



33/50 Program: Fact Sheets on the 17 Target Chemicals



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33/50 PROGRAM: FACT SHEETS ON THE 17 TARGET CHEMICALS

Introduction

Today's industrial society generates a large amount of chemical wastes in the process of manufacturing the goods and services on which we have come to depend. Many of these chemicals have been found to cause adverse effects on human health and the environment, and consequently, efforts have been focused on treatment and disposal of waste streams to limit their release to the environment. The U.S. Environmental Protection Agency (EPA) has initiated several programs geared toward reducing the generation of these chemical waste streams in the first place through substituting less harmful compounds or modifying processes and procedures. One of these programs is called the 33/50 Program. The 33/50 Program focuses on the industrial sector and has identified 17 toxic chemicals as a target for reduction. The EPA has emphasized that pollution prevention techniques should be given highest priority as the method for reducing the releases of these 17 chemicals. This document provides some general information on the 17 chemicals and indicates why it is important to reduce their release.

Background - 33/50 Program

EPA's 33/50 Program calling for voluntary industry reductions of 17 toxic chemicals, is aimed at achieving an overall national reduction of 33 percent by 1992 and 50 percent by 1995 based on releases and transfers reported to the Toxics Release Inventory (TRI) in 1988. The 17 high-priority toxic chemicals included in the Program accounted for 1.4 billion pounds of the releases and transfers reported to TRI in 1988; a 50 percent reduction would eliminate 700 million pounds by 1995.

It is important to note that the chemicals included in the 33/50 Program are in no way meant as a list of the most toxic or most environmentally damaging chemicals. Rather, these chemicals were selected based on recommendations from each of EPA's program offices. There were three basic reasons for selecting these chemicals. First, these chemicals pose a wide range of health and environmental hazards including: carcinogenicity, systemic effects, reproductive effects, developmental effects, generation of tropospheric ozone, and destruction of the stratospheric ozone layer. Second, these chemicals and their compounds are used in large volumes by industry and released to the environment in substantial quantities. Third, EPA believes there is a substantial likelihood that releases of these chemicals could be reduced through pollution prevention. Five of the chemicals are metals — chromium, cadmium, nickel, lead, and mercury; four are chlorinated alkanes — methylene chloride, chloroform, carbon tetrachloride, and trichloroethane; three are aromatic hydrocarbons — benzene, toluene, and xylene; two are chlorinated alkenes — trichloroethylene and perchloroethylene; two are ketones — methyl ethyl ketone and methyl isobutyl ketone; and one is a nitrile — cyanide.

The table entitled "33/50 Program 17 Target Chemicals Chart," summarizes the release and transfer data reported to the TRI for 1988 for the 17 chemicals and indicates, for comparison, the quantities of these chemicals that were produced and imported in 1988. The release and transfer data are from the 1988 TRI data reported to the EPA. This data is current as of 4/24/92. The public is cautioned to remember that the data for releases and transfers to the environment do not encompass all releases to the environment of the target chemicals. Rather, TRI data only include reported releases from manufacturing facilities that meet certain threshold criteria (described below). In addition, chemicals managed offsite (transfers) may, to some extent, be destroyed in treatment processes and not released to the environment. This chart also shows the number of facilities emitting each chemical. Please bear in mind that these numbers *cannot* be added together to provide the total number of facilities emitting the 17 chemicals because a facility may emit more than one chemical. Facility numbers are current as of 3/22/92.

Chemical Fact Sheets

The chemical fact sheets that follow this introduction provide a one-page summary for each chemical, outlining its production and uses, potential human health and environmental effects, the regulations that address it, and selected examples of pollution prevention measures that are being implemented to reduce releases of the chemical to the environment. A glossary of terms used in the fact sheets is included.

The one-page summaries (i.e., fact sheets) are intended to provide quick "snap shots" of each chemical. They supply the Chemical Abstract Service Registration Number (CAS Reg. No.), the release and transfer quantities by media, and the number of facilities reporting as recorded in the TRI 1988 database. The facility numbers given on each fact sheet *cannot* be added together to provide the total number of facilities emitting the 17 chemicals because a facility may emit more than one chemical. For the 1988 reporting year, industries required to report to the TRI are manufacturing facilities that met the following criteria:

1. They produced, imported, or processed 50,000 pounds or more of any of the TRI chemicals, or
2. They used in any other manner 10,000 pounds or more of a TRI chemical, and
3. They employed the equivalent of 10 or more full time employees.

"Manufacturing facilities" include those industries represented by two-digit Standard Industrial Classification codes (SIC) 20 - 39. In contrast, to provide a general sense of the quantity of each chemical that is handled in the U.S., the total amount produced and imported for each chemical is also provided. The number shown for "1988 U.S. Production for Commerce" is an estimate of the amount of the chemical

produced for commercial purposes by industry. It does not reflect the quantity of the chemical generated inadvertently as a byproduct of another process.

Each fact sheet includes a section on production and uses of the chemical. The primary industries reporting releases and transfers of these chemicals to the TRI are listed at the top of the fact sheet and described in this section. In addition, sources of the chemical that may not be required to report to the TRI are generally indicated.

Each fact sheet includes a brief overview of the potential human health and environmental effects of the chemical. This overview was developed using existing EPA reviews and databases, such as The Integrated Risk Information System (IRIS), the Agency for Toxic Substances and Disease Registry (ATSDR) Toxicological Profiles, and other EPA reports. All 17 chemicals may cause systemic effects in humans; ten of the chemicals (benzene, cadmium, carbon tetrachloride, chloroform, chromium, methylene chloride, lead, nickel, tetrachloroethylene, and trichloroethylene) may cause cancer in humans. Many of the chemicals may cause adverse effects in aquatic organisms; cadmium, mercury, and lead can bioconcentrate in aquatic organisms. The chlorinated alkanes may be sources of chlorine atoms that destroy upper atmospheric ozone. The ketones and the aromatic hydrocarbons are volatile organic compounds whose presence in the lower atmosphere may contribute to photochemical oxidant and smog formation.

Even though these chemicals are labelled as "toxic," their presence in a workplace or a community is not, in itself, cause for undue alarm. Many factors must combine before a *potentially* toxic chemical actually causes harm to human health or damage to the environment. The information provided in these chemical profiles is a first step in providing some perspective on their possible impacts. The public should recognize that potential effects are only a part of the information required to assess a chemical's potential impact on human health and the environment. Levels at which specific effects can be expected to occur, as well as levels of likely exposures and exposure pathways, must be considered in any assessment of a chemical's potential to cause adverse effects.

Next, each chemical fact sheet contains a list of the regulations that address the chemical and indicates the provisions under which it is addressed.

Finally, the fact sheets provide brief examples of pollution prevention techniques to reduce the sources of releases of these chemicals. The application of pollution prevention techniques will vary depending on the specific use of the chemical in a particular industrial process. This information is based on various Agency presentations, case studies, and reports available through the Pollution Prevention Information Clearinghouse (PPIC).

Health and Environmental Effects Summaries

A related document, 33/50 Program: Health and Environmental Effects Summaries for the 17 Target Chemicals, contains a more detailed description of the potential health and environmental effects resulting from exposure to each chemical. These summaries indicate, where available, the concentrations above which exposure should be a concern.

Other Sources of Information

Additional information on pollution prevention (and the 33/50 Program) is available from the PPIC. The PPIC contains technical, policy, programmatic, legislative, and financial information on pollution prevention activities across the country and abroad. The clearinghouse is a free, nonregulatory service of U.S. EPA and may be reached by personal computer modem (the Pollution Prevention Electronic Information System or PIES), telephone, or mail.¹

Another source of information on pollution prevention opportunities is a series of bibliographic reports that EPA is developing for industries that are major releasers of the 17 target chemicals. Each report provides summaries of the industrial processes within the category primarily responsible for release of the chemicals of concern. The reports will also describe general pollution prevention and recycling alternatives applicable to the processes. A guided bibliography of documents that may provide detailed technical information on pollution prevention and recycling options for the particular industrial processes will also be included. Two reports are available now:

EPA/560/8-92/001A; Pollution Prevention Options in Metal Fabricated Products Industries, A Bibliographic Report; U.S. EPA, Office of Pollution Prevention and Toxics; January 1992.

EPA/560/8-92/001C; Pollution Prevention Options in Wood Furniture Manufacturing, A Bibliographic Report; U.S. EPA, Office of Pollution Prevention and Toxics; February 1992.

Copies of these reports may be obtained by calling EPA's clearinghouse at (703) 821-4800.

¹ The PIES is a free computer bulletin board that allows a user to access the full range of information contained in the PPIC. Since the PIES system is interactive, users can address questions to other users and PPIC technical staff, order documents, and exchange information. To learn how to use the PPIC and the PIES, call (703) 821-4800. To access the PIES using a PC, a modem and communications software, set your software to no parity, 8 data bits, and 1 stop bit, and program your computer to dial (703) 506-1025.

Further information regarding the health and environmental effects of these 17 chemicals may be requested in writing from:

IRIS — a computerized database. Information on using the database and the charges involved may be obtained from:

IRIS User Support Group
Environmental Criteria and Assessment Office
U.S. Environmental Protection Agency
26 West Martin Luther King Drive
Cincinnati, OH 45268

ATSDR — toxicological profiles for benzene, cadmium, carbon tetrachloride, chloroform, chromium, cyanide, lead, methylene chloride, mercury, nickel, perchloroethylene, toluene, 1,1,1-trichloroethane, trichloroethylene, and xylene may be purchased from:

National Technical Information Service (NTIS)
5285 Port Royal Road
Springfield, VA 22161
Telephone (800)336-4700 or (703)487-4650

ATSDR draft of in progress toxicological profiles may be requested from:

Ms. Wendy Golden
Division of Toxicology
ATSDR, Mail stop E-29
1600 Clifton Road NE
Atlanta, GA 30333
Telephone (404)639-0700

GLOSSARY FOR FACT SHEETS

Air, releases to: Emissions of toxic chemicals to the air; including: (1) fugitive emissions, that is, emissions to the air that are not conveyed through stacks, vents, ducts, pipes, or any other confined air stream; fugitives include equipment leaks, evaporative losses from surface impoundments and spills, emissions from building ventilation systems, etc.; (2) stack or point air emissions, that is, emissions that occur through confined air streams such as stacks, vents, ducts, or pipes; point emissions include storage tank emissions and generally include emissions from air pollution control equipment.

Acute Toxicity: Adverse health effects arising shortly after a single exposure to a chemical.

CAA: The Clean Air Act of 1990.

Carcinogenicity: The ability of a substance to cause or contribute to causing cancer.

CAS No.: The Chemical Abstract Service Registry Number identifies a chemical by a unique 8-digit number.

Chronic Toxicity: Adverse health effects arising after long-term exposure; they may or may not be reversible.

CERCLA: The Comprehensive Environmental Response, Compensation, and Liability Act which created the Superfund program and reporting requirements for hazardous substances.

CERCLA Reportable Quantity (RQ): The quantity of a hazardous substance that triggers reports under CERCLA. If a substance is released in amounts exceeding its RQ, the release must be reported to the National Response Center, the State Emergency Response Commission, and community emergency coordinators for areas likely to be affected.

CWA: The Clean Water Act.

Deep-Well Injection: The deposition of a raw or treated, filtered hazardous waste by pumping it into deep wells, where it is contained in the pores of permeable subsurface rock.

DOT Reportable Quantity: The quantity of a substance specified in U.S. Department of Transportation regulations that triggers requirements, such as labelling or packaging, for shipping these substances.

Developmental Effects: Adverse effects observed in a developing organism; these effects include death, altered growth, structural abnormality, or functional deficiency.

EPCRA: The Emergency Planning and Community Right-To-Know Act, of 1986, also known as Title III of SARA.

FIFRA Pesticide Ingredient: An ingredient of a pesticide that must be registered with EPA under the Federal Insecticide, Fungicide, and Rodenticide Act. Products making pesticide claims must register under FIFRA and may be subject to labeling and use requirements.

Fugitive Emissions: See "Air, releases to:"

Isomers: Chemical compounds that are made up of the same elements but the spatial orientation of these elements differs.

Land, releases to: Disposal of toxic chemicals on land within the boundaries of the facility — including disposal of solid wastes in a landfill; disposal by land treatment, that is, a disposal method in which a waste containing a toxic chemical is applied onto or incorporated into soil; and disposal in a surface impoundment, that is, a natural topographic depression, man-made excavation, or diked area, such as pits, ponds, or lagoons, designed to hold an accumulation of liquid wastes or wastes containing free liquids.

Neurobehavioral: These are the behavioral manifestations of neurotoxic effects. A measure of neurotoxic effects is a series of tests collectively known as a functional observation battery (FOB), designed to measure these effects. **Neurotoxic Effects:** Adverse effects observed in the nervous system; these effects include pathological change in the structure or function of the brain, spinal cord or peripheral nerves.

OSHA PEL: The Occupational Safety and Health Act Permissible Exposure Level. The employer must ensure that no employee is exposed to an airborne concentration in excess of this level. PELs are specified in Occupational Safety and Health Administration regulations.

Persistence: Refers to the length of time a compound, once introduced into the environment, stays there. A compound may persist indefinitely or for less than a second.

Photochemical Oxidants: Air pollutants formed by the reaction of oxides of nitrogen (or other chemicals) and hydrocarbons in the lower atmosphere in the presence of sunlight.

Probable Carcinogen: An expression used to classify a chemical relative to its potential to cause cancer in humans. EPA refers to probable carcinogens as Group B carcinogens.

Process: The preparation of a chemical substance or mixture, after its manufacture, for distribution in commerce.

POTW: Publically Owned Treatment Works — a waste treatment works owned by a State, city, or Indian tribe, usually designed to treat domestic sewage.

Releases: Any spilling, leaking, pumping, pouring, emitting, emptying, discharging, injecting, escaping, leaching, dumping, or disposing into the environment.

Reproductive Effects: Adverse effects that impair an organism's ability to produce offspring. These effects include those that impair either the male or the female reproductive capacity. Effects include adverse changes in sexual behavior, in fertility, and in pregnancy outcomes.

RCRA: The Resource Conservation and Recovery Act — the Federal statute that regulates the generation, treatment, storage, disposal, or recycling of solid and hazardous waste.

RCRA Ground Water Monitoring List: The RCRA list of compounds that are to be monitored in the ground water at hazardous waste landfills.

RCRA Hazardous Waste (Listed): The RCRA wastes that are specifically listed as hazardous in the regulations. These wastes need not be subjected to a particular test to indicate their toxicity because the dangers they present are considered self-evident.

SARA: The Superfund Amendments and Reauthorization Act of 1986, which amended CERCLA and established, under Title III, community right-to-know provisions for chemical reporting requirements.

SDWA MCL: The Safe Drinking Water Act Maximum Contaminant Level is the maximum permissible level of a contaminant in water delivered to any user of a public water system. MCLs are enforceable standards.

SIC Code: The Standard Industrial Classification Code is a four-digit coding system developed by the U.S. Census Bureau and the U.S. Office of Management and Budget (OMB), that categorizes the principle product or group of products produced or distributed, or services rendered, at a site's physical location. The first two digits indicate a general grouping, the second two digits reflect a particular product within the general category.

Systemic: Health effects (generally noncancer) that are manifest in various body systems, tissues, and organs.

TRI: The Toxic Release Inventory (TRI) established by EPCRA is a database of information required to be submitted by facilities that manufacture, process, or use (in quantities above a specified amount) approximately 300 toxic chemicals listed under SARA Title III.

Transfers: Any movement of materials from an industrial facility to a treatment or disposal facility such as a landfill or incinerator which is offsite.

TSCA: The Toxic Substances Control Act.

Water, Releases to: Discharges of toxic chemicals to receiving streams or water bodies — including discharges from process outfalls such as pipes and open trenches, discharges from on-site wastewater treatment systems, and contributions from stormwater runoff. This does not include discharges to a POTW or other off-site wastewater treatment facility; these are considered "transfers."

References for Chemical Production/Import Estimates

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Bureau of the Census, Foreign Trade Division, Import/Export Data for 1988.

Chemical Economics Handbook, (1988 data) SRI International, Menlo Park, CA.

Chemical Marketing Reporter, January 23, 1989.

Chemical Marketing Reporter, January 30, 1989.

Chemical Marketing Reporter, June 18, 1990.

"Locating and Estimating Air Emissions from Sources of Benzene," U.S. EPA, Office of Air Quality Planning and Standards, EPA 450/4-84-007Q, March 1988.

Mineral Commodity Summary, Minerals Information Office, U.S. Geological Survey, Bureau of Mines, Washington, DC, January, 1989.

Mineral Facts and Problems, Minerals Information Office, U.S. Geological Survey, Bureau of Mines, Washington, DC, 1985.

Minerals Yearbook, Minerals Information Office, U.S. Geological Survey, Bureau of Mines, Washington, DC, 1988/1989.

Port Import/Export Reporting Service, PIERS, New York, as reported in Journal of Commerce, March 14, 1989, p. 9b.

Synthetic Organic Chemicals, U.S. International Trade Commission, Publication No. 2219, 1989.

U.S. Exports, FT446/Annual 1988, Schedule B Commodity by Country, U.S. Department of Commerce, 1988.

U.S. Imports for Consumption and General Imports, FT246/Annual 1988, TSUSA Commodity by Country of Origin, U.S. Department of Commerce, 1988.

33/50 PROGRAM

17 TARGET CHEMICALS CHART

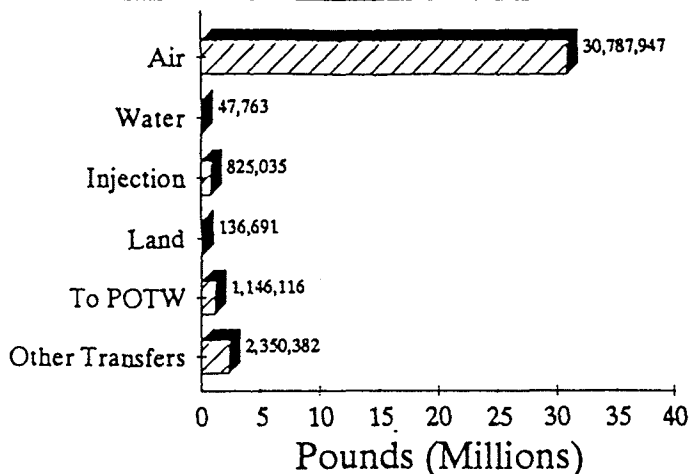
Chemical Name	U.S. Production 1988 (In 000 lbs)	Imports 1988 (In 000 lbs)	TRI 1988 Data							
			Number of Facilities	Release to Air (In lbs)	Release to Water (In lbs)	Deep-Well Injection (In lbs)	Release to Land (In lbs)	Transfer to POTW (In lbs)	Other Transfer (In lbs)	Annual Total Release + Transfer (In lbs)
BENZENE	15,506,700	1,046,300	495	30,787,947	47,763	825,035	136,691	1,146,116	2,350,382	35,293,934
CADMIUM & COMPOUNDS	4,160	5,472	241	122,412	4,415	2,409	389,729	21,862	1,288,933	1,829,760
CARBON TETRACHLORIDE	761,400	135,100	97	3,767,421	16,447	98,054	14,759	5,014	1,349,761	5,251,456
CHLOROFORM	523,600	27,300	188	23,871,504	1,120,702	36,002	68,498	1,226,573	1,469,422	27,792,701
CHROMIUM & COMPOUNDS	262,000	992,100	2,763	1,342,593	394,869	54,902	40,206,005	2,111,581	25,826,699	69,936,649
CYANIDE & COMPOUNDS	1,197,000	3,600	338	2,313,171	196,951	5,445,176	108,969	1,152,094	2,922,369	12,138,730
LEAD & COMPOUNDS	2,216,000	374,800	1,746	2,689,819	241,293	2,760	27,397,746	210,535	30,426,495	60,968,648
MERCURY & COMPOUNDS	2,680	726.4	61	25,761	1,656	27	13,779	2,141	275,224	318,588
METHYL ETHYL KETONE	482,000	102,200	2,553	136,034,011	77,304	253,762	162,163	935,896	30,806,197	168,269,333
METHYL ISOBUTYL KETONE	205,300	14,900	1,074	32,678,562	762,358	116,655	31,775	1,509,782	11,251,283	46,350,415
METHYLENE CHLORIDE	504,100	27,400	1,374	125,995,543	350,270	1,478,833	157,960	2,936,101	22,773,265	153,691,972
NICKEL & COMPOUNDS	90,500	308,732	2,040	679,131	217,852	239,263	3,641,306	900,330	13,113,112	18,790,994
TETRACHLOROETHYLENE	497,700	119,400	620	35,614,502	33,784	72,250	106,394	586,994	5,338,846	41,752,770
TOLUENE	6,386,300	813,300	4,006	288,100,970	210,825	1,480,666	739,028	3,558,829	64,654,221	358,744,539
1,1,1-TRICHLOROETHANE	723,600	40,000	3,942	174,866,744	95,619	1,000	187,786	304,348	19,688,012	194,943,509
TRICHLOROETHYLENE	201,700	13,300	766	54,623,373	14,050	390	21,440	79,652	6,531,916	61,270,821
XYLENES	8,557,400	483,000	3,622	162,308,319	215,394	122,978	650,635	4,224,054	40,873,076	208,394,456
TOTALS				1,075,621,783	4,001,552	10,230,162	74,034,663	20,911,902	280,939,213	1,465,739,275

BENZENE

CAS Registry Number: 71-43-2

Release or Transfer Medium

1988 TRI Releases and Transfers



Total 1988 TRI Releases and Transfers:
35,293,934 lbs.

Number of Facilities Reporting to TRI:
495

Major TRI Reporting Industries:
Blast Furnaces and Steel Mills
Chemicals and Allied Products
Petroleum Refining and Mining

1988 U.S. Production for Commerce:
15,506,700,000 lbs.

1988 Imports:
1,046,300,000 lbs.

Production and Uses: Benzene, which has a slightly sweet odor, is a colorless, flammable liquid that can be extracted from petroleum or coal. Most benzene is converted into other chemicals, e.g., ethylbenzene — used to produce styrene, cumene — used in resins and construction adhesives, and cyclohexane — used in synthetic fibers, and nitrobenzene. Benzene is also added to fuel as an octane enhancer. Benzene is used to a lesser extent in industries associated with transportation equipment; machinery; stone, clay and glass products; and paper products.

Health and Environmental Effects: Benzene is a human carcinogen, may damage human chromosomes, causes a range of systemic effects, may adversely affect the ability to reproduce, and may also damage the developing fetus. Benzene may cause adverse effects in aquatic and terrestrial organisms, but does not persist in water and does not bioconcentrate appreciably in aquatic organisms. Benzene is a volatile organic compound (VOC) and can contribute to smog formation.

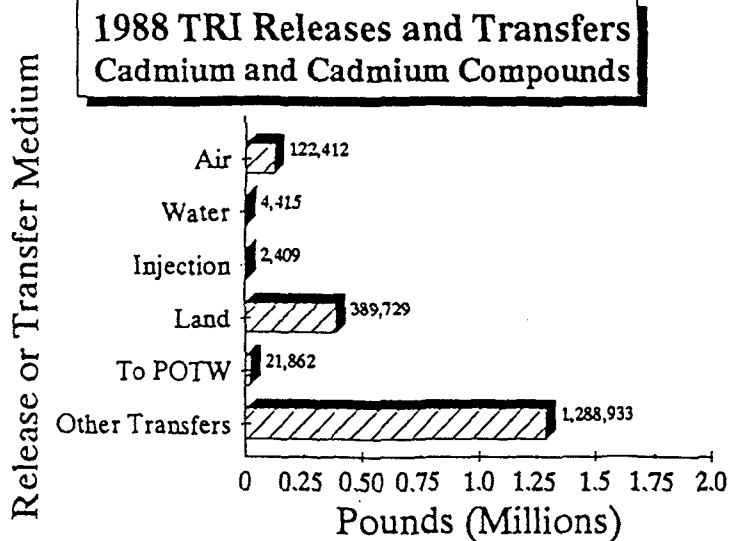
Regulations: Benzene is regulated as follows:

CAA Hazardous Air Pollutant	CWA Toxic Priority Pollutant
CERCLA Reportable Quantity	SARA (NPL Sites)
SDWA Max. Contaminant Level	FIFRA Pesticide Ingredient
OSHA Permissible Exposure Limit	DOT Reportable Quantity
RCRA Hazardous Waste (Listed)	RCRA Groundwater Monitoring List

Pollution Prevention: Fugitive emissions of benzene from equipment leaks have been reduced through improved equipment inspection and maintenance and use of recovery/cooling systems. Benzene wastes from the pulp bleaching industry have been reduced by the use of closed-cycle technology in the chlorine dioxide bleaching process.

CADMIUM AND CADMIUM COMPOUNDS

CAS Registry Number: Cadmium-7440-43-9, Cadmium Compds (TRI Chem ID No. 20-04-2)



Total 1988 TRI Releases and Transfers:
1,829,760 lbs.

Number of Facilities Reporting to TRI:
241

Major TRI Reporting Industries:
Plating and Polishing
Primary Metals
Storage Batteries
Chemicals

1988 U.S. Production for Commerce:
4,160,000 lbs.

1988 Imports:
5,472,000 lbs.

Production and Uses: Cadmium is a silvery-white, soft, malleable metal that is produced as a byproduct during zinc production, and to a lesser extent, copper and lead production. Low levels of cadmium are ubiquitous, as it occurs naturally in soil and is readily taken up by plants and animals. It is primarily used as cadmium hydroxide in storage batteries. Other significant uses are in plating and coating applications, in pigments, and as a PVC stabilizer. It is generated in small amounts during copper and lead smelting, iron and steel production, fossil fuel combustion, and municipal incineration.

Health and Environmental Effects: Cadmium is a probable human carcinogen, and may also damage human chromosomes. Cadmium causes a range of systemic effects (for example, kidney and lung damage) and may adversely affect the ability to reproduce. Cadmium may damage the developing fetus as well. Cadmium causes adverse acute and chronic effects in aquatic organisms. Like many metals, cadmium strongly bioconcentrates.

Regulations: Cadmium is regulated as follows:

CERCLA Reportable Quantity	RCRA Hazardous Waste (Listed)
SDWA Max. Contaminant Level	RCRA Groundwater Monitoring List
OSHA Permissible Exposure Limit	SARA (NPL Sites)
CWA Toxic Priority Pollutant	CAA Hazardous Air Pollutant

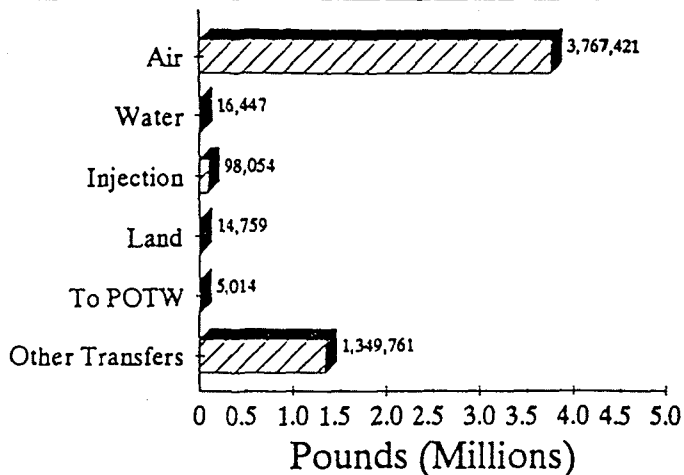
Pollution Prevention: Cadmium wastes have been eliminated in silver solder and brazing applications through substitution of noncadmium containing alloys. The concentration of cadmium has been reduced in plating bath solutions, reducing the hazard of spent plating solutions and reducing the carryover of chemicals from the plating bath.

CARBON TETRACHLORIDE

CAS Registry Number: 56-23-5

Release or Transfer Medium

1988 TRI Releases and Transfers



Total 1988 TRI Releases and Transfers:

5,251,456 lbs.

Number of Facilities Reporting to TRI:

97

Major TRI Reporting Industries:

Chemicals

1988 U.S. Production for Commerce:

761,400,000 lbs.

1988 Imports:

135,100,000 lbs.

Production and Uses: Carbon tetrachloride is a clear, heavy liquid with a sweet odor. It is produced by chlorination of methanol, methane or higher hydrocarbons or by interaction of carbon disulfide and chlorine in the presence of iron. It is used predominantly for the production of chlorofluorocarbons 11 and 12. Because carbon tetrachloride is used as a feedstock for CFCs, reductions in carbon tetrachloride can be expected in a short timeframe as CFCs are phased out. It is used also in the production of dyes, drugs, and lubricants.

Health and Environmental Effects: Carbon tetrachloride is a probable human carcinogen. It is only slightly toxic to aquatic organisms. It does not persist in water and does not bioconcentrate appreciably in aquatic organisms. Carbon tetrachloride is thought to be very long-lived in the atmosphere and may reach the upper atmosphere where it can be a source of ozone-destroying chlorine atoms.

Regulations: Carbon tetrachloride is regulated as follows:

CERCLA Reportable Quantity	RCRA Groundwater Monitoring List
DOT Reportable Quantity	RCRA Hazardous Waste
OSHA Permissible Exposure Limit	FIFRA Pesticide Ingredient
SDWA Max. Contaminant Level	SARA (NPL Sites)
CWA Toxic Priority Pollutant	CAA Hazardous Air Pollutant
CAA Class I Ozone Depleter	

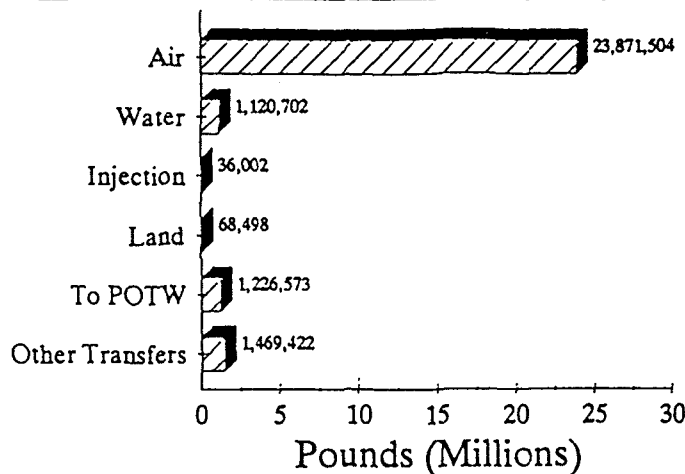
Pollution Prevention: The U.S. Department of Energy has reduced the use of carbon tetrachloride as a cleaning fluid in plutonium manufacturing areas through better operating methods. Carbon tetrachloride has been replaced as a cleaner in some instances by aqueous cleaners.

CHLOROFORM

CAS Registry Number: 67-66-3

Release or Transfer Medium

1988 TRI Releases and Transfers



Total 1988 TRI Releases and Transfers:

27,792,701 lbs.

Number of Facilities Reporting to TRI:

188

Major TRI Reporting Industries:

Chemicals

Paper and Allied Products

1988 U.S. Production for Commerce:

523,600,000 lbs.

1988 Imports:

27,300,000 lbs.

Production and Uses: Chloroform, also known as trichloromethane, is a colorless, heavy, volatile liquid with a pleasant, sweet odor. The primary process used to produce chloroform is the chlorination of methyl chloride resulting from the reaction of methanol and hydrogen chloride. It is predominantly used in the production of chlorofluorocarbon 22. It is a byproduct of the chlorine bleaching process in the production of pulp and paper. Other minor uses include solvents, fumigants, and intermediates used in the production of other chemicals.

Health and Environmental Effects: Chloroform is a probable human carcinogen. It causes a range of systemic effects (for example, damage to central nervous system and kidneys) and may adversely affect the developing fetus. Chloroform causes adverse acute and chronic effects in aquatic organisms. Chloroform does not persist in water, and it does not bioconcentrate appreciably in aquatic organisms.

Regulations: Chloroform is regulated as follows:

CWA Toxic Priority Pollutant

SARA (NPL Sites)

DOT Reportable Quantity

CERCLA Reportable Quantity

FIFRA Pesticide Ingredient

RCRA Hazardous Waste (Listed)

SARA Extremely Hazardous Substance

RCRA Groundwater Monitoring List

SDWA Max. Contaminant Level

OSHA Permissible Exposure Limit

CAA Hazardous Air Pollutant

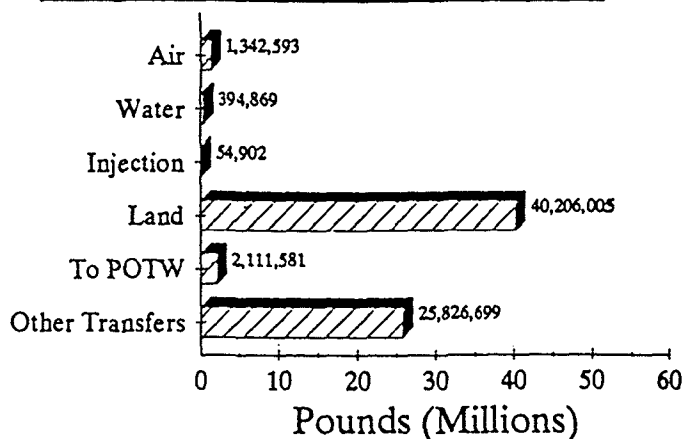
Pollution Prevention: Other bleaching processes have been substituted for chlorine bleaching to reduce generation of chloroform wastes in the paper industry. These include chlorine dioxide, oxygen, and hydrogen peroxide. Also, use of more efficient pulping processes reduces the amount of bleaching required. High intensity mixing can minimize over-chlorination in the chlorination stage of the paper bleaching process and minimize formation of chlorinated organic compounds in bleached pulps and bleached plant process waters.

CHROMIUM AND CHROMIUM COMPOUNDS

CAS Reg. No.: Chromium - 7440-47-3, Chromium Compds (TRI Chem ID No. 20-06-4)

1988 TRI Releases and Transfers Chromium and Chromium Compounds

Release or Transfer Medium



Total 1988 TRI Releases and Transfers:
69,936,649 lbs.

Number of Facilities Reporting to TRI:
2,763

Major TRI Reporting Industries:

Plating and Polishing
Primary Metals
Industrial & Organic Chemicals

1988 U.S. Production for Commerce:
262,000,000 lbs.

1988 Imports:
992,100,000 lbs.

Production and Uses: Chromium is a steel-gray metal derived from chromite ore. It is primarily used in the fabrication of stainless steel alloys. Other significant applications include: other alloys, pigments, wood preservatives, and plating and anodizing. The metals industry uses chromium as a lining material in high-temperature refractories. Chromium is used as a catalyst, a water treatment (anti-corrosion) additive, a drilling mud additive, a component of some artists' paints (chrome yellow), and can be found in phosphate fertilizers. Chromium is an impurity in fossil fuels and is released during fossil fuel combustion.

Health and Environmental Effects: Chromium exists in two major chemical forms: trivalent and hexavalent chromium. Hexavalent chromium is a known human carcinogen and may also damage human chromosomes. Hexavalent chromium causes a range of systemic effects (e.g., kidney damage) and may damage the developing fetus as well. Chromium causes adverse acute and chronic effects in aquatic organisms. It persists in water but does not bioconcentrate appreciably. Trivalent chromium is generally less toxic than hexavalent chromium.

Regulations: Chromium is regulated as follows:

TSCA (Use in cooling towers)
CWA Toxic Priority Pollutant
SDWA Max. Contaminant Level
RCRA Hazardous Waste (TCLP)
FIFRA Pesticide Ingredient

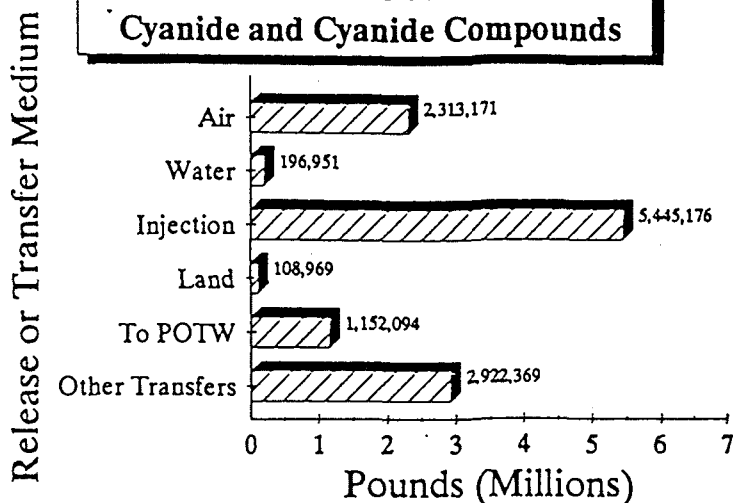
CAA Hazardous Air Pollutant
CERCLA Reportable Quantity and NPL Sites
RCRA Groundwater Monitoring List
OSHA Permissible Exposure Limits

Pollution Prevention: Nonchromated solutions are being evaluated for use in etch cleaning of wrought aluminum in the transportation equipment manufacturing industry. A refractive plastic coating that gives the appearance of chrome plating is being developed to replace some chrome plating applications. There have been improvements in rinsing techniques and this has reduced the amount of chromium effluents.

CYANIDE AND CYANIDE COMPOUNDS

CAS Reg. No.: Hydrogen Cyanide 74-09-8, Cyanide Compds (TRI Chem ID No 20-09-7)

1988 TRI Releases and Transfers Cyanide and Cyanide Compounds



Total 1988 TRI Releases and Transfers:
12,138,730 lbs.

Number of Facilities Reporting to TRI:
338

Major TRI Reporting Industries:
Chemicals
Blast Furnaces & Steel Mills

1988 U.S. Production for Commerce:
1,197,000,000 lbs. (Hydrogen Cyanide)
1988 Imports:
3,600,000 lbs. (Sodium Cyanide)

Production and Uses: Cyanide exists in both man-made and natural forms. Hydrogen cyanide is a colorless liquid or gas with a slight almond scent. It is produced in reactions with ammonia, air, and natural gas. Most hydrogen cyanide is converted to other chemicals, primarily: adiponitrile (used in the production of nylon), methyl methacrylate, sodium cyanide, and cyanuric chloride. The primary use for sodium cyanide is the extraction of gold from low-grade ores. It is also used in electroplating and metal treatment. Small amounts of hydrogen cyanide are generated and released during gasoline combustion.

Health and Environmental Effects: Hydrogen cyanide is not considered at this time to cause cancer in animals or humans. Hydrogen cyanide, however, is one of the quickest acting, potentially lethal, toxicants used in industry today. Hydrogen cyanide causes a range of systemic effects and may adversely affect the developing fetus as well. Hydrogen cyanide causes adverse effects in aquatic organisms. Hydrogen cyanide does not persist in water, and it does not bioconcentrate appreciably in aquatic organisms.

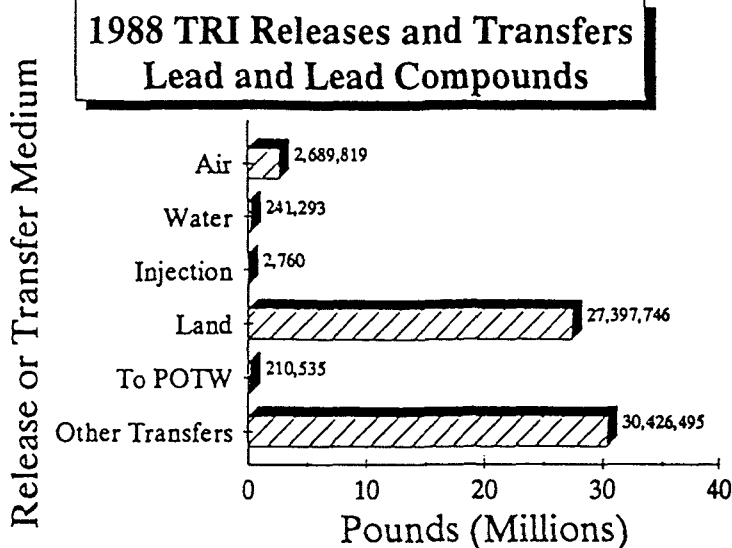
Regulations: Cyanide is regulated as follows:

SARA (NPL Sites)	SARA Extremely Hazardous Substance
CERCLA Reportable Quantity	CAA Hazardous Air Pollutant
OSHA Permissible Exposure Limit	RCRA Groundwater Monitoring List
RCRA Hazardous Waste (Listed)	CWA Toxic Priority Pollutant
FIFRA Pesticide Ingredient	

Pollution Prevention: Substitution of a cyanide-free plating process for a cyanide plating process can eliminate all forms of cyanide from the process and the resulting waste sludge. The concentration of cyanide has been reduced in plating bath solutions reducing the hazard of spent plating solutions and reducing the carryover of chemicals from the plating bath.

LEAD AND LEAD COMPOUNDS

CAS Reg. No.: Lead - 7439-92-1, Lead Compds (TRI Chem. ID No. 20-11-1)



Total 1988 TRI Releases and Transfers:
60,968,648 lbs.

Number of Facilities Reporting to TRI:
1,746

Major TRI Reporting Industries:
Primary Metals
Storage Batteries

1988 U.S. Production for Commerce:
2,216,000,000 lbs.

1988 Imports:
374,800,000 lbs.

Production and Uses: Lead is a blue/white solid in its elemental form. It is produced with other metals such as zinc and copper in domestic mines, then smelted to remove impurities. Large amounts of lead are produced from secondary smelters as a result of recycling lead products. About 80 percent of all lead is used to manufacture batteries. Metallic lead is also used as a component of alloys such as solder, brass, and bronze. Other uses for lead and lead compounds are radiation shielding, ammunition and cable coverings, and as a component of pigments.

Health and Environmental Effects: Lead is a probable human carcinogen. Lead causes a range of systemic effects, including its potential to cause adverse effects to the peripheral as well as the central nervous system. This includes neurobehavioral effects such as learning disabilities in the developing child. Lead may adversely affect the ability to reproduce as well as damage the developing fetus. It causes adverse acute and chronic effects in aquatic organisms. Lead persists in water and can bioconcentrate in aquatic organisms.

Regulations: Lead is regulated as follows:

CWA Toxic Priority Pollutant	CAA Criteria Air Pollutant
CERCLA Reportable Quantity	SARA (NPL Sites)
SDWA Max. Contaminant Level	FIFRA Pesticide Ingredient
OSHA Permissible Exposure Limit	RCRA Groundwater Monitoring List
RCRA Hazardous Waste (Listed)	CAA Hazardous Air Pollutant

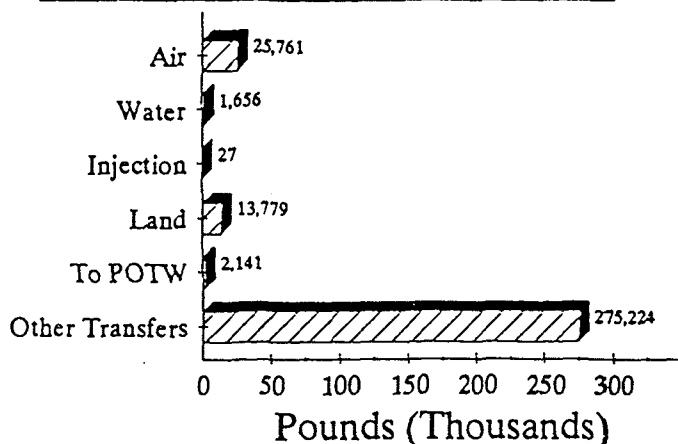
Pollution Prevention: Lead paint solid residues have been eliminated by the use of powdered paint technology (encapsulating parts in fluidized paint particles) in the power equipment manufacturing industry. Lead cable coverings have been replaced by plastic cable coverings in the communications industry. The concentration of lead has been reduced in plating bath solutions reducing the hazard of spent plating solutions and the carryover of chemicals from the plating bath.

MERCURY AND MERCURY COMPOUNDS

CAS Reg. No.: Mercury - 7439-97-6, Mercury Cmpds (TRI Chem. ID No. 20-13-3)

1988 TRI Releases and Transfers Mercury and Mercury Compounds

Release or Transfer Medium



Total 1988 TRI Releases and Transfers:
318,588 lbs.

Number of Facilities Reporting to TRI:
61

Major TRI Reporting Industries:
Alkalies and Chlorine
Electronics
Pulp Mills

1988 U.S. Production for Commerce:
2,680,000 lbs.

1988 Imports:
726,400 lbs.

Production and Uses: Mercury is a silvery, extremely heavy liquid possessing an extremely high surface tension. It is one of the few metals that is liquid at room temperature. It is produced from mining operations in which the ore is heated to liberate mercury vapor. The largest uses of mercury are in batteries and in chlorine manufacture. Other significant uses include paints and electrical devices. It is used to a lesser extent in a variety of uses including measuring devices, such as thermometers, and dental amalgams. Mercury is an impurity in fossil fuel and is released during fossil fuel combustion.

Health and Environmental Effects: Mercury, at this time, is not considered to be carcinogenic in humans or animals. Metallic mercury vapor and organic mercury compounds appear to be the most toxic forms of mercury, primarily causing adverse effects to the nervous system and kidney. Acute exposure to metallic mercury vapor can cause severe lung damage. Mercury, especially in its organic forms, is highly toxic to aquatic species, persistent in water and bioaccumulative in aquatic species.

Regulations: Mercury is regulated as follows:

CAA Hazardous Air Pollutant	CWA Toxic Priority Pollutant
CERCLA Reportable Quantity	SARA (NPL Sites)
SDWA Max. Contaminant Level	FIFRA Pesticide Ingredient
OSHA Permissible Exposure Limit	DOT Reportable Quantity
RCRA Hazardous Waste (Listed)	RCRA Groundwater Monitoring List

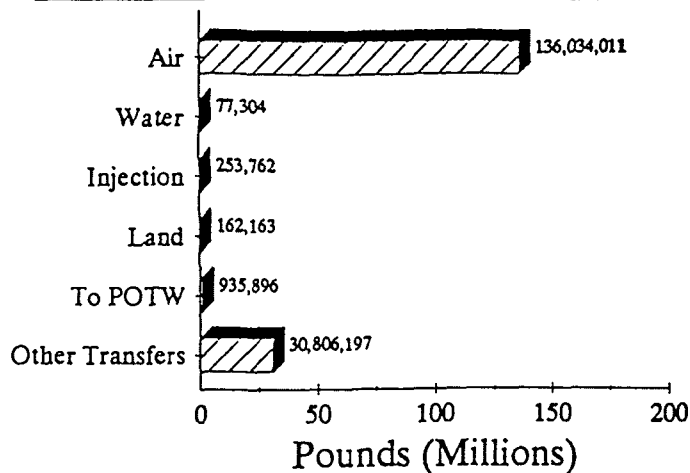
Pollution Prevention: Substitution of organosilicate additives for mercury has in part eliminated the use of mercury in the production of commercial household batteries at one firm. Mercury cells can be replaced with diaphragm cells to eliminate the use of mercury in chlorine production. The use of mercury as a biocide in interior paints is being replaced by less toxic biocides.

METHYL ETHYL KETONE

CAS Registry Number: 78-93-3

Release or Transfer Medium

1988 TRI Releases and Transfers



Total 1988 TRI Releases and Transfers:

168,269,333 lbs.

Number of Facilities Reporting to TRI:

2,553

Major TRI Reporting Industries:

Electronic Components	Petroleum Refining
Coated Fabrics	Aluminum Sheeting
Transportation Equip.	Wood Furniture
Paint & Allied Products	
Rubber & Misc. Plastic Products	
Paper Coating and Glazing	

1988 U.S. Production for Commerce:

482,000,000 lbs.

1988 Imports:

102,200,000 lbs.

Production and Uses: Methyl Ethyl Ketone (MEK) is a colorless, flammable liquid with a pleasant, pungent odor. MEK is produced from mixed butylenes. It is primarily used in solvents for coatings, adhesives, magnetic tapes and printing inks. MEK coating solvents are used in fabric, plastics, paints, furniture, and metal finishes.

Health and Environmental Effects: MEK is not considered at this time to cause cancer in animals or humans. Nose and throat irritation has been reported in humans exposed to MEK. Prolonged skin contact with MEK may produce dermatitis. It is moderately toxic to aquatic organisms, does not persist in water, and does not bioconcentrate appreciably in aquatic organisms. MEK is a volatile organic compound (VOC) and can contribute to smog formation.

Regulations: MEK is regulated as follows:

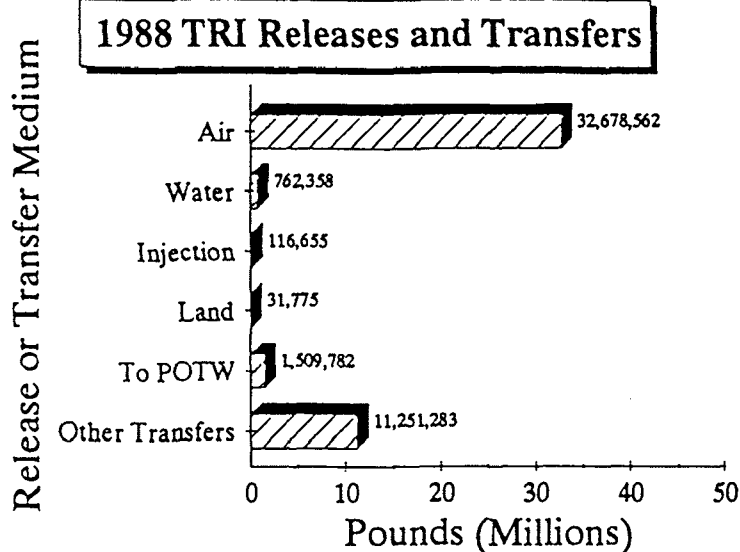
CAA Hazardous Air Pollutant
SARA (NPL Sites)
FIFRA Pesticide Ingredient
DOT Reportable Quantity

CERCLA Reportable Quantity
OSHA Permissible Exposure Limit
RCRA Hazardous Waste
RCRA Groundwater Monitoring List

Pollution Prevention: The use of MEK as a paint solvent has been reduced by substituting water-based primers. Low-volatile content coatings are being tested for coating wood in the furniture industry. A wide variety of reactive solid and reactive liquid coatings can replace solvent-based coatings. On-demand curing or activation of the coatings can be controlled by microwave, dielectric, ultraviolet (or other radiation), ultrasonic, or inductive heating energy input. This technology is currently in the developmental stages. Spray painting, using carbon dioxide and other gases, can be used as a pollution prevention alternative to traditional coating applications requiring solvent-based paints. Improved production planning in paint manufacturing can reduce spent MEK waste.

METHYL ISOBUTYL KETONE

CAS Registry Number: 108-10-1



Total 1988 TRI Releases and Transfers:
46,350,415 lbs.

Number of Facilities Reporting to TRI:
1,074

Major TRI Reporting Industries:

Chemicals
Transportation Equipment
Primary Metals
Coated Fabrics
Wood Furniture

1988 U.S. Production for Commerce:
205,300,000 lbs.

1988 Imports:
14,900,000 lbs.

Production and Uses: Methyl Isobutyl Ketone (MIBK) is a colorless, stable liquid with a pleasant odor. It is produced through the hydrogenation of mesityl oxide, which is, in turn derived from acetone. MIBK is primarily used in coating solvents in paints, metal treating, coated fabrics, and furniture. It is also used in process solvents in the preparation of pharmaceuticals, botanicals, plastics, and other products.

Health and Environmental Effects: MIBK is not considered at this time to cause cancer in animals or humans. It causes a range of systemic effects, including toxicity of the liver, kidney, and central nervous system. Prolonged skin contact with MIBK may produce dermatitis. MIBK is only slightly toxic to aquatic organisms. It does not persist in water, and does not bioconcentrate appreciably in aquatic organisms. Methyl isobutyl ketone is a volatile organic compound (VOC) and can contribute to smog formation.

Regulations: MIBK is regulated as follows:

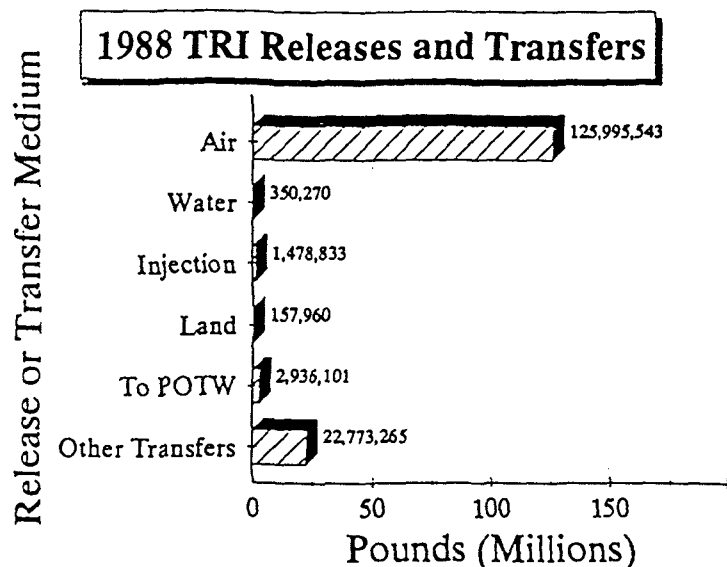
CAA Hazardous Air Pollutant
SARA (NPL Sites)
OSHA Permissible Exposure Limit
RCRA Hazardous Waste (Listed)

CERCLA Reportable Quantity
RCRA Groundwater Monitoring List
FIFRA Pesticide Ingredient

Pollution Prevention: The use of MIBK as a paint solvent has been reduced by substituting water-based primers. Low-volatile content coatings are being tested for coating wood in the furniture industry. A wide variety of reactive solid and reactive liquid coatings can replace solvent-based coatings. On-demand curing or activation of the coatings can be controlled by microwave, dielectric, ultraviolet (or other radiation), ultrasonic, or inductive heating energy input. This technology is currently in the developmental stages. Spray painting, using supercritical carbon dioxide can be used as a pollution prevention alternative to traditional coating applications requiring solvent-based paints.

METHYLENE CHLORIDE

CAS Registry Number: 75-09-2



Total 1988 TRI Releases and Transfers:
153,691,972 lbs.

Number of Facilities Reporting to TRI:
1,374

Major TRI Reporting Industries:
Photographic Equipment & Supply
Rubber and Misc. Plastic Products
Chemicals

1988 U.S. Production for Commerce:
504,100,000 lbs.

1988 Imports:
27,400,000 lbs.

Production and Uses: Methylene Chloride, also known as Dichloromethane, is a colorless, volatile liquid with a sweet, penetrating odor. The primary use of methylene chloride is as a solvent in paint stripping and metal degreasing. Other uses include chemical processing, aerosols, foam blowing, and electronics. It is used in smaller amounts in the pharmaceutical industry and in several consumer products, e.g., paint remover, spray paint, adhesives, and tire cleaner.

Health and Environmental Effects: Methylene Chloride is a probable human carcinogen. Methylene chloride causes a range of systemic effects including toxicity of the liver, kidneys, and nervous system. Methylene chloride is only slightly toxic to aquatic organisms. It does not persist in water, and does not bioconcentrate appreciably in aquatic organisms.

Regulations: Methylene chloride is regulated as follows:

CWA Toxic Priority Pollutant	CAA Hazardous Air Pollutant
CERCLA Reportable Quantity	SDWA Max. Contaminant Level
FIFRA Pesticide Ingredient	RCRA Groundwater Monitoring List
DOT Reportable Quantity	RCRA Hazardous Waste (Listed)
SARA (NPL Sites)	

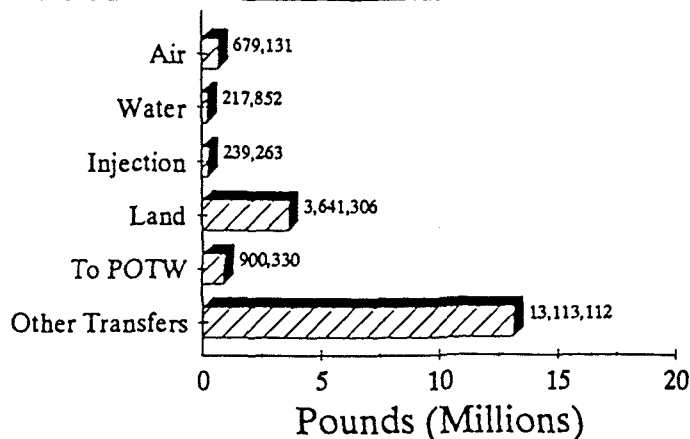
Pollution Prevention: Terpene-based solutions and aqueous-based cleaners have been used as substitutes for methylene chloride in many vapor degreasing operations and other metal cleaning applications. Substitutes for methylene chloride paint stripping in transportation maintenance facilities include blasting with plastic media, carbon dioxide pellets, sodium bicarbonate, wheat starch, and high pressure water spray. Laser ablative cleaning and plasma etching are "dry" methods that can also be used in some paint stripping applications. Some chemical manufacturing processes have been modified to provide internal recycling of methylene chloride.

NICKEL AND NICKEL COMPOUNDS

CAS Reg. No.: Nickel - 7440-02-0, Nickel Compds (TRI Chem. ID No. 20-14-4)

1988 TRI Releases and Transfers Nickel and Nickel Compounds

Release or Transfer Medium



Total 1988 TRI Releases and Transfers:
18,790,994 lbs.

Number of Facilities Reporting to TRI:
2,040

Major TRI Reporting Industries:
Primary Metals
Industrial Inorganic Chemicals
Plating and Polishing
Petroleum Refining

1988 U.S. Production for Commerce:
90,500,000 lbs.

1988 Imports:
308,732,000 lbs.

Production and Uses: Nickel is a silvery white, hard, and malleable metal that possesses excellent corrosion resistance and can be polished to a high sheen. Its ore is present primarily in the sulfide form. Nickel is alloyed with other metals to provide strength and corrosion resistance over a wide range of temperatures. Another significant use of nickel is in electroplating. Smaller amounts can be found in automobiles, household appliances, batteries, dyes, and catalysts. Nickel is an impurity in fossil fuel and is released during fossil fuel combustion.

Health and Environmental Effects: Human cancer has been attributed to nickel refinery dust, most of which was believed to be nickel subsulfide. Nickel compounds may also damage human chromosomes. Nickel compounds cause a range of systemic effects including damage to the lungs, immune system, and blood. Nickel and its compounds can also cause contact dermatitis, which may lead to severe sensitization (allergic) reactions. Nickel compounds may adversely affect the ability to reproduce as well as damage the developing fetus. They cause adverse acute and chronic effects in aquatic organisms. Nickel persists in water but does not bioconcentrate appreciably in aquatic organisms.

Regulations: Nickel is regulated as follows:

CAA Hazardous Air Pollutant
CERCLA Reportable Quantity
OSHA Permissible Exposure Limit

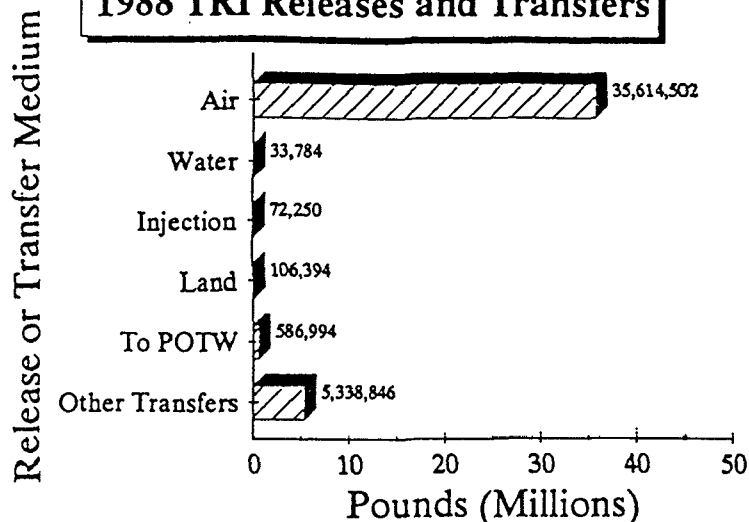
CWA Toxic Priority Pollutant
SARA (NPL Sites)
RCRA Groundwater Monitoring List

Pollution Prevention: The concentration of nickel has been reduced in plating bath solutions reducing the hazard of spent plating solutions and reducing the carryover of chemicals from the plating bath. In some instances, nickel has been recovered from rinse water and recycled within the process.

TETRACHLOROETHYLENE

CAS Registry Number: 127-18-4

1988 TRI Releases and Transfers



Total 1988 TRI Releases and Transfers:
41,752,770 lbs.

Number of Facilities Reporting to TRI:
620

Major TRI Reporting Industries:
Transportation Equipment
Industrial Machinery & Equipment
Plating and Polishing
Chemicals
Misc. Rubber Products
Electronics

1988 U.S. Production for Commerce:
497,700,000 lbs.

1988 Imports:
119,400,000 lbs.

Production and Uses: Tetrachloroethylene, also known as Perchloroethylene (PCE), is a clear, volatile liquid with a sweet odor. The primary uses of PCE are in the dry cleaning and textile processing industries. Other uses include CFC 11 and 12 production and metal degreasing. (Note, dry cleaners generally do not meet the thresholds for reporting to TRI).

Health and Environmental Effects: Tetrachloroethylene is a probable human carcinogen. Tetrachloroethylene causes a range of systemic effects and may also adversely affect the ability to reproduce. Tetrachloroethylene may also damage the developing fetus. Tetrachloroethylene causes adverse acute and chronic effects in aquatic organisms. It does not persist in water, and does not bioconcentrate appreciably in aquatic organisms.

Regulations: Tetrachloroethylene is regulated as follows:

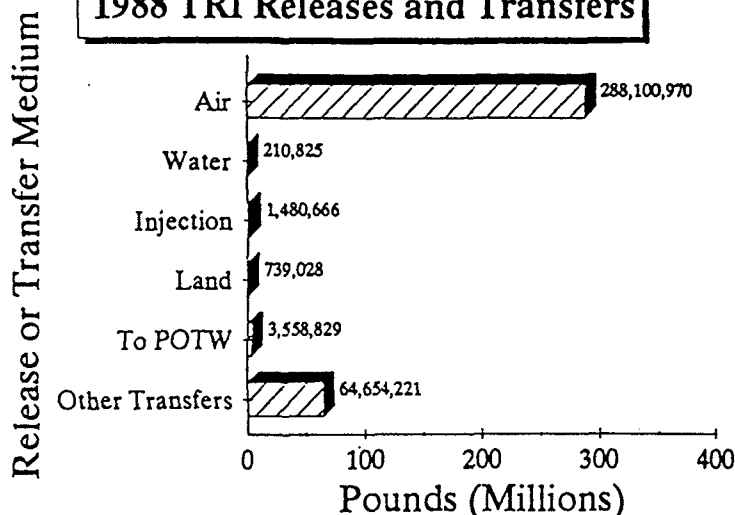
CAA Hazardous Air Pollutant	CWA Toxic Priority Pollutant
CERCLA Reportable Quantity	SARA (NPL Sites)
OSHA Permissible Exposure Limit	FIFRA Pesticide Ingredient
RCRA Groundwater Monitoring	RCRA Hazardous Waste
DOT Reportable Quantity	

Pollution Prevention: Terpene-based solutions and aqueous-based cleaners have been used as substitutes for PCE in many vapor degreasing operations and other metal cleaning applications. Pre-cleaning of parts by wiping or blowing with air can extend the life of degreasing solvents. Also, "dirty solvents" can be used in a primary wash in equipment cleaning to reduce solvent needs. For some operations, petroleum or alkali solvents can be used for degreasing in place of PCE. Design modifications to vats and containers used for degreasing (including adjusting freeboard height and using chilled freeboards), have reduced emissions of PCE.

TOLUENE

CAS Registry Number: 108-88-3

1988 TRI Releases and Transfers



Total 1988 TRI Releases and Transfers:

358,744,539 lbs.

Number of Facilities Reporting to TRI:

4,006

Major TRI Reporting Industries:

Commercial Printing
Paper
Chemicals
Petroleum Refining
Wood Furniture
Misc. Rubber Manufacturing
Coated Fabrics

1988 U.S. Production for Commerce:

6,386,300,000 lbs.

1988 Imports:

813,300,000 lbs.

Production and Uses: Toluene is a colorless, volatile, sweet-smelling liquid. It occurs naturally as a component of crude oil, and is isolated during industrial refining. Much of toluene is converted into other chemicals (e.g., benzene, toluene diisocyanate, benzoic acid) or used as a solvent in paints, adhesives, inks, and cleaning fluids. Lesser grades of toluene are used in gasoline.

Health and Environmental Effects: Toluene is not considered at this time to cause cancer in animals or humans. It may cause a range of systemic effects including toxicity of the brain and central nervous system, the liver and the kidney. It may damage the developing fetus. Toluene causes adverse effects in aquatic organisms. It does not persist in water, and does not bioconcentrate appreciably in aquatic organisms. Toluene is a volatile organic compound (VOC) and can contribute to smog formation.

Regulations: Toluene is regulated as follows:

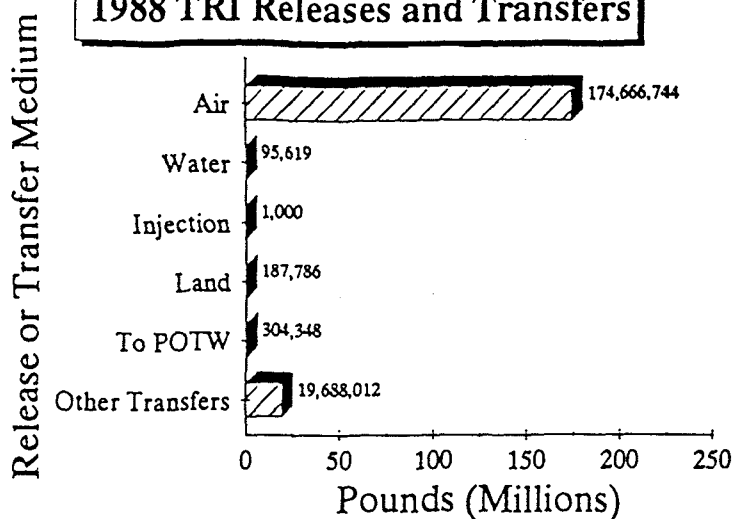
CAA Hazardous Air Pollutant	CWA Toxic Priority Pollutant
SARA (NPL Sites)	CERCLA Reportable Quantity
OSHA Permissible Exposure Limit	FIFRA Pesticide Ingredient
DOT Reportable Quantity	RCRA Groundwater Monitoring List
RCRA Hazardous Waste (Listed)	

Pollution Prevention: Water-based inks have been substituted for solvent-based inks in flexographic and rotogravure printing processes. Water-based inks for printing wood grain on fiberboard and plywood have been substituted for toluene-based inks. Water based paints have been substituted for solvent based paints in a variety of industries.

1,1,1-TRICHLOROETHANE

CAS Registry Number: 71-55-6

1988 TRI Releases and Transfers



Total 1988 TRI Releases and Transfers:

194,943,509 lbs.

Number of Facilities Reporting to TRI:

3,942

Major TRI Reporting Industries:

Transportation Equip.
Primary Metals
Fabricated Metal Products
Rubber and Misc. Plastics Products
Electronics
Industrial Machinery & Equip.
Hard Surface Floor Covering
Plastic Bags

1988 U.S. Production for Commerce:

723,600,000 lbs.

1988 Imports:

40,000,000 lbs.

Production and Uses: 1,1,1-Trichloroethane (TCA), also known as methyl chloroform, is a colorless, volatile liquid with a sweet/sharp odor. It does not occur naturally but is produced by the chemical industry. The primary use of TCA is metal degreasing. Other uses include electronics, coatings, chemical processing, adhesives, and aerosols. It can also be a component of spot removers, shoe polish, inks, cleaners for brakes, and other common products.

Health and Environmental Effects: TCA is not considered at this time to cause cancer in animals or humans. TCA may cause neurotoxic effects. It is moderately toxic to aquatic organisms. TCA does not persist in water, and it does not bioconcentrate appreciably in aquatic organisms. Depending on conditions in the lower atmosphere, TCA may reach the upper atmosphere, where it can be a source of ozone-destroying chlorine atoms.

Regulations:

TCA is regulated as follows:

CWA Toxic Priority Pollutant
RCRA Hazardous Waste
OSHA Permissible Exposure Limit
SDWA Max. Contaminant Level
CAA Hazardous Air Pollutant

RCRA Groundwater Monitoring
CERCLA Reportable Quantity
SARA (NPL Sites)
FIFRA Pesticide Ingredient
CAA Class I Ozone Depleter

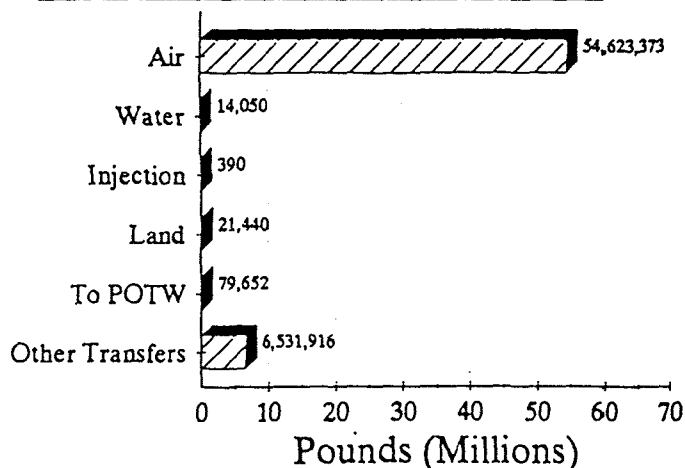
Pollution Prevention: Biodegradable solvents and several commercial products may replace TCA as a wax removal product at one Federal laboratory. Supercritical fluids are being investigated as a possible replacement for TCA in precision cleaning applications. Terpene-based solutions and aqueous-based cleaners have been used as substitutes for TCA in many vapor degreasing operations and other metal cleaning applications. Precleaning of parts by wiping or blowing with air can extend the life of degreasing solvents. Also, "dirty solvents" can be used in a primary wash in equipment cleaning to reduce solvent needs. Process modifications that have been implemented in the electronic circuit board assembly process to reduce TCA usage include: using aqueous cleaning, boardless electronics, low-solids flux soldering, no flux soldering in a nitrogen atmosphere, and redesigning the printed circuit board.

TRICHLOROETHYLENE

CAS Registry Number: 79-01-6

Release or Transfer Medium

1988 TRI Releases and Transfers



Total 1988 TRI Releases and Transfers:

61,270,821 lbs.

Number of Facilities Reporting to TRI:

766

Major TRI Reporting Industries:

Industrial Machinery & Equip.
Transportation Equip.
Fabricated Metal Products
Plastics Products
Concrete Blocks and Bricks
Semiconductors & Related Devices
Primary Metal Industries
Weaving & Finishing Mills Wool

1988 U.S. Production for Commerce:

201,700,000 lbs.

1988 Imports:

13,300,000 lbs.

Production and Uses: Trichloroethylene (TCE) is a clear, volatile liquid with a sweet odor. The primary use of TCE is metal degreasing. Other uses include chemical processing, adhesives, and dry cleaning applications. It is also used in paint removers.

Health and Environmental Effects: Trichloroethylene is a probable human carcinogen. Trichloroethylene causes a range of systemic effects, including kidney, liver, and central nervous system toxicity. It also causes adverse acute and chronic effects in aquatic organisms. Trichloroethylene does not persist in water and it does not bioconcentrate appreciably in aquatic organisms.

Regulations: Trichloroethylene is regulated as follows:

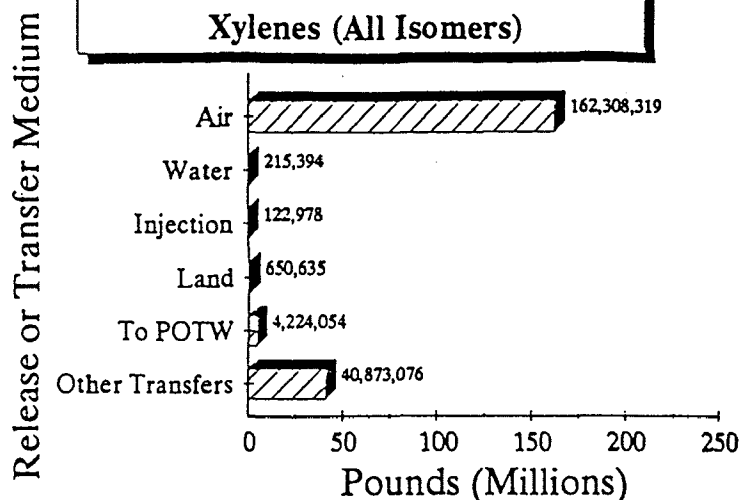
CAA Hazardous Air Pollutant	CWA Toxic Priority Pollutant
CERCLA Reportable Quantity	SARA (NPL Sites)
SDWA Max. Contaminant Level	FIFRA Pesticide Ingredient
OSHA Permissible Exposure Limit	DOT Reportable Quantity
RCRA Hazardous Waste (Listed)	RCRA Groundwater Monitoring List

Pollution Prevention: Terpene-based solutions and aqueous-based cleaners have been used as substitutes for TCE in many vapor degreasing operations and other metal cleaning applications. High speed agitators have been used to improve the performance of these approaches. Precleaning of parts by wiping or blowing with air can extend the life of degreasing solvents. Also, "dirty solvents" can be used in a primary wash in equipment cleaning to reduce solvent needs. A number of hydrocarbon solvents have been found to be suitable replacements for chlorinated solvents in the cleaning of metal parts. Paint stripping operations in the aerospace industry have been modified to use plastic beads to strip paints, eliminating the use of solvents.

XYLENES (All Isomers)

CAS Registry Number: Xylene Mixed Isomers - 1330-20-7

1988 TRI Releases and Transfers Xylenes (All Isomers)



Total 1988 TRI Releases and Transfers:

208,394,456 lbs.

Number of Facilities Reporting to TRI:

3,622

Major TRI Reporting Industries:

Transportation Equip.
Chemicals
Petroleum Refining
Wood Furniture
Metal Cans
Motors and Generators
Wood Products

1988 U.S. Production for Commerce

8,557,400,000 lbs.

1988 Imports:

483,000,000 lbs.

Production and Uses: Xylene exists in the form of three individual isomers (para-, ortho-, and meta-xylene). Mixed xylene is a commercial product that contains approximately 40 percent meta-xylene and 20% each of para- and ortho-xylene and ethylbenzene. The mixture is a clear liquid with a slightly sweet odor. The majority of xylenes are produced by the catalytic reforming of petroleum. Its principle use is as an intermediate for other organic chemicals in the production of plastic soft drink bottles, polyester fibers, and other products. It is also used as a solvent in paints, coatings, and agriculture, and along with benzene and toluene, used in gasoline.

Health and Environmental Effects: Xylenes are not considered at this time to cause cancer in animals or humans. Xylenes, however, may cause a range of systemic effects and may damage the developing fetus. Xylenes cause adverse effects in aquatic organisms; they do not persist in water, and do not bioconcentrate appreciably in aquatic organisms. Xylenes are volatile organic compounds (VOC) and can contribute to smog formation.

Regulations: Xylenes are regulated as follows:

CAA Hazardous Air Pollutant
SARA (NPL Sites)
RCRA Hazardous Waste (Listed)
FIFRA Pesticide Ingredient

CERCLA Reportable Quantity
RCRA Ground Water Monitoring List
OSHA Permissible Exposure Limit
DOT Reportable Quantity

Pollution Prevention: The use of water-based and lower solvent content coatings has reduced the solvent use in some applications. Low-volatile content coatings are being tested for coating wood in the furniture industry. A wide variety of reactive solid and reactive liquid coatings can replace solvent based coatings. On-demand curing or activation of the coatings can be controlled by microwave, dielectric, ultraviolet (or other radiation), ultrasonic, or inductive heating energy input. This technology is currently in the developmental stages. Spray painting using supercritical carbon dioxide has been used in place of traditional coating applications requiring solvent-based paints.