	Burned	Emission Factors Are Based on Wet, As-fired Wood Waste with Average Properties of 50 Weight Percent Moisture and 2,500 Kcal/kg (4,500 Btu/lb) Higher Heating Value.	EPA. 1995. Section 1.6, Wood Waste Combustion in Boilers. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	D
Wood/Bark	10200905	Scrubber		3.50E-04	Lb	Tons	Burned	Emission Factors Are Based on Wet, As-fired Wood Waste with Average Properties of 50 Weight Percent Moisture and 2,500 Kcal/kg (4,500 Btu/lb) Higher Heating Value.	EPA. 1995. Section 1.6, Wood Waste Combustion in Boilers. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	D
Wood/Bark	10300902	Scrubber		3.50E-04	Lb	Tons	Burned	Emission Factors Are Based on Wet, As-fired Wood Waste with Average Properties of 50 Weight Percent Moisture and 2,500 Kcal/kg (4,500 Btu/lb) Higher Heating Value.	EPA. 1995. Section 1.6, Wood Waste Combustion in Boilers. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	D

Table C-1 (Continued)

Lead Emission Factors Compiled from Version 6.23 of the Factor Information Retrieval (FIRE) Data System

Material	Source Classification Code	Primary Control	Secondary Control	Emission Factor	Unit	Measure	Action	Notes	References	Quality
Wood/Bark	10100902	Wet Scrubber		3.50E-04	Lb	Tons	Burned	Units Are Lb of Pollutant/ton of Wood Waste Burned. Emission Factors Are Based on Wet, As-fired Wood Waste with Average Properties of 50 Weight% Moisture and 4500 Btu/lb Higher Heating Value.	EPA. February, 1999. Section 1.6, Wood Waste Combustion In Boilers. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42, Supplement E. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	D
Wood/Bark	10200902	Uncontrolled		4.45E-04	Lb	Tons	Burned	Emission Factors Are Based on Wet, As-fired Wood Waste with Average Properties of 50 Weight Percent Moisture and 2,500 Kcal/kg (4,500btu/lb) Higher Heating Value.	EPA. October, 1996. Section 1.6, Table 5, Wood Waste Combustion in Boilers. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42, Supplement B. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	B
Wood/Bark	10200905	Uncontrolled		4.45E-04	Lb	Tons	Burned	Emission Factors Are Based on Wet, As-fired Wood Waste with Average Properties of 50 Weight Percent Moisture and 2,500 Kcal/kg (4,500btu/lb) Higher Heating Value.	EPA. October, 1996. Section 1.6, Table 5, Wood Waste Combustion in Boilers. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42, Supplement B. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	B
Wood/Bark	10300902	Multiple Cyclone W/o Fly Ash Reinjection		3.20E-04	Lb	Tons	Burned	Units Are Lb of Pollutant/ton of Wood Waste Burned. Emission Factors Are Based on Wet, As-fired Wood Waste with Average Properties of 50 Weight% Moisture and 4500 Btu/lb Higher Heating Value. Due to Lead's Relative Volatility, it Is Assumed That Flyash Reinjection Does Not Have a Significant Effect on Lead Emissions Following Mechanical Collectors.	EPA. February, 1999. Section 1.6, Wood Waste Combustion In Boilers. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42, Supplement E. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	D

Table C-1 (Continued)

Lead Emission Factors Compiled from Version 6.23 of the Factor Information Retrieval (FIRE) Data System

Material	Source Classification Code	Primary Control	Secondary Control	Emission Factor	Unit	Measure	Action	Notes	References	Quality
Wood/Bark	10300902	Uncontrolled		4.45E-04	Lb	Tons	Burned	Emission Factors Are Based on Wet, As-fired Wood Waste with Average Properties of 50 Weight Percent Moisture and 2,500 Kcal/kg (4,500btu/lb) Higher Heating Value.	EPA. October, 1996. Section 1.6, Table 5, Wood Waste Combustion in Boilers. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42, Supplement B. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	B
Wood/Bark	10300902	Multiple Cyclone W/o Fly Ash Reinjection		3.20E-04	Lb	Tons	Burned	Emission Factors Are Based on Wet, As-fired Wood Waste with Average Properties of 50 Weight Percent Moisture and 2,500 Kcal/kg (4,500 Btu/lb) Higher Heating Value.	EPA. 1995. Section 1.6, Wood Waste Combustion in Boilers. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	D
Wood/Bark	10200905	Wet Scrubber		3.50E-04	Lb	Tons	Burned	Units Are Lb of Pollutant/ton of Wood Waste Burned. Emission Factors Are Based on Wet, As-fired Wood Waste with Average Properties of 50 Weight% Moisture and 4500 Btu/lb Higher Heating Value.	EPA. February, 1999. Section 1.6, Wood Waste Combustion In Boilers. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42, Supplement E. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	D
Wood/Bark	10300902	Wet Scrubber		3.50E-04	Lb	Tons	Burned	Units Are Lb of Pollutant/ton of Wood Waste Burned. Emission Factors Are Based on Wet, As-fired Wood Waste with Average Properties of 50 Weight% Moisture and 4500 Btu/lb Higher Heating Value.	EPA. February, 1999. Section 1.6, Wood Waste Combustion In Boilers. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42, Supplement E. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	D
Wood/Bark	10200902	Wet Scrubber		3.50E-04	Lb	Tons	Burned	Units Are Lb of Pollutant/ton of Wood Waste Burned. Emission Factors Are Based on Wet, As-fired Wood Waste with Average Properties of 50 Weight% Moisture and 4500 Btu/lb Higher Heating Value.	EPA. February, 1999. Section 1.6, Wood Waste Combustion In Boilers. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42, Supplement E. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	D

Table C-1 (Continued)

Lead Emission Factors Compiled from Version 6.23 of the Factor Information Retrieval (FIRE) Data System

Material	Source Classification Code	Primary Control	Secondary Control	Emission Factor	Unit	Measure	Action	Notes	References	Quality
Wood/Bark	10100902	Uncontrolled		4.45E-04	Lb	Tons	Burned	Emission Factors Are Based on Wet, As-fired Wood Waste with Average Properties of 50 Weight Percent Moisture and 2,500 Kcal/kg (4,500btu/lb) Higher Heating Value.	EPA. October, 1996. Section 1.6, Table 5, Wood Waste Combustion in Boilers. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42, Supplement B. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	B
Wood/Bark	10200905	Electrostatic Precipitator		1.60E-05	Lb	Tons	Burned	Emission Factors Are Based on Wet, As-fired Wood Waste with Average Properties of 50 Weight Percent Moisture and 2,500 Kcal/kg (4,500 Btu/lb) Higher Heating Value.	EPA. February, 1999. Section 1.6, Wood Waste Combustion In Boilers. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42, Supplement E. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	D
Wood/Bark	10100902	Multiple Cyclone W/ Fly Ash Reinjection		3.20E-04	Lb	Tons	Burned	Emission Factors Are Based on Wet, As-fired Wood Waste with Average Properties of 50 Weight Percent Moisture and 2,500 Kcal/kg (4,500 Btu/lb) Higher Heating Value.	EPA. 1995. Section 1.6, Wood Waste Combustion in Boilers. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	D
Wood/Bark	10100902	Multiple Cyclone W/ Fly Ash Reinjection		3.20E-04	Lb	Tons	Burned	Units Are Lb of Pollutant/ton of Wood Waste Burned. Emission Factors Are Based on Wet, As-fired Wood Waste with Average Properties of 50 Weight% Moisture and 4500 Btu/lb Higher Heating Value. Due to Lead's Relative Volatility, it Is Assumed That Flyash Reinjection Does Not Have a Significant Effect on Lead Emissions Following Mechanical Collectors.	EPA. February, 1999. Section 1.6, Wood Waste Combustion In Boilers. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42, Supplement E. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	D

Table C-1 (Continued)

Lead Emission Factors Compiled from Version 6.23 of the Factor Information Retrieval (FIRE) Data System

Material	Source Classification Code	Primary Control	Secondary Control	Emission Factor	Unit	Measure	Action	Notes	References	Quality
Wood/Bark	10200902	Multiple Cyclone W/ Fly Ash Reinjection		3.20E-04	Lb	Tons	Burned	Emission Factors Are Based on Wet, As-fired Wood Waste with Average Properties of 50 Weight Percent Moisture and 2,500 Kcal/kg (4,500 Btu/lb) Higher Heating Value.	EPA. 1995. Section 1.6, Wood Waste Combustion in Boilers. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	D
Wood/Bark	10300902	Multiple Cyclone W/ Fly Ash Reinjection		3.20E-04	Lb	Tons	Burned	Emission Factors Are Based on Wet, As-fired Wood Waste with Average Properties of 50 Weight Percent Moisture and 2,500 Kcal/kg (4,500 Btu/lb) Higher Heating Value.	EPA. 1995. Section 1.6, Wood Waste Combustion in Boilers. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	D
Wood/Bark	10300902	Multiple Cyclone W/ Fly Ash Reinjection		3.20E-04	Lb	Tons	Burned	Units Are Lb of Pollutant/ton of Wood Waste Burned. Emission Factors Are Based on Wet, As-fired Wood Waste with Average Properties of 50 Weight% Moisture and 4500 Btu/lb Higher Heating Value. Due to Lead's Relative Volatility, it Is Assumed That Flyash Reinjection Does Not Have a Significant Effect on Lead Emissions Following Mechanical Collectors.	EPA. February, 1999. Section 1.6, Wood Waste Combustion In Boilers. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42, Supplement E. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	D

Table C-1 (Continued)

Lead Emission Factors Compiled from Version 6.23 of the Factor Information Retrieval (FIRE) Data System

Material	Source Classification Code	Primary Control	Secondary Control	Emission Factor	Unit	Measure	Action	Notes	References	Quality
Wood/Bark	10200905	Multiple Cyclone W/ Fly Ash Reinjection		3.20E-04	Lb	Tons	Burned	Units Are Lb of Pollutant/ton of Wood Waste Burned. Emission Factors Are Based on Wet, As-fired Wood Waste with Average Properties of 50 Weight% Moisture and 4500 Btu/lb Higher Heating Value. Due to Lead's Relative Volatility, it Is Assumed That Flyash Reinjection Does Not Have a Significant Effect on Lead Emissions Following Mechanical Collectors.	EPA. February, 1999. Section 1.6, Wood Waste Combustion In Boilers. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42, Supplement E. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	D
Wood/Bark	10200905	Multiple Cyclone W/ Fly Ash Reinjection		3.20E-04	Lb	Tons	Burned	Emission Factors Are Based on Wet, As-fired Wood Waste with Average Properties of 50 Weight Percent Moisture and 2,500 Kcal/kg (4,500 Btu/lb) Higher Heating Value.	EPA. 1995. Section 1.6, Wood Waste Combustion in Boilers. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	D
Wood/Bark	10200902	Miscellaneous Control Devices		4.45E-04	Lb	Tons	Burned	Units Are Lb of Pollutant/ton of Wood Waste Burned. Emission Factors Are Based on Wet, As-fired Wood Waste with Average Properties of 50 Weight% Moisture and 4500 Btu/lb Higher Heating Value. Emission Factor Represents Measurements from Wood Waste Combustors Equipped with Pm Controls (I.e., Fabric Filters, Multi-cyclones, Esp, and Wet Scrubbers).	EPA. February, 1999. Section 1.6, Wood Waste Combustion In Boilers. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42, Supplement E. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	B

Table C-1 (Continued)

Lead Emission Factors Compiled from Version 6.23 of the Factor Information Retrieval (FIRE) Data System

Material	Source Classification Code	Primary Control	Secondary Control	Emission Factor	Unit	Measure	Action	Notes	References	Quality
Wood/Bark	10200902	Multiple Cyclone W/o Fly Ash Reinjection		3.20E-04	Lb	Tons	Burned	Emission Factors Are Based on Wet, As-fired Wood Waste with Average Properties of 50 Weight Percent Moisture and 2,500 Kcal/kg (4,500 Btu/lb) Higher Heating Value.	EPA. 1995. Section 1.6, Wood Waste Combustion in Boilers. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	D
Wood/Bark	10200902	Electrostatic Precipitator		1.60E-05	Lb	Tons	Burned	Units Are Lb of Pollutant/ton of Wood Waste Burned. Emission Factors Are Based on Wet, As-fired Wood Waste with Average Properties of 50 Weight% Moisture and 4500 Btu/lb Higher Heating Value.	EPA. February, 1999. Section 1.6, Wood Waste Combustion In Boilers. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42, Supplement E. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	D
Wood/Bark	10100902	Miscellaneous Control Devices		4.45E-04	Lb	Tons	Burned	Units Are Lb of Pollutant/ton of Wood Waste Burned. Emission Factors Are Based on Wet, As-fired Wood Waste with Average Properties of 50 Weight% Moisture and 4500 Btu/lb Higher Heating Value. Emission Factor Represents Measurements from Wood Waste Combustors Equipped with Pm Controls (I.e., Fabric Filters, Multi-cyclones, Esp, and Wet Scrubbers).	EPA. February, 1999. Section 1.6, Wood Waste Combustion In Boilers. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42, Supplement E. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	B
Wood/Bark	10100902	Electrostatic Precipitator		1.60E-05	Lb	Tons	Burned	Units Are Lb of Pollutant/ton of Wood Waste Burned. Emission Factors Are Based on Wet, As-fired Wood Waste with Average Properties of 50 Weight% Moisture and 4500 Btu/lb Higher Heating Value.	EPA. February, 1999. Section 1.6, Wood Waste Combustion In Boilers. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42, Supplement E. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	D

Table C-1 (Continued)

Lead Emission Factors Compiled from Version 6.23 of the Factor Information Retrieval (FIRE) Data System

Material	Source Classification Code	Primary Control	Secondary Control	Emission Factor	Unit	Measure	Action	Notes	References	Quality
Wood/Bark	10300902	Miscellaneous Control Devices		4.45E-04	Lb	Tons	Burned	Units Are Lb of Pollutant/ton of Wood Waste Burned. Emission Factors Are Based on Wet, As-fired Wood Waste with Average Properties of 50 Weight% Moisture and 4500 Btu/lb Higher Heating Value. Emission Factor Represents Measurements from Wood Waste Combustors Equipped with Pm Controls (I.e., Fabric Filters, Multi-cyclones, Esp, and Wet Scrubbers).	EPA. February, 1999. Section 1.6, Wood Waste Combustion In Boilers. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42, Supplement E. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	B
Wood/Bark	10100902	Multiple Cyclone W/o Fly Ash Reinjection		3.20E-04	Lb	Tons	Burned	Emission Factors Are Based on Wet, As-fired Wood Waste with Average Properties of 50 Weight Percent Moisture and 2,500 Kcal/kg (4,500 Btu/lb) Higher Heating Value.	EPA. 1995. Section 1.6, Wood Waste Combustion in Boilers. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	D
Wood/Bark	10100902	Multiple Cyclone W/o Fly Ash Reinjection		3.20E-04	Lb	Tons	Burned	Units Are Lb of Pollutant/ton of Wood Waste Burned. Emission Factors Are Based on Wet, As-fired Wood Waste with Average Properties of 50 Weight% Moisture and 4500 Btu/lb Higher Heating Value. Due to Lead's Relative Volatility, it Is Assumed That Flyash Reinjection Does Not Have a Significant Effect on Lead Emissions Following Mechanical Collectors.	EPA. February, 1999. Section 1.6, Wood Waste Combustion In Boilers. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42, Supplement E. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	D

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Lead Emission Factors Compiled from Version 6.23 of the Factor Information Retrieval (FIRE) Data System

Material	Source Classification Code	Primary Control	Secondary Control	Emission Factor	Unit	Measure	Action	Notes	References	Quality
Wood/Bark	10200905	Multiple Cyclone W/o Fly Ash Reinjection		3.20E-04	Lb	Tons	Burned	Units Are Lb of Pollutant/ton of Wood Waste Burned. Emission Factors Are Based on Wet, As-fired Wood Waste with Average Properties of 50 Weight% Moisture and 4500 Btu/lb Higher Heating Value. Due to Lead's Relative Volatility, it Is Assumed That Flyash Reinjection Does Not Have a Significant Effect on Lead Emissions Following Mechanical Collectors.	EPA. February, 1999. Section 1.6, Wood Waste Combustion In Boilers. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42, Supplement E. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	D
Wood/Bark	10200902	Multiple Cyclone W/o Fly Ash Reinjection		3.20E-04	Lb	Tons	Burned	Units Are Lb of Pollutant/ton of Wood Waste Burned. Emission Factors Are Based on Wet, As-fired Wood Waste with Average Properties of 50 Weight% Moisture and 4500 Btu/lb Higher Heating Value. Due to Lead's Relative Volatility, it Is Assumed That Flyash Reinjection Does Not Have a Significant Effect on Lead Emissions Following Mechanical Collectors.	EPA. February, 1999. Section 1.6, Wood Waste Combustion In Boilers. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42, Supplement E. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	D

Table C-1 (Continued)

Lead Emission Factors Compiled from Version 6.23 of the Factor Information Retrieval (FIRE) Data System

Material	Source Classification Code	Primary Control	Secondary Control	Emission Factor	Unit	Measure	Action	Notes	References	Quality
Wood/Bark	10200902	Multiple Cyclone W/ Fly Ash Reinjection		3.20E-04	Lb	Tons	Burned	Units Are Lb of Pollutant/ton of Wood Waste Burned. Emission Factors Are Based on Wet, As-fired Wood Waste with Average Properties of 50 Weight% Moisture and 4500 Btu/lb Higher Heating Value. Due to Lead's Relative Volatility, it Is Assumed That Flyash Reinjection Does Not Have a Significant Effect on Lead Emissions Following Mechanical Collectors.	EPA. February, 1999. Section 1.6, Wood Waste Combustion In Boilers. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42, Supplement E. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	D
Wood/Bark	10200905	Miscellaneous Control Devices		4.45E-04	Lb	Tons	Burned	Units Are Lb of Pollutant/ton of Wood Waste Burned. Emission Factors Are Based on Wet, As-fired Wood Waste with Average Properties of 50 Weight% Moisture and 4500 Btu/lb Higher Heating Value. Emission Factor Represents Measurements from Wood Waste Combustors Equipped with Pm Controls (I.e., Fabric Filters, Multi-cyclones, Esp, and Wet Scrubbers).	EPA. February, 1999. Section 1.6, Wood Waste Combustion In Boilers. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42, Supplement E. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	B
Wood/Bark	10300902	Electrostatic Precipitator		1.60E-05	Lb	Tons	Burned	Emission factors are based on wet, as-fired wood waste with average properties of 50 weight percent moisture and 2,500 kcal/kg (4,500 Btu/lb) higher heating value.	EPA. February, 1999. Section 1.6, Wood Waste Combustion In Boilers. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42, Supplement E. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	D

Table C-2

California Air Resources Board's (CARB) California Air Toxic Emission Factors for Lead

Source Classification Code (SCC)	System Type	Material Type	Air Pollution Control Device	Other Description	Maximum Emission Factor	Mean Emission Factor	Median Emission Factor	Units
N/A	Abrasive Blasting	Dust	None	None	4.97E+01	5.75E+02	5.75E+02	mg/kg
30500211	Asphalt Production	Diesel/Aggregate	C/FF	None	2.77E-06	2.17E-06	2.17E-06	lbs/ton
30500205	Asphalt Production	Diesel/Aggregate	FF	None	4.04E-06	1.45E-06	1.45E-06	lbs/ton
30500205	Asphalt Production	Diesel/Aggregate	WS	None	2.19E-03	2.19E-03	2.19E-03	lbs/ton
N/A	Asphalt Production	Dust	None	None	1.40E+01	1.40E+01	1.40E+01	mg/kg
N/A	Asphalt Production	Rock plant mine feed	None	None	1.40E+01	1.40E+01	1.40E+01	mg/kg
N/A	Asphalt Production	Specialty mine feed	None	None	1.40E+01	1.40E+01	1.40E+01	mg/kg
30500211	Asphalt Production	Natural gas/Aggregate	C/FF	None	2.10E-05	1.52E-06	1.52E-06	lbs/ton
30500211	Asphalt Production	Natural gas/Aggregate	C/WS	None	2.10E-05	1.52E-06	1.52E-06	lbs/ton
30500211	Asphalt Production	Back-up oil/Aggregate	C/BH	None	7.41E-06	2.11E-06	2.11E-06	lbs/ton
30500211	Asphalt Production	Process oil 70/Aggregate	C/WS	None	7.41E-06	2.11E-06	2.11E-06	lbs/ton
30400522	Battery Production	Grids	None	None	7.98E-03	6.46E-03	6.46E-03	lbs/ton
30400505	Battery Production	Batteries	None	None	1.77E-02	4.77E-03	4.77E-03	lbs/MBat

Table C-2 (Continued)

California Air Resources Board's (CARB) California Air Toxic Emission Factors for Lead

Source Classification Code (SCC)	System Type	Material Type	Air Pollution Control Device	Other Description	Maximum Emission Factor	Mean Emission Factor	Median Emission Factor	Units
30400505	Battery Production	Batteries	None	None	2.39E-02	8.43E-03	8.43E-03	lbs/MBat
10100222	Boiler	Coal/Natural gas	None	None	3.14E-04	2.70E-04	2.70E-04	lbs/ton
10200802	Boiler	Coke/Coal	LI/AI/B	None	4.41E-06	4.32E-06	4.32E-06	lbs/ton
10100401	Boiler	No. 6 Fuel oil	None	None	3.79E-03	1.04E-03	1.04E-03	lbs/Mgal
10200401	Boiler	No. 6 Fuel oil	None	None	3.62E-02	6.41E-04	6.41E-04	lbs/Mgal
10200402	Boiler	No. 6 Fuel oil	None	None	3.62E-02	6.41E-04	6.41E-04	lbs/Mgal
10200403	Boiler	No. 6 Fuel oil	None	None	3.62E-02	6.41E-04	6.41E-04	lbs/Mgal
10200401	Boiler	Residual oil	None	None	3.62E-02	6.41E-04	6.41E-04	lbs/Mgal
10300811	Boiler	Landfill gas	None	None	6.85E-03	5.71E-03	5.71E-03	lbs/MMcf
10200701	Boiler	Refinery gas	None	EA<100%	2.49E-03	2.42E-03	2.42E-03	lbs/MMcf
10200701	Boiler	Refinery gas	SCR	EA<100%	2.49E-03	2.42E-03	2.42E-03	lbs/MMcf
10200701	Boiler	Refinery gas	None	EA>100%	7.73E-03	7.51E-04	7.51E-04	lbs/MMcf
30500606	Cement Kiln	Coal/Raw materials	FF	None	3.06E-04	1.96E-05	1.96E-05	lbs/ton
30500606	Cement Kiln	Coal/Coke/Raw materials	FF	None	2.34E-06	8.91E-07	8.91E-07	lbs/ton
30601401	Coke Calcining	Natural gas/Coke	SD/FF	None	9.27E-05	4.92E-05	4.92E-05	lbs/ton
N/A	Composition	Crude oil	None	None	2.97E+02	2.97E+02	2.97E+02	ug/l
N/A	Composition	Diesel	None	None	2.58E+02	4.17E+02	4.17E+02	ug/l
N/A	Composition	Jp-4	None	None	1.64E+03	1.64E+03	1.64E+03	ug/l
N/A	Composition	Jp-5	None	None	2.05E+02	2.05E+02	2.05E+02	ug/l
N/A	Composition	Lube oil	None	None	1.98E+02	2.97E+02	2.97E+02	ug/l

Table C-2 (Continued)

California Air Resources Board's (CARB) California Air Toxic Emission Factors for Lead

Source Classification Code (SCC)	System Type	Material Type	Air Pollution Control Device	Other Description	Maximum Emission Factor	Mean Emission Factor	Median Emission Factor	Units
31502101	Crematory	Propane/Bodies	None	None	6.29E-05	6.27E-05	6.27E-05	lbs/body
50100506	Dehydrator	Natural gas/Sludge	C	None	4.93E-07	4.93E-07	4.93E-07	lbs/ton
30400101	Delaquering	Aluminum	None	None	2.25E-02	2.12E-02	2.12E-02	lbs/ton
30902501	Drum Burning Furnace	Drums	AB	None	4.98E-04	3.98E-04	3.98E-04	lbs/drum
30502201	Dryer	Potash	S	None	6.76E-05	6.62E-05	6.62E-05	lbs/ton
30502201	Dryer	Sulfate of potash	BH	None	1.86E-03	1.71E-03	1.71E-03	lbs/ton
10100903	Fluidized Bed Combustor	Agricultural waste	AI/C/FF	None	6.77E-05	6.71E-05	6.71E-05	lbs/ton
10100903	Fluidized Bed Combustor	Agricultural/Urban wood waste	LI/SNCR/C/FF	None	1.32E-04	1.28E-04	1.28E-04	lbs/ton
10100903	Fluidized Bed Combustor	Urban wood waste	LI/SNCR/C/FF	None	5.99E-05	5.94E-05	5.94E-05	lbs/ton
10100217	Fluidized Bed Combustor	Coal	LI/AI/C/FF	None	2.11E-04	3.30E-05	3.30E-05	lbs/ton
10100217	Fluidized Bed Combustor	Coal	LI/AI/FF/ESP	None	2.11E-04	3.30E-05	3.30E-05	lbs/ton
10100801	Fluidized Bed Combustor	Coke	LI/AI/C/FF	None	4.12E-04	8.49E-05	8.49E-05	lbs/ton
30600201	Fluid Catalytic Cracking Unit	Refinery gas/Oils	ESP/COB	None	5.76E-04	3.43E-04	3.43E-04	lbs/MBar
N/A	Fugitives	Casing gas/Natural gas	None	None	1.10E-03	2.00E-03	2.00E-03	ppbv
30300926	Furnace	Alloy stock	None	Electric Induction	8.64E-03	8.55E-03	8.55E-03	lbs/ton

Table C-2 (Continued)

California Air Resources Board's (CARB) California Air Toxic Emission Factors for Lead

Source Classification Code (SCC)	System Type	Material Type	Air Pollution Control Device	Other Description	Maximum Emission Factor	Mean Emission Factor	Median Emission Factor	Units
30400107	Furnace	Aluminum	FF	Dross	5.28E-04	4.16E-04	4.16E-04	lbs/ton
30400199	Furnace	Aluminum	None	Melting Pot	1.60E-06	1.20E-06	1.20E-06	lbs/ton
30400103	Furnace	Aluminum	FF	Reverberatory	3.87E-04	3.36E-04	3.36E-04	lbs/ton
30400103	Furnace	Aluminum	None	Reverberatory	1.87E-03	2.98E-04	2.98E-04	lbs/ton
30400224	Furnace	Brass/Bronze ingot	FF	Electric Induction	1.32E-03	1.02E-03	1.02E-03	lbs/ton
30501402	Furnace	Raw materials	None	None	5.21E-04	5.13E-04	5.13E-04	lbs/ton
30501403	Furnace	Raw materials	None	None	5.21E-04	5.13E-04	5.13E-04	lbs/ton
30400401	Furnace	Lead	FF	Melting Pot	4.57E-03	2.77E-03	2.77E-03	lbs/ton
30400401	Furnace	Lead	FF	Melting Pot	4.57E-03	2.77E-03	2.77E-03	lbs/ton
30400408	Furnace	Lead	FF	Melting Pot	2.05E-03	1.16E-03	1.16E-03	lbs/ton
30400408	Furnace	Lead	FF	Melting Pot	2.05E-03	1.16E-03	1.16E-03	lbs/ton
N/A	Gas Processing	Fuel gas	None	None	2.36E-01	3.56E+00	3.56E+00	ppbv
31000403	Heater	Pipeline oil	None	None	5.48E-04	1.79E-04	1.79E-04	lbs/Mgal
30600106	Heater	Refinery gas	DeNOx	EA<100%	8.43E-03	1.50E-03	1.50E-03	lbs/MMcf
30600106	Heater	Refinery gas	DeNOx	EA<100%	8.43E-03	1.50E-03	1.50E-03	lbs/MMcf
30600106	Heater	Refinery gas	None	EA<100%	8.43E-03	1.50E-03	1.50E-03	lbs/MMcf
30600106	Heater	Refinery gas	None	EA<100%	8.43E-03	1.50E-03	1.50E-03	lbs/MMcf
30600106	Heater	Refinery gas	SCR	EA<100%	8.43E-03	1.50E-03	1.50E-03	lbs/MMcf
30600106	Heater	Refinery gas	SCR	EA<100%	8.43E-03	1.50E-03	1.50E-03	lbs/MMcf

Table C-2 (Continued)

California Air Resources Board's (CARB) California Air Toxic Emission Factors for Lead

Source Classification Code (SCC)	System Type	Material Type	Air Pollution Control Device	Other Description	Maximum Emission Factor	Mean Emission Factor	Median Emission Factor	Units
30600106	Heater	Refinery gas	None	EA>100%	9.28E-04	9.19E-04	9.19E-04	lbs/MMcf
30600106	Heater	Refinery gas	None	EA>100%	9.28E-04	9.19E-04	9.19E-04	lbs/MMcf
30600106	Heater	Refinery gas	SCR	EA>100%	9.28E-04	9.19E-04	9.19E-04	lbs/MMcf
30600106	Heater	Refinery gas	SCR	EA>100%	9.28E-04	9.19E-04	9.19E-04	lbs/MMcf
50300205	Incinerator	Diesel/Waste explosives	None	None	2.47E-02	7.42E-03	7.42E-03	lbs/ton
31307001	Oven	Coatings of electric motor winding wires	None	None	1.78E-02	1.51E-02	1.51E-02	lbs/ton
30901006	Plating	Chromic acid	PBS	None	1.53E+02	1.29E+02	1.29E+02	mg/amp-h
30501622	Preheater Kiln	Coal/Raw materials	C/FF	None	5.89E-05	3.92E-05	3.92E-05	lbs/ton
31000413	Steam Generator	Crude oil	None	None	4.90E-04	2.60E-04	2.60E-04	lbs/Mgal
31000413	Steam Generator	Crude oil	SO2 Scrub	None	4.90E-04	2.60E-04	2.60E-04	lbs/Mgal
30400101	Shredding and Delaquering	Aluminum	BH	None	4.97E-05	3.19E-05	3.19E-05	lbs/ton
30400108	Shredding and Delaquering	Aluminum	BH	None	4.97E-05	3.19E-05	3.19E-05	lbs/ton
N/A	Tank	Produced water	None	None	7.00E-04	7.00E-04	7.00E-04	ppbv
20200103	Turbine	No. 2 Distillate oil	None	None	7.18E-04	7.04E-04	7.04E-04	lbs/Mgal
20200203	Turbine	Natural gas/Refinery gas	COC/SCR	None	1.90E-03	1.81E-03	1.81E-03	lbs/MMcf
20200705	Turbine	Natural gas/Refinery gas	COC/SCR	None	1.90E-03	1.81E-03	1.81E-03	lbs/MMcf
20200203	Turbine	Natural gas/Refinery gas	SCR/AI/COC	None	1.90E-03	1.81E-03	1.81E-03	lbs/MMcf
20200705	Turbine	Natural gas/Refinery gas	SCR/AI/COC	None	1.90E-03	1.81E-03	1.81E-03	lbs/MMcf

Table C-2 (Continued)

California Air Resources Board's (CARB) California Air Toxic Emission Factors for Lead

Source Classification Code (SCC)	System Type	Material Type	Air Pollution Control Device	Other Description	Maximum Emission Factor	Mean Emission Factor	Median Emission Factor	Units
20200203	Turbine	Natural/Refinery/Liquid petroleum gas	COC/SCR	None	7.16E-02	6.85E-02	6.85E-02	lbs/MMcf
20200705	Turbine	Natural/Refinery/Liquid petroleum gas	COC/SCR	None	7.16E-02	6.85E-02	6.85E-02	lbs/MMcf
20201013	Turbine	Natural/Refinery/Liquid petroleum gas	COC/SCR	None	7.16E-02	6.85E-02	6.85E-02	lbs/MMcf
20200701	Turbine	Refinery gas	COC	None	4.18E-02	4.15E-02	4.15E-02	lbs/MMcf

INDEX

The pages listed in bold text in the index correspond to the primary uses or definitions of the associated term. Additionally, this index includes a list of primary purposes for the numerical examples that are presented throughout the document and selected questions and answers contained in Appendix B.

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