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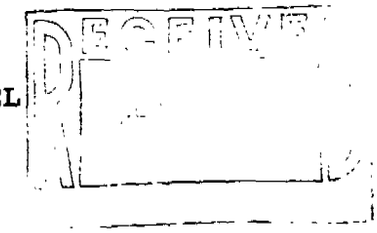

MEMORANDUM TO THE CMA VINYLIDENE CHLORIDE PANEL

Re: EPA Hazardous Air Pollutant Source Category List (Docket A-90-49)

Attached are copies of the pages from the EPA 1985 document "Locating and Estimating Air Emissions from Sources of Vinylidene Chloride" that were included in the above-referenced docket. We will distribute copies of the complete report when it arrives.

Also attached is a copy of relevant portions of EPA's Preliminary Draft Documentation for Developing the Source Category List, which was added to the docket on January 25.

R. Bruce Dickson

RBD:cs
Enclosure

SL 063698

Radian

United States
Environmental Protection
Agency

Office of Air Quality
Planning and Standards
Research Triangle Park NC

A-90-49

II-A-19

Air

EPA

Locating And Estimating Air Emissions From Sources Of Vinylidene Chloride

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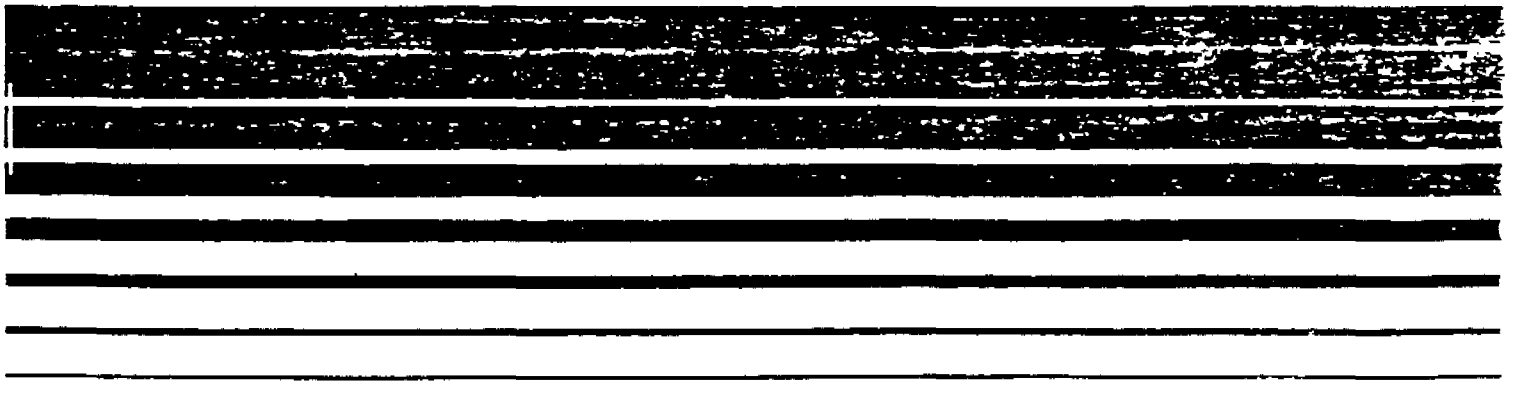

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EPA Project Officer: Thomas F. Lahre

16. ABSTRACT

To assist groups interested in inventorying air emissions of various potentially toxic substances, EPA is preparing a series of documents such as this to compile available information on sources and emissions of these substances. This document deals specifically with vinylidene chloride. Its intended audience includes Federal, State and local air pollution personnel and others interested in locating potential emitters of vinylidene chloride in making gross estimates of air emissions therefrom.

This document presents information on 1) the types of sources that may emit vynilidene chloride, 2) process variations and release points that may be expected within these sources, and 3) available emissions information indicating the potential for vinylidene chloride release into the air from each operation.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
Vinylidene Chloride Emissions Sources Locating Air Emission Sources Toxic Substances		

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SL 063700

POLYMERIZATION OF VINYLIDENE CHLORIDE

Vinylidene chloride monomer is polymerized with a variety of other monomers to produce copolymers with special properties. VDC copolymers can be divided into high VDC polymers, generally containing 70 to 95 percent VDC, and low VDC polymers, generally containing 10 to 70 percent VDC.

High VDC polymers are unique in their low permeabilities to oxygen, water vapor, and other gases. They also have good clarity and a glossy appearance. High VDC polymers typically are used as vapor barrier coatings on various film substrates, such as paper, polyester, polypropylene, or polyethylene. High VDC polymers are also used to make Saran films which can be used alone or laminated to other plastic films. The comonomers most commonly used to produce high VDC polymers are vinyl chloride, acrylic acid, acrylic esters and acrylonitrile.[2,25,26]

In low VDC polymers, the VDC monomer generally is added to improve the flame retardant properties of the finished polymer. Low VDC polymers are used as flame resistant coatings, saturants, dipping compounds, and adhesives. They can also be sprayed onto fibers and textiles. Typical comonomers used in these applications include acrylic esters, vinyl acetate, and vinyl chloride. VDC is used with styrene and butadiene monomers to produce a flame retardant styrene-butadiene latex for carpet backing. VDC is also used with acrylonitrile to produce modacrylic synthetic fibers.[2,25,26]

Emissions from VDC polymerization are discussed in this section. Emissions of residual VDC monomer from the subsequent processing and fabrication of VDC in polymers are discussed in a later section. Copolymer production and fabrication generally are carried out at separate facilities.

Process Description

The reactions involved in the production of vinylidene chloride copolymers are illustrated in Figure 6. The major process used to produce VDC copolymers is emulsion polymerization. This polymerization technique can be used to produce both latex resin and dried resins.[25]

followed by drying with hot air. The dried product comprises polymer particles. The particle diameter produced by emulsion polymerization is 100 to 150 nanometers.[2,25]

Suspension Polymerization--

The same basic steps are used in suspension polymerization as in emulsion polymerization (Figure 7).[1] VDC (Stream 1), comonomer (Stream 2), and water (Stream 3) are metered and charged to a batch reactor along with surfactant and initiator (Stream 4). In suspension polymerization, the initiator used is soluble in the organic phase. The batch is agitated to produce a suspension of the organic phase in the water phase. After charging, the batch is heated to activate the initiator, which causes polymerization. The reactor must then be cooled to remove the heat of polymerization.[2,25]

Suspension polymerization generally is carried out at about 60°C. The duration of the reaction is 30 to 60 hours and the degree of completion is about 85 to 90 percent.[2] After the polymerization reaction has reached the desired degree of completion, the polymer (Stream 5) generally is stripped of unreacted monomer (Stream 6) by steam and heat, either in the reactor or in a separate vessel. Unreacted monomer is recycled (Stream 7) or vented to a control system. The batch is then transferred to a holding tank (Stream 8) and dried (Stream 11) with hot air to produce dry polymer particles. Typical particle diameters produced by suspension polymerization range from 150 to 590 microns.[2,25]

Solution Polymerization--

As noted above, solution polymerization is used on the production of vinylidene chloride copolymer synthetic fibers. These fibers typically have a low VDC content.[2,25,26] Information is not available on the specific steps used in the solution polymerization of VDC copolymers; however, the general reaction steps are expected to be similar to those used in the solution polymerization of other resins.

In a solution polymerization process, the polymerization reaction is carried out in a solvent which dissolves both the monomers and the

TABLE 8. ESTIMATED CONTROLLED VINYLIDENE CHLORIDE EMISSION FACTORS FOR A HYPOTHETICAL VINYLIDENE CHLORIDE POLYMERIZATION PLANT[a]

Emission source	Source designation[b]	Controlled VDC emission factor[c]
Reactor	B	3.5 kg/Mg[d]
Monomer recovery	D	0.33 kg/Mg[d]
Unloading/storage	A	2.1 kg/Mg[d]
Process fugitive	G	2.8-11 kg/Mg[e]
Total		1.4-7.0 kg/Mg[d]

[a]Any given plant may vary in configuration and level of control from this hypothetical facility. The reader is encouraged to contact plant personnel to confirm the existence of emitting operations and control technology at a particular facility prior to estimating emissions therefrom.

[b]Letters refer to vents designated in Figure 7.

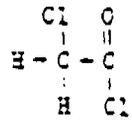
[c]Emission factors in terms of kg/Mg refer to kilogram of vinylidene chloride emitted per megagram of vinylidene chloride polymerized. In cases where a particular source designation applies to multiple operations, these factors represent combined emissions for all, not each, of these operations within the hypothetical facility. The types of controls employed were not reported.

[d]Based on industry estimates.

[e]Based on EPA projections of monomer emissions from small and medium sized generic polymerization plants with quarterly inspection and maintenances of valves, pumps, compressors, flanges, relief valves, and process drains.[29] Industry reports that more stringent inspection and maintenance programs are practiced than are reflected in the factors cited in this table. (See text for discussion.) These more stringent measures result in fugitive emission control efficiencies as high as 90 to 95 percent from an uncontrolled situation where no significant measures are taken for leak detection and repair.[18,19]

USE OF VINYLIDENE CHLORIDE IN SPECIALTY CHEMICAL PRODUCTION

Vinylidene chloride is used as a chemical intermediate in the production of chloroacetyl chloride. This use of VDC is minor in comparison with its use in production of VDC copolymers. The structure of chloroacetyl chloride is as follows:



Its main use is in the manufacture of chloroacetophenone, the principal ingredient in tear gas. It is also used in the manufacture of pharmaceuticals.[7,9]

Process Description and Emissions

Information on the process used to produce chloroacetyl chloride from VDC is not available, nor are data available to estimate VDC emissions from the process. Dow Chemical reports no losses of VDC to the environment from the process used in chloroacetyl chloride production.[9]

Source Locations

The VDC process for chloroacetyl chloride is used by the Dow Chemical U.S.A., of Midland, Michigan.[9] Production facilities are located at Dow Chemical's Michigan Division plant at Midland.[18]

primary solvents and toluene as a diluent. Following the dissolution step, additives such as wax, talc and silica are added in a closed blender. The polymer solution is then fed to a dip tank, through which a cellophane film strip is drawn.

After passing through the dip tank, the cellophane, now coated with VDC copolymer solution, is run through a dryer consisting of two chambers. In the first, dry air at 90 to 140°C is passed over the film, resulting in removal of the solvent.[32] In the second chamber, the film is conditioned in warm humid air.

Solvent laden vapor is collected from the drying chamber and ducted to carbon absorption beds. Solvent stripped from the beds is purified by distillation and recycled to the process. Heating air from the second drying chamber is vented to the atmosphere.

Coating with Latex Copolymer--

As noted in the earlier section of POLYMERIZATION OF VINYLIDENE CHLORIDE, a latex is a polymer emulsion in water. Materials typically coated with high-VDC latex include paper products and plastic films.[32]

The latex may first be blended with additives, such as wax or pigments, or diluted with additional water in a vented mixing tank. The latex is pumped from the mixing tank to a holding tank and then to the dip tank. The holding tank allows reduction of any foam that may form during mixing. The material to be coated is rolled through the dip tank and then to a drying oven. In the drying oven, water is removed from the latex and the latex forms a barrier film. Both the dip tank and the drying oven are vented to the atmosphere.[32]

Extrusion of Thermoplastic Copolymer--

The raw material for extrusion is dried emulsion or suspension resin in the form of a powder or small granules. The polymer is mixed with additives such as plasticizer in a high-intensity blender. Mechanical energy dissipated in the blender heats the resin to about 170°C.[32] The blender is vented through a hood, usually to a ... stack. From the high-intensity blender, the resin is fed to a ribbon blender, where it is homogenized further and cooled. The blended resin may be

TABLE 11. ESTIMATES OF UNCONTROLLED EMISSION FACTORS FROM HIGH-VDC COPOLYMER FABRICATION PROCESSES

Process	Copolymer VDC concentrations (ppmw)[a] Raw resin[b] (c_i)	Processed resin[c] (c_o)	Estimated uncontrolled emission factor (g/Mg)[d]
Celophane coating	10-120	neg[e]	10-120
Latex coating	50-2000	0-500	50-1500
Extrusion	2-25	neg[e]	2-25

[a]Reference 32.

[b]Resin entering the dissolver (Figure 8).

[c]Resin leaving the dryer (Figure 8).

[d]Calculated from residual VDC levels. Emissions are expressed in terms of grams of VDC per Mg of copolymer processed.

[e]neg = negligible.

A-90-49
II-C-1

United States Environmental Protection Agency
Office of Air Quality Planning and Standards
Research Tnangle Park NC 27711

Air

EPA

DOCUMENTATION FOR DEVELOPING THE SOURCE CATEGORY LIST

PRELIMINARY DRAFT

NESHAP

A-90-49
II-C-1

DRAFT
December 14, 1990

DISCLAIMER

This preliminary draft report has been reviewed by the Emission Standards Division, Office of Air Quality Planning and Standards, U. S. Environmental Protection Agency, and approved for review as received from the Radian Corporation. Approval does not signify that the contents necessarily reflect the views and policies of the U.S. Environmental Protection Agency, nor does mention of trade names of commercial products constitute endorsement or recommendation for use.

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TABLES

1. INTRODUCTION

Title III (Air Toxics) of the 1990 amendments to the Clean Air Act identifies a list of 189 hazardous air pollutants (HAPs). The Act requires the U.S. Environmental Protection Agency (EPA) to publish a list of all categories and subcategories of major and area sources of the HAPs within one year of enactment. According to the Act, a major source means any stationary source (including all emission points and units located within a contiguous area and under common control) of air pollution that emits, considering installed and operating controls, in the aggregate, 10 tons per year or more of any HAP or 25 tons per year or more of any combination of HAPs. An area source means any stationary source of HAPs that is not a major source.

Stationary source categories that emit one or more of the listed 189 HAPs have been identified by EPA's Office of Air Quality Planning and Standards (OAQPS). The purpose of this report is to describe the methodology used to identify sources that emit HAPs and to document the technical references which support the Agency's conclusion that one or more of the listed HAPs is emitted from a specified source category. The methodology used to develop the list of source categories is discussed in Chapter 2.

The source categories and the hazardous pollutant(s) associated with each source category are listed by Industry Group in Table 3.1 of Chapter 3. An Industry Group consists of source categories that have similar industrial descriptions. Table 3.1 includes a reference list and also refers to an appendix of additional detail pertaining to certain selected references. The references cited are available for public review in the rulemaking docket (Docket No.) which is available for public inspection at EPA's Air Docket Section, Room M-1500, Waterside Mall, 401 M Street SW, Washington, DC.

2. METHODOLOGY FOR DEVELOPING THE SOURCE CATEGORY LIST

Identification of source categories was dependent on the availability of reference sources that relate emissions information to specific industrial sources. Source categories that either produce or use the HAPs were identified using all known sources of emissions information. More than one reference may have identified a source category as emitting one or more of the 189 HAPs, but in these cases, only one reference may be shown.

The following information sources were used to develop the list of source categories:

- Pollutant speciation profiles for Source Classification Codes (SCCs) used in the National Emissions Data Systems (NEDS) and the National Acid Precipitation Assessment Program (NAPAP);
- Published production and consumption data for the chemical industry and emission factors developed by the EPA's Emission Standards Division (ESD);
- Toxic Release Inventory System (TRIS) of Section 313, Superfund Amendments and Reauthorization Act (SARA);
- EPA's National Air Toxics Information Clearinghouse (NATICH); and
- Additional EPA reports and memoranda.

The references used to develop the source category list were evaluated in a prioritized manner. The pollutants and source categories that were found in the first-preferred reference were not evaluated using the other available references. This approach was designed to use all available information to identify major emission source categories, but to place greater emphasis on the most reliable information sources. Information derived from the reference sources is discussed in the following sections and is presented in the order of preference in which the reference sources were evaluated. The specific references used for each source category are cited in Table 3.1.

2.1 NATIONAL EMISSIONS DATA SYSTEM (NEDS)

Many emission sources were characterized by Source Classification Codes (SCCs) contained within EPA's National Emissions Data System (NEDS).[1] NEDS is a database of emissions reported by individual states for sources emitting 100 tons per year or more of any criteria pollutant. An SCC is an 8-digit code divided into 4 levels of identifiers: 1) the category process; 2) the major industry; 3) the major product; and 4) different operations within the category process. A list of approximately 4,000 SCCs and descriptions may be found in Criteria Pollutant Emission Factors for the 1985 NAPAP Emissions Inventory.[2] NEDS provides emission estimates for volatile organic compounds (VOC) and particulate matter (PM), but not for individual HAPs.

Speciation profiles developed by EPA[3,4] were assigned to each SCC contained in NEDS. Speciation profiles distinguish the chemical constituents within the total VOC or PM emissions.

Linking a speciation profile with an SCC provided an estimate of the HAP constituents emitted from a source category. The SCC identifiers were used to define the source category and its industry group. Those source categories appear first in Table 3.1 and are listed by industry group in the approximate numerical order of their SCC codes. The HAPs are listed for each source category and the appendix for Table 3.1 (Appendix A) lists the SCCs and the corresponding speciation profiles which were used to associate a specific hazardous pollutant with a given source category. The source categories appear in Appendix A by industry group in the same order they are listed in Table 3.1.

In the appendix, it is noted that in each speciation profile has an associated "Data Quality Rating" ("A" through "E"). These ratings are based on the following:

Data Quality A: Data set is based on a composite of several tests using analytical techniques such as GC/MS, and can be considered representative of the total population.

Data Quality B: Data set is based on a composite of several tests using analytical techniques such as GC/MS, and can be considered representative of a large percentage of the total population.

Data Quality C: Data set is based on a small number of tests using analytical techniques such as GC/MS and can be considered reasonably representative of the total population.

Data Quality D: Data set is based on a single source using analytical techniques such as GC/MS; or data set is taken from a number of sources where data are based on engineering calculations.

Data Quality E: Data set is based on engineering judgment and/or has no documentation provided; may not be considered representative of the total population.

The uncertainty associated with the "E" quality profiles is such that they are substantially less reliable than the other profiles. Data quality E profiles were not used to identify source categories with the one exception for the source category Architectural Coatings in the Industry Group--Surface Coating Processes.

2.2 EMISSION STANDARDS DIVISION (ESD) APPROACH

The approach used by the EPA's Emission Standards Division assesses emissions from industrial processes that produce or consume organic chemicals. The approach uses published chemical production and consumption data and emission factors developed by the ESD from previous regulatory studies. Many source categories that emit hazardous air pollutants were identified using this approach.

EPA's regulatory development program to control HAP emissions from the synthetic organic chemical manufacturing industry (SOCMI) has identified many source categories within the SOCMI. For the purposes of this listing, the SOCMI is defined as those units producing any of the chemicals listed in: 1) the Code of Federal Regulations Title 40, Part 60, Subpart VV--Standards of Performance for Equipment Leaks of VOC in (SOCMI)[5]; and 2) the "Industrial Organic Chemical Use Trees" prepared for EPA's Industrial Environmental Research Laboratory.[6] Many of the chemicals produced in SOCMI process units were included on the list of 189 hazardous air pollutants. The chemical use

trees, which indicate the derivation and uses of individual industrial chemicals, helped identify chemicals that use a HAP as a raw material in the process of their production. The source categories listed in Table 3.1 for the Industry Group--Production of Synthetic Organic Chemicals, are those processes that either produce a HAP or use a HAP as a raw material in the production process. The hazardous pollutant(s) emitted are noted for each source category.

Chemical marketing publications were evaluated to identify source categories that produce or use one of the 189 HAPs. Some chemical production source categories were verified by the SRI Directory of Chemical Producers.[7] Publications such as the Mannsville Chemical Synopsis[8] and the Chemical Marketing Reporter[9] were used to identify the consumption pattern for as many of the remaining HAPs as possible. Each end-use noted for a chemical was considered a source category and therefore one chemical may have been associated with many different source categories.

2.3 TOXIC RELEASE INVENTORY SYSTEM (TRIS)

As required by the Superfund Amendments and Reauthorization Act (SARA), Section 313, owners and operators of certain facilities must report annually their releases of listed toxic chemicals. The emissions data is reported to the Toxic Release Inventory System (TRIS) database which is maintained by EPA. TRIS data is available to the public through the EPA's Office of Toxic Substances, Public Data Branch. As of 1990, annual reporting is required for certain manufacturing facilities that manufacture or process greater than 25,000 pounds or use greater than 10,000 pounds of a listed chemical in a calendar year. The annual reports estimate the total amount of each chemical that is released into the air, water, or soil either by accident, by routine plant operations, or by transportation as waste to another location.[10]

Single emission estimates reported in TRIS may represent the aggregate of many production and use activities at a plant site. The Standard Industrial Classification (SIC) code is given for each facility reporting emissions data in TRIS. The NEDS Source Classification Codes (SCC) are not provided. The SIC codes give a more generic industrial description of the

source and it would require an additional and time-consuming evaluation of each of the numerous SIC codes to identify the same source categories described by the SCC codes. To avoid duplicate listing of source categories that had already been identified by SCC codes, a chemical-specific approach was used with the TRIS database to identify source categories for pollutants not covered by the previously described references. In Table 3.1, the source categories defined by TRIS are specified only by chemical name. Because all production and use are reported as a single emission estimate for each plant site, those source categories appear in the Industry Group--Production and Use Activities (TRIS).

2.4 NATIONAL AIR TOXICS INFORMATION CLEARINGHOUSE

The National Air Toxics Information Clearinghouse (NATICH) is a database that is maintained by EPA and is available to State and local air pollution control agencies through the EPA National Computer Center. Information contained in NATICH includes data submitted by State and local air permitting agencies. It is intended to facilitate information exchange among EPA, State, and local agencies regarding toxic air pollutants. Data contained in NATICH includes: acceptable ambient concentrations and standards for air pollutants; pollutant research information; permitting information; and source testing information.[11]

Many State and local agencies conduct emission source testing as part of their air toxics control program. The source testing information in NATICH was sorted by pollutant and the descriptions associated with each test were reviewed. This identified additional source categories for a few of the remaining HAPs that had not previously been addressed by the other reference sources.

2.5 OTHER REFERENCE SOURCES

Other EPA reports and documentation were used to identify source categories in addition to the previously described information sources. Many of the reports were prepared in support of the rulemaking procedures for National Emission Standards for Hazardous Air Pollutants (NESHAP) and New Source Performance Standards (NSPS). This documentation includes preliminary

source assessments and surveys for hazardous air pollutants, background information for proposed regulations, reports on control technologies, and federal regulations and notices for proposed rulemaking.

2.6 REFERENCES

1. U.S. Environmental Protection Agency, National Emissions Data System (NEDS). Office of Air Quality Planning and Standards, National Air Data Branch. Research Triangle Park, NC. July 1988.

2. U.S. Environmental Protection Agency. Criteria Pollutant Emission Factors for the 1985 NAPAP Emissions Inventory. Office of Research and Development, Research Triangle Park, NC. Publication No. EPA-600/7-87-015. 1987.

3. U.S. Environmental Protection Agency. Air Emissions Species Manual, Volume 2, Volatile Organic Compound (VOC) Species Profiles. Office of Air Quality Planning and Standards, Research Triangle Park, NC. NTIS No. PB90-185844. October 1989.

4. U.S. Environmental Protection Agency. Air Emissions Species Manual, Volume 2. Particulate Matter (PM) Species Profiles. Office of Air Quality Planning and Standards, Research Triangle Park, NC. NTIS No. PB90-184367. October 1989.

5. Federal Register, Volume 48, Number 202, Standards of Performance for New Stationary Sources; Synthetic Organic Chemical Manufacturing Industry; Equipment Leaks of VOC; Reference Methods 18 and 22. October 18, 1983.

6. Radian Corporation and Paul W. Spaite Company. Industrial Organic Chemical Use Trees. Prepared for U.S. Environmental Protection Agency, Office of Research and Development, Industrial Environmental Research Laboratory, Cincinnati, Ohio. Contract No. 68-03-3038-SBR09 and 68-03-3171. October 1983.

7. 1987 Directory of Chemical Producers United States of America, SRI International, Menlo Park, CA.

8. "Chemical Products Synopsis" Series, Mannsville Chemical Products Corporation, Mannsville, New York.

9. "Chemical Profiles" series in Chemical Marketing Reporter, Schnell Publishing Company, New York.

10. U.S. Environmental Protection Agency. Toxic Chemical Release Inventory Reporting Package for 1989. Office of Toxic Substances, Washington, D.C. Publication No. EPA-560/4-90-001. January 1990.

11. U.S. Environmental Protection Agency. National Air Toxics Information Clearinghouse: NATICH Data Base Report on State, Local, and EPA Air Toxics Activities. Office of Air Quality Planning and Standards, Research Triangle Park, NC. Contract No. 68D80065. July 1989.

3. LISTING OF SOURCE CATEGORIES BY INDUSTRY GROUP

The source categories are listed in Table 3.1 by industry group. For example, the source categories--coke ovens, feroalloys production, and gray iron foundries, all belong to the industry group entitled "Ferrous Metals". Many source categories do not have similar industrial descriptions. Source categories that can not be identified by a common industry type appear in the "Miscellaneous" Industry Group. These source categories primarily consist of various production operations and chemical uses.

Because many users of this list may use SCC codes from NEDS to identify source categories, the source categories that were identified by NEDS data appear first in Table 3.1. The source categories are listed by their industry group in the approximate numerical order of their SCC codes. As other source categories and industry groups are listed that were not identified by NEDS data, an alphabetical listing is used. Two exceptions to the alphabetical listing are the Industry Groups--Miscellaneous and Production and Use Activities (TRIS). These two Industry Groups appear last in Table 3.1. A Table of Contents is included for Table 3.1 and may be used to locate the source categories within the given industry groups.

The references used to identify source categories are included by number in Table 3.1 to correspond to the list of references in Section 3.2. The appendix for Table 3.1 (Appendix A) lists the SCCs and the corresponding speciation profiles which were used to associate a specific hazardous pollutant with a given source category. Those source categories are located in Appendix A by their industry group in the same order they are listed in Table 3.1.

TABLE 3.1 Source Categories and Associated Toxic Pollutant(s) Listed by Industry Group

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TABLE 3.1 TABLE OF CONTENTS (Continued)

Table 3.1. Source Categories and Associated Toxic Pollutant(s) Listed by Industry Group.

INDUSTRY GROUP=FUEL COMBUSTION

SCC RANGE	SOURCE CATEGORY NAME	POLLUTANT NAME	REFERENCE*
101002-101013	UTILITY EXTERNAL COMBUSTION BOILERS	ARSENIC COMPOUNDS (INORGANIC INCLUD. ARSINE)	30, see also Appendix A
101002-101013		CADMIUM COMPOUNDS	30, see also Appendix A
101002-101013		CHROMIUM COMPOUNDS	30, see also Appendix A
101002-101013		LEAD COMPOUNDS	30, see also Appendix A
101002-101013		MANGANESE COMPOUNDS	30, see also Appendix A
101002-101013		NICKEL COMPOUNDS	30, see also Appendix A
101002-101013		SELENIUM COMPOUNDS	30, see also Appendix A
101004-101013		FORMALDEHYDE	29, see also Appendix A
101004-101013		HEXANE	29, see also Appendix A
101006-101011		BENZENE	29, see also Appendix A
101006-101011		TOLUENE	29, see also Appendix A
		BERYLLIUM COMPOUNDS	106
		MERCURY COMPOUNDS	106
		PHOSPHORUS	107
		POLYCYCLIC ORGANIC MATTER	106
102002-102002	INDUSTRIAL EXTERNAL COMBUSTION BOILERS	ETHYL BENZENE	29, see also Appendix A
102002-102002		XYLENE (O-)	29, see also Appendix A
102002-102014		ARSENIC COMPOUNDS (INORGANIC INCLUD. ARSINE)	30, see also Appendix A
102002-102014		BENZENE	29, see also Appendix A
102002-102014		CADMIUM COMPOUNDS	30, see also Appendix A
102002-102014		CHROMIUM COMPOUNDS	30, see also Appendix A
102002-102014		HEXANE	29, see also Appendix A
102002-102014		LEAD COMPOUNDS	30, see also Appendix A
102002-102014		MANGANESE COMPOUNDS	30, see also Appendix A
102002-102014		MERCURY COMPOUNDS	30, see also Appendix A
102002-102014		NICKEL COMPOUNDS	30, see also Appendix A
102002-102014		SELENIUM COMPOUNDS	30, see also Appendix A
102002-102014		TOLUENE	29, see also Appendix A
102004-102014		FORMALDEHYDE	29, see also Appendix A
		BERYLLIUM COMPOUNDS	106
		PHOSPHORUS	107
		POLYCYCLIC ORGANIC MATTER	106
103002-103013	INSTITUTIONAL EXTERNAL COMBUSTION BOILERS	ARSENIC COMPOUNDS (INORGANIC INCLUD. ARSINE)	30, see also Appendix A
103002-103013		CADMIUM COMPOUNDS	30, see also Appendix A
103002-103013		CHROMIUM COMPOUNDS	30, see also Appendix A
103002-103013		LEAD COMPOUNDS	30, see also Appendix A
103002-103013		MANGANESE COMPOUNDS	30, see also Appendix A
103002-103013		NICKEL COMPOUNDS	30, see also Appendix A
103002-103013		SELENIUM COMPOUNDS	30, see also Appendix A
103004-103013		HEXANE	29, see also Appendix A
103004-105002		FORMALDEHYDE	29, see also Appendix A
103006-105002		BENZENE	29, see also Appendix A
103006-105002		TOLUENE	29, see also Appendix A
		BERYLLIUM COMPOUNDS	106
		MERCURY COMPOUNDS	106
		PHOSPHORUS	107
		POLYCYCLIC ORGANIC MATTER	106
105001-105002	EXTERNAL COMBUSTION SPACE HEATERS	ARSENIC COMPOUNDS (INORGANIC INCLUD. ARSINE)	30, see also Appendix A
105001-105002		BENZENE	29, see also Appendix A
105001-105002		CADMIUM COMPOUNDS	30, see also Appendix A
105001-105002		CHROMIUM COMPOUNDS	30, see also Appendix A
105001-105002		FORMALDEHYDE	29, see also Appendix A
105001-105002		HEXANE	29, see also Appendix A
105001-105002		LEAD COMPOUNDS	30, see also Appendix A
105001-105002		MANGANESE COMPOUNDS	30, see also Appendix A
105001-105002		NICKEL COMPOUNDS	30, see also Appendix A
105001-105002		SELENIUM COMPOUNDS	30, see also Appendix A
105001-105002		TOLUENE	29, see also Appendix A

Table 3.1 (Continued)

INDUSTRY GROUP-PRODUCTION OF SYNTHETIC ORGANIC CHEMICALS (continued)

SCC RANGE	SOURCE CATEGORY NAME	POLLUTANT NAME	REFERENCE*
	DIALLYL PHTHALATE PRODUCTION	PHTHALIC ANHYDRIDE	22,23,31,32
	DIAMINOPHENOL HYDROCHLORIDE PRODUCTION	DINITROPHENOL - 2,4	22,23,31,32
	DIBROMOMETHANE PRODUCTION	METHYLENE CHLORIDE (DICHLOROMETHANE)	22,23,31,32
	DIBUTOXYETHYL PHTHALATE PRODUCTION	ETHYLENE GLYCOL MONOBUTYL ETHER	22,23,31,32
	DICHLORO-1-BUTENE (3,4-ISOMER) PRODUCTION	BUTADIENE-1,3	22,23,31,32
	DICHLORO-2-BUTENE (1,4-) PRODUCTION	BUTADIENE-1,3	22,23,31,32
	DICHLOROANILINE (ALL ISOMERS) PRODUCTION	NITROBENZENE	22,23,31,32
	DICHLOROBENZENE (1,4-ISOMER) (P- ISOMER) PRODUCTIO	BENZENE	22,23,31,32
		CHLORINE	22,23,31,32
		CHLOROBENZENE	22,23,31,32
		DICHLOROBENZENE(P) - 1,4 (PDB)	22,23,31,32
		HYDROCHLORIC ACID	22,23,31,32
	DICHLOROBENZENE (M-ISOMER) PRODUCTION	BENZENE	22,23,31,32
		CHLORINE	22,23,31,32
		CHLOROBENZENE	22,23,31,32
		DICHLOROBENZENE (P-ISOMER) (1,4-) (PDB)	22,23,31,32
		HYDROCHLORIC ACID	22,23,31,32
	DICHLOROBENZENE (O-ISOMER) PRODUCTION	BENZENE	22,23,31,32
		CHLORINE	22,23,31,32
		CHLOROBENZENE	22,23,31,32
		DICHLOROBENZENE (P-ISOMER) (1,4-) (PDB)	22,23,31,32
		HYDROCHLORIC ACID	22,23,31,32
	DICHLORODIFLUOROMETHANE PRODUCTION	CARBON TETRACHLORIDE	22,23,31,32
		HYDROCHLORIC ACID	22,23,31,32
		HYDROGEN FLUORIDE	22,23,31,32
	DICHLOROETHANE (1,2-ISOMER) (EDC) PRODUCTION	CHLORINE	22,23,31,32
		DICHLOROETHANE - 1,2 (EDC)	22,23,31,32
		HYDROCHLORIC ACID	22,23,31,32
		VINYL CHLORIDE (CHLORO ETHYLENE)	22,23,31,32
	DICHLOROETHYL ETHER (BIS(2-CHLOROETHYL)ETHER) PROD	CHLORINE	22,23,31,32
		DICHLOROETHYL ETHER (BIS(2-CHLOROETHYL)ETHER)	22,23,31,32
	DICHLOROETHYLENE (1,2- ISOMER) PRODUCTION	TRICHLOROETHYLENE	22,23,31,32
	DICHLOROPHENOL (2,4-ISOMER) PRODUCTION	PHENOL	22,23,31,32
	DICHLOROPROPENE (1,3-ISOMER) PRODUCTION	ALLYL CHLORIDE	22,23,31,32
		DICHLOROPROPENE - 1,3	22,23,31,32
	DICHLOROTETRAFLUOROETHANE PRODUCTION	PERCHLOROETHYLENE(TETRACHLOROETHYLENE)	22,23,31,32
	DICYANIDIAMIDE	DICYANIDIAMIDE	22,23,31,32
		CYANAMIDE	22,23,31,32
	DIETHANOLAMINE	DIETHANOLAMINE	22,23,31,32
		ETHYLENE OXIDE	22,23,31,32
	DIETHYL PHTHALATE PRODUCTION	PHTHALIC ANHYDRIDE	22,23,31,32
	DIETHYLAMINE PRODUCTION	TRIETHYLAMINE	22,23,31,32
	DIETHYLANILINE (2,6-ISOMER) PRODUCTION	ANILINE	22,23,31,32
	DIETHYLENE GLYCOL DIBUTYL ETHER PRODUCTION	DIETHYLENE GLYCOL MONOBUTYL ETHER	22,23,31,32
	DIETHYLENE GLYCOL DIETHYL ETHER (GLYCOL ETHER) PRO	ACETALDEHYDE	22,23,31,32
		DIETHYLENE GLYCOL DIETHYL ETHER	22,23,31,32
		DIETHYLENE GLYCOL MONOETHYL ETHER	22,23,31,32
	DIETHYLENE GLYCOL DIMETHYL ETHER (GLYCOL ETHER) PR	DIETHYLENE GLYCOL DIMETHYL ETHER	22,23,31,32
		DIETHYLENE GLYCOL MONOMETHYL ETHER	22,23,31,32
		FORMALDEHYDE	22,23,31,32
	DIETHYLENE GLYCOL MONOBUTYL ETHER (GLYCOL ETHER) P	DIETHYLENE GLYCOL MONOBUTYL ETHER	22,23,31,32
		ETHYLENE GLYCOL MONOBUTYL ETHER	22,23,31,32
		ETHYLENE OXIDE	22,23,31,32
	DIETHYLENE GLYCOL MONOBUTYL ETHER ACETATE (GLYCOL	DIETHYLENE GLYCOL MONOBUTYL ETHER	22,23,31,32
	DIETHYLENE GLYCOL MONOETHYL ETHER (GLYCOL ETHER) P	DIETHYLENE GLYCOL MONOETHYL ETHER	22,23,31,32
		ETHYLENE GLYCOL MONOETHYL ETHER	22,23,31,32
		ETHYLENE OXIDE	22,23,31,32
	DIETHYLENE GLYCOL MONOETHYL ETHER ACETATE (GLYCOL	DIETHYLENE GLYCOL MONOETHYL ETHER	22,23,31,32
		DIETHYLENE GLYCOL MONOETHYL ETHER ACETATE	22,23,31,32

Table 3.1 (Continued)

INDUSTRY GROUP-PRODUCTION OF SYNTHETIC ORGANIC CHEMICALS (continued)

SCC RANGE	SOURCE CATEGORY NAME	POLLUTANT NAME	REFERENCE*
	TOLUENE DIISOCYANATES (MIXTURE) PRODUCTION	DINITROTOLUENE - 2,4 (DNT)	22,23,31,32
		TOLUENE	22,23,31,32
		TOLUENE 2,4 DIAMINE	22,23,31,32
		TOLUENE 2,4 DIISOCYANATE	22,23,31,32
	TOLUENE PRODUCTION	BENZENE	22,23,31,32
		BIPHENYL	22,23,31,32
		TOLUENE	22,23,31,32
		XYLENES (ISOMERS AND MIXTURE) MIX	22,23,31,32
	TOLUENESULFONIC ACIDS (ALL ISOMERS) PRODUCTION	TOLUENE	22,23,31,32
	TOLUENESULFONYL CHLORIDE PRODUCTION	TOLUENE	22,23,31,32
	TOLUIDINE (O-ISOMER) PRODUCTION	DINITROTOLUENE - 2,4 (DNT)	22,23,31,32
		TOLUIDINE (O-)	22,23,31,32
	TRICHLOROANILINE (2,4,6-ISOMER) PRODUCTION	ANILINE	22,23,31,32
	TRICHLOROBENZENE (1,2,4-ISOMER) PRODUCTION	TRICHLOROBENZENE (1,2,4-)	22,23,31,32
	TRICHLOROETHANE (1,1,2-ISOMER) (VINYL TRICHLORIDE)	CHLORINE	22,23,31,32
		HYDROCHLORIC ACID	22,23,31,32
		TRICHLOROETHANE (1,1,2-) (VINYL TRICHLORIDE)	22,23,31,32
		VINYL CHLORIDE (CHLORO ETHYLENE)	22,23,31,32
	TRICHLOROETHYLENE PRODUCTION	CHLORINE	22,23,31,32
		DICHLOROETHANE - 1,2 (EDC)	22,23,31,32
		HYDROCHLORIC ACID	22,23,31,32
		TRICHLOROETHYLENE	22,23,31,32
	TRICHLOROFLUOROMETHANE PRODUCTION	CARBON TETRACHLORIDE	22,23,31,32
		HYDROCHLORIC ACID	22,23,31,32
		HYDROGEN FLUORIDE	22,23,31,32
	TRICHLOROPHENOL (2,4,5-) PRODUCTION	TRICHLOROPHENOL-2,4,5	22,23,31,32
	TRICHLOROTRIFLUOROETHANE (1,2,2 -1,1,2 ISOMER) PRO	CHLORINE	22,23,31,32
		HYDROCHLORIC ACID	22,23,31,32
		HYDROGEN FLUORIDE	22,23,31,32
		PERCHLOROETHYLENE(TETRACHLOROETHYLENE,	22,23,31,32
	TRIETHANOLAMINE PRODUCTION	DIETHANOLAMINE	22,23,31,32
		ETHYLENE OXIDE	22,23,31,32
	TRIETHYLAMINE PRODUCTION	TRIETHYLAMINE	22,23,31,32
	TRIETHYLENE GLYCOL DIMETHYL ETHER (GLYCOL ETHER) P	FORMALDEHYDE	22,23,31,32
		TRIETHYLENE GLYCOL DIMETHYL ETHER	22,23,31,32
	TRIETHYLENE GLYCOL MONOMETHYL ETHER PRODUCTION	ETHYLENE OXIDE	22,23,31,32
		METHANOL	22,23,31,32
	TRIETHYLENE GLYCOL PRODUCTION	ETHYLENE GLYCOL	22,23,31,32
		ETHYLENE OXIDE	22,23,31,32
	TRIMETHYLAMINE PRODUCTION	METHANOL	22,23,31,32
	TRIMETHYLCYCLOHEXANOL PRODUCTION	ISOPHORONE	22,23,31,32
	TRIMETHYLCYCLOHEXANONE PRODUCTION	ISOPHORONE	22,23,31,32
	TRIMETHYLCYCLOHEXYLAMINE PRODUCTION	ISOPHORONE	22,23,31,32
	TRIMETHYLOPROPANE PRODUCTION	FORMALDEHYDE	22,23,31,32
	TRIMETHYLPENTANE (2,2,4-) PRODUCTION	TRIMETHYLPENTANE (2,2,4-)	22,23,31,32
	TRIPROPYLENE GLYCOL PRODUCTION	PROPYLENE OXIDE	22,23,31,32
	VINYL ACETATE PRODUCTION	VINYL ACETATE	22,23,31,32
	VINYL CHLORIDE (CHLORO ETHYLENE) PRODUCTION	CHLORINE	22,23,31,32
		DICHLOROETHANE - 1,2 (EDC)	22,23,31,32
		HYDROCHLORIC ACID	22,23,31,32
		VINYL CHLORIDE (CHLORO ETHYLENE)	22,23,31,32
	VINYL TOLUENE PRODUCTION	TOLUENE	22,23,31,32
	VINYLCYCLOHEXENE (4-ISOMER) PRODUCTION	BUTADIENE-1,3	22,23,31,32
	VINYLIDENE CHLORIDE (1,1-DICHLOROETHYLENE) PRODUCT	TRICHLOROETHANE (1,1,2-) (VINYL TRICHLORIDE)	22,23,31,32
		VINYLIDENE CHLORIDE (1,1-DICHLOROETHYLENE)	22,23,31,32
	XANTHATES (POTASSIUM ETHYL XANTHATE) PRODUCTION	CARBON DISULFIDE	22,23,31,32
	XYLENE (M-ISOMER) PRODUCTION	XYLENES (ISOMERS AND MIXTURE) MIX	22,23,31,32
	XYLENE SULFONIC ACID PRODUCTION	XYLENES (ISOMERS AND MIXTURE) MIX	22,23,31,32

20. Letter from Scopelliti, T., Enviro-Scope Consulting Corporation, to Rosensteel, R. E., U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Chemicals and Petroleum Branch, Research Triangle Park, NC. August 29, 1990. Information regarding metal shredding operations.

21. (reserved)

22. Radian Corporation and Paul W. Spaite Company. Industrial Organic Chemical Use Trees. Prepared for U.S. Environmental Protection Agency. Office of Research and Development, Industrial Environmental Research Laboratory, Cincinnati, Ohio. Contract No. 68-03-3038-SBR09 and 68-03-3171. October 1983.

23. Memorandum from B. King, Radian Corporation, to L. Evans, U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. October 31, 1990. Task II: Characterization of Chemical Production Categories Not Found in Literature Search and Identification of Affected and Unaffected Product-Processes.

24. 1987 Directory of Chemical Producers United States of America, SRI International, Menlo Park, CA.

25. Memorandum from R. B. Lucas, Office of Air Quality Planning and Standards, Chemicals and Petroleum Branch, to J. Padgett, Assoc. Director for Intermedia and Intergovernmental Programs, Office of Air Quality Planning and Standards. July 20, 1988. New Study on the Air Toxics Problem in the United States - POTW Emissions.

26. U.S. Environmental Protection Agency. Alternative Control Technology Document - Ethylene Oxide Sterilization/Fumigation Operations, Office of Air Quality Planning and Standards, Research Triangle Park, NC. Publication No. EPA-450/3-89-007. NTIS PB90-131434. March 1989.

27. U.S. Environmental Protection Agency. National Air Toxics Information Clearinghouse (NATICH) Database. Office of Air Quality Planning and Standards, Pollutant Assessment Branch, Research Triangle Park, NC.

28. U.S. Environmental Protection Agency, Toxic Chemical Release Inventory System (TRIS). Office of Toxic Substances, Information Management Division, Public Data Branch, Washington, DC.

29. U.S. Environmental Protection Agency. Air Emissions Species Manual, Volume 1, Volatile Organic Compound (VOC) Species Profiles. Office of Air Quality Planning and Standards, Research Triangle Park, NC. Publication No. EPA-450/2-90-001a. NTIS No. PB90-185844. January 1990.

30. U.S. Environmental Protection Agency. Air Emissions Species Manual, Volume 2, Particulate Matter (PM) Species Profiles. Office of Air Quality Planning and Standards, Research Triangle Park, NC. Publication No. EPA-450/2-90-001b. NTIS No. PB90-184367. January 1990.

31. Federal Register, Volume 48, No. 202, Standards of Performance for New Stationary Sources; Synthetic Organic Chemical Manufacturing Industry; Equipment Leaks of VOC; Reference Methods 18 and 22. October 18, 1983.

32. Docket No. A-79-32. Standards of Performance for New Stationary Sources; Synthetic Organic Chemical Manufacturing Industry; Equipment Leaks of VOC. U.S. Environmental Protection Agency, Central Docket Section (A-130), 401 M Street, S.W., Washington, DC.

33. Federal Register, Volume 53, No. 54, Assessment of Naphthalene As a Potentially Toxic Air Pollutant. March 21, 1988.

34. Docket No. A-87-10. Assessment of Naphthalene As a Potentially Toxic Air Pollutant. U.S. Environmental Protection Agency, Central Docket Section (A-130), 401 M Street, S.W., Washington, DC.

35. Federal Register. Volume 50, No. 111. Pilot Program on Acrylonitrile. June 10, 1985.

36. Federal Register. Volume 50, No. 197. Assessment of 1,3-Butadiene as a Potentially Toxic Air Pollutant. October 10, 1985.

37. Docket No. A-85-14. Assessment of 1,3-Butadiene as a Potentially Toxic Air Pollutant. U.S. Environmental Protection Agency, Central Docket Section (A-130), 401 M Street, S.W., Washington, DC.

38. Federal Register. Volume 50, No. 188, Intent to List Chloroform as a Hazardous Air Pollutant. September 27, 1985.

39. Docket No. A-85-12. Intent to List Chloroform as a Hazardous Air Pollutant, U.S. Environmental Protection Agency, Central Docket Section (A-130), 401 M Street S.W., Washington, DC.

40. Federal Register. Volume 50, No. 190. Assessment of Hexachlorocyclopentadiene as a Potentially Toxic Air Pollutant. October 1, 1985.

41. Docket No. A-84-26. Assessment of Hexachlorocyclopentadiene as a Potentially Toxic Air Pollutant. U.S. Environmental Protection Agency, Central Docket Section (A-130), 401 M Street, S.W., Washington, DC.

42. Federal Register. Volume 50, No. 188, Assessment of Chloroprene as a Potentially Toxic Air Pollutant. September 27, 1985.

APPENDIX A

This appendix lists the SCC's and the speciation profile numbers which associate specific hazardous pollutants with a given source category. The SCC's and speciation profiles listed here for specific pollutants are cited from the following references:

U.S. Environmental Protection Agency. Air Emissions Species Manual, Volume 1: Volatile Organic Compound (VOC) Species Profiles. Office of Air Quality Planning and Standards, Research Triangle Park, NC. NTIS No. PB90-185844. Publication No. EPA-450/2-90-001a. January 1990.

U.S. Environmental Protection Agency. Air Emissions Species Manual, Volume 2: Particulate Matter (PM) Species Profiles. Office of Air Quality Planning and Standards, Research Triangle Park, NC. NTIS No. PB90-184367. Publication No. EPA-450/2-90-0016. January 1990.

Specific source categories and pollutants may be located by industry group in the same order they appear in Table 3.1 (see p. 3-2, Table of Contents for Table 3.1).