WASHINGTON STATE
DEPARTMENT OF
ECOLOGY

Chemicals of Special Concern in Washington State

By
Ellen Atkinson

Washington State Department of Ecology
Toxics Cleanup Program
Policy and Technical Support Section
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Preface

The subject of chemical contamination of land, water, and air can be overwhelming in scope and in complexity. The technical language makes it more difficult to understand by people not educated in the field of chemistry or toxicology. The purpose of this manual is to provide accurate and understandable information about a limited number of chemicals to people without special training in the field of chemistry or toxicology.

The 132 chemicals discussed in this manual were selected based on the potential risk they pose to human health and environment and the likelihood they will be encountered in the environment in Washington state. This manual is intended to be used as a basic reference guide about the names, sources, uses, physical description, exposure limits, and harmful effects of these hazardous substances.

The list of chemicals was derived from a number of sources. They include the U.S. Environmental Protection Agency list of 129 priority pollutants, the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) hazardous substances list, the Washington Department of Ecology Site Management and Information System list of the most commonly encountered hazardous substances at hazardous waste cleanup sites in Washington state, and the 1985 Hazardous Waste Annual Report Summary published by the Department of Ecology. A draft list of chemicals selected from the above sources was distributed for review to staff from the Departments of Ecology, Labor and Industries, Social and Health Services, and Agriculture, the U.S. Environmental Protection Agency, the Department of Environmental Health at the University of Washington, and the Department of Agricultural Chemistry at Oregon State University. Pesticides are included that are in wide use in the Puget Sound Region according to a list from Resources for the Future compiled by Tetra Tech for the Environmental Protection Agency. Some pesticides no longer permitted for use in this country are included because of their widespread use in the past, their longevity in the environment, and their continued use in other countries. Although the listing of chemicals in this manual is not all inclusive, it does represent many of the major chemicals of concern.

Some important words regarding this document. All the information regarding chemical substances has been generated or reported by the sources listed in the endnotes. **The Department of Ecology is not responsible for the accuracy of these sources, their completeness, or the accuracy of compilation.** New findings may emerge in the field of toxicology, which may invalidate any information given in this manual. The most current additions are dated October 1991. Although every effort was made to be as accurate as possible, mistakes may occur. Readers are encouraged to communicate any errors to the Department of Ecology. It is important when gathering information about any chemical to validate it with secondary independent sources.

Also, **statements in this manual do not necessarily represent the views of Ecology or any individual.** Rather, they have been compiled as a general understanding regarding environmental definitions, descriptions, or issues.

The reader may find that some information about a chemical is not presented. Omissions include disposal methods, risk assessment (the method by which exposure limits are set), Department of Transportation (DOT) designations to label hazardous substances in transit, detection limits, methods of monitoring and detection, and information concerning industrial handling of chemicals. If desired information is not available in this manual, other references should be consulted such as those listed in "References".

Also, much of the information summarized in this manual is now available through a number of data bases that can be accessed using personal computers. Readers requiring this more detailed information should consider accessing these data bases.

For contacting the Department of Ecology regarding this manual please refer to the section: "Telephones and Address References."

List of Chemicals

Readers may know chemicals listed here by synonyms or trade names, many of which are referenced within the main document, alphabetically.

Acetic acid
Acetone
Acrolein
Acrylonitrile
Alachlor
Aldicarb
Aldrin
Aluminum
Ammonia
Aniline
Antimony
Arsenic
Asbestos
Atrazine
Benomyl
Benzene
Beryllium
Bromacil
Bromoform
1,3-Butadiene
Cadmium
Carbaryl
Carbofuran
Carbon dioxide
Carbon monoxide
Carbon tetrachloride
Chlordane
Chlorine
Chlorobenzene
Chloroform
Chlorpyrifos
Chromium
Copper sulphate
Cresol
Cyanide
2,4-D
DDT
Diazinon
Dibromochloromethane
Dicamba
Dichlorobenzene
Dichlorodifluoromethane
1,2-Dichloroethylene
Dichloroethyl ether
Dichloropropene
Dieldrin
2,4-Dimethylphenol
Dinitrotoluene
Dioctyl phthalate
Dioxane
Dioxin
Disulfoton
Diuron
Endosulfan
Ethion
Ethylbenzene
Ethylene dibromide
Ethylene dichloride
Ethylene oxide
Fenvalerate
Fluorides
Fluorotrichloromethane
Formaldehyde
Gasoline
Glyphosate
Guthion
Heptachlor
Hexachlorobenzene
Hexachlorobutadiene
Hexachlorocylohexane
Hexane
Hydrochloric acid
Hydrogen fluoride
Isophorone
Kerosene
Lead
Malathion
MCPA
Mercury
Methane
Methyl bromide
Methyl chloride
Methylchloroform
Methylene chloride
Methyl ethyl ketone
Methyl isobutyl ketone
Naphthalene
N-butyl phthalate
Nickel
Nitric acid
Nitrogen oxide
Nitrobenzene
Nitrophenol
Nitrosamines
Ozone
PAHs
Parathion
Particulates
PCBs
Pentachlorophenol
Petroleum
Phenol
Phorate
Prometryn
Pronamide
Propylene dichloride
Selenium
Simazine
Sodium hydroxide
Styrene
Sulfur
Sulfur dioxide
Sulfuric acid
Sulfuryl fluoride
Systox
Tebuthiuron
Tetrachloroethane
Tetrachloroethylene
Toluene
Toluene-2,4-diisocyanate
Toxaphene
Trialkyl tin compounds
1,2,4-Trichlorobenzene
1,1,2-Trichloroethane
Trichloroethylene
2,4,6-Trichlorophenol
Triclopyr
Trifluralin
Vinyl chloride
Vinylidene chloride
Xylene
Zinc phosphide

Layout Explanation of Chemicals in Alphabetical Listing

The name of the chemical is listed first. It is followed by the Chemical Abstracts Service Registry (CAS) number, which is a common identification used in researching chemicals. There is an index of the chemicals by CAS number in the back. The next number is the **molecular** or **atomic weight** of the chemical. This measurement is needed if one is to convert measurements of the chemical given in parts per million (**ppm**) to milligrams per meter cubed (**mg/m^3**). Examples of measurements one might need to convert are given in the EXPOSURE LIMIT section of each chemical review. The conversion formula is given on the same page listing the tables of measurement.

Items that are bolded are further defined in the glossary, tables of measurement, or layout explanation.

SYNONYMS

Chemicals may be accurately labelled in many different ways. This section includes many, though not necessarily all of them.

TRADE NAMES

As well as the technical names given in the synonym section, chemicals are often given names by the company that produces them. This section includes trade names.

DESCRIPTION

Described is the physical description of the chemical. **Data gaps** of environmental fate for each chemical are noted in this section.

SOURCES AND USES

The sources and uses of the chemical are discussed, as well as frequencies and levels of detection of the chemical in the environment.

TOXIC EFFECTS AND SYMPTOMS

Symptoms from **acute** (usually short-term) exposures are listed first, from mild to severe. Generally, milder acute symptoms follow exposures to lesser concentrations of the chemical. **Chronic** (usually longer exposures) effects on human health are listed next, as well as environmental effects. Chronic symptoms may appear at exposures to lower concentrations than those producing acute symptoms. Symptoms and effects of laboratory animals in animal studies are noted.

CANCER POTENTIAL

The EPA has a scheme for categorizing chemicals according to their **carcinogenic** potential, which is used within this document whenever possible:

Group A: Human carcinogen. There is sufficient evidence in **epidemiological** studies to support causal association between exposure and cancer.

Group B: Probable human carcinogen. There is limited evidence in epidemiological studies (Group B1) and/or sufficient evidence from animal studies (Group B2).

Group C: Possible human carcinogen. There is limited or **equivocal** evidence from animal studies and inadequate or no data in humans.

Group D: Not classified. There is inadequate or no human and animal evidence of carcinogenicity.

Group E: Evidence of lack of carcinogenicity for humans. There is evidence of lack of carcinogenicity in at least two adequate animal tests in different species or in adequate epidemiological and animal studies.

TOXICITY

A **toxicity** rating is included in parentheses, in this section as well, in the form of a number "**1**", "**2**", "**3**", or the letter "**D**":

(1)—"low"— LD50 of 4,000 to 40,000 mg/kg

(2)—"medium"—LD50 of 400 to 4,000 mg/kg

(3)—"high"— LD50 less than 400 mg/kg

(D)—insufficient data to determine a rating.

"LD50" is the abbreviation for the dose of a substance required to cause death for half of the exposed subjects.

EXPOSURE LIMITS

Current limits for various routes of exposure are noted.

When the word "**skin**" appears with the exposure limit for a substance, it means absorption through the skin of the chemical is as at least as significant as inhalation.

Other exposure limits frequently not included in the entries, but available from sources through the Department of Ecology include freshwater toxicity limits (established by tests with different kinds of fish and aquatic life), chronic animal toxicity limits (established by tests with laboratory animals), acute waterfowl toxicity limits, aquatic plant toxicity limits, irrigable plant toxicity limits, and chronic plant toxicity limits.

Most exposure limits, except for acceptable daily intake limits (**ADI**), assume there are no other routes of exposure, and all limits exclude other chemical exposures and **synergistic** effects of exposure to combinations of specific chemicals.

Subjects relevant to exposure limits that are not discussed include the detection limits (how little can be detected?) and detection analysis technology (how is it detected?). These are mostly of concern to persons making measurements.

INDEXES

In the manual there are two indexes grouping the chemicals. The first index, "Chemicals Listed by Industrial Use or Production", may be of use in identifying substances which may result from those practices. The second index is by CAS number, the system of chemical identification, useful in checking chemical identities.

Tables of Measurement

g = gram = 1 gram
kg = kilogram = 1,000 grams (thousand grams)
mg = milligram = .001 grams (one thousandth gram)
μg = microgram = .000001 gram (one millionth gram)
ng = nanogram = .000000001 gram (one billionth gram)

m^3 = 1 cubic meter = 1.3079 cubic yards

1 micron = .000001 meter (one millionth meter)
1 meter = 3.2808 feet

l = liter = 1 liter
dl = deciliter = .1 liters (one tenth liter)
ml = milliliter = .001 liters (one thousandth liter)

1 liter = 1.0567 quarts

1 gram = .03527 ounces
1 kilogram = 2.2046 pounds
1 metric ton = 2,204.62 pounds
1 long ton = 2,240 pounds

1 barrel (bbl), liquid = 42 gallons (petroleum products)

mg/kg/day = milligram of chemical per kilogram of body weight per day
μg/kg/day = microgram of chemical per kilogram of body weight per day

If one wants to convert measurements of a chemical given in parts per million (ppm) to milligrams per meter cubed (mg/m^3), use this formula:

$$\frac{\textit{(ppm value) (gram molecular/atomic weight of the substance)}}{24.45} = mg/m3.$$

Chemicals Listed Alphabetically

AC 3422 (trade name): *see Ethion.*

ACENAPHTHENE: *see PAHs.*

ACENAPHTHYLENE: *see PAHs.*

ACETIC ACID CAS 64-19-7; **molecular weight** 60:

SYNONYMS: Glacial acetic acid, ethanoic acid, vinegar acid.

DESCRIPTION: Acetic acid is a colorless, watery liquid that sinks and mixes with water. Its strong vinegar odor is perceptible at a range of 5 to 80 **ppm**. Vinegar is 4 to 6 percent acetic acid. Acetic acid does not **bioaccumulate.**[1]

USES AND SOURCES: Acetic acid is used in metal manufacturing, in laboratories, in chemical production, in auto and textiles manufacturing, and in plating and printing industries.[1] It is found at illegal drug laboratory **hazardous waste** sites, where amphetamines, cocaine, MDA, and STP have been processed[2]. Acetic acid is a component of cigarette smoke.[3]

TOXIC EFFECTS AND SYMPTOMS: Harmful **exposure** to acetic acid may occur through inhalation and skin contact. Exposure may irritate and burn the eyes, at concentrations below 10 ppm, nose, skin, and throat, as well as cause nausea and vomiting.[1] Severe burns occur from .5 **ml** of 1 percent solutions. Prolonged exposure may cause **chronic** bronchitis, erode dental enamel, cause inflammation of nails, and promote heart damage. There is no evidence that exposure to acetic acid causes cancer.[1] Acetic acid is considered to be of high **toxicity** (3).[5]

Acetic acid is harmful to aquatic life in very low concentrations.[1]

EXPOSURE LIMITS:

AIR: OSHA TWA 10 **ppm** (approximately 180 **mg/m**^{3}).[4]

WATER: Recommended drinking water limit 128 **ppm.**[1]

See "More About Exposure Limits."

ACETONE CAS 67-64-1; **molecular weight** 58.08:

SYNONYMS: 2-Propanone, Dimethyl ketone, Pyroacetic ether, Beta-ketopropane.

DESCRIPTION: Acetone is a flammable, colorless liquid that floats and mixes with water. Its pungent sweetish odor is perceptible at a range of 1 to 300 **ppm**. It is biodegradable and there is no **bioaccumulation** or **food chain contamination.**[1]

USES AND SOURCES: Acetone is used as a process solvent and an industrial degreaser in making metal, furniture, clocks, and watches. It is used in vehicle maintenance, in machinery manufacturing, in laboratories, in chemical production, in pharmaceutical preparations, in printing, in resin manufacture, and in paint shops.[1] Acetone is found at illegal drug laboratory **hazardous waste** sites, where cocaine, LSD, and MDA have been processed.[2] It is a component of cigarette smoke.[3]

HARMFUL EFFECTS AND SYMPTOMS: Routes of harmful **exposure** to acetone include inhalation, ingestion, and skin contact. The odor is a good warning. The inhalation **hazard** is moderate. Symptoms include irritated eyes, nose, and throat, headache, drowsiness, and loss of coordination. Serious poisonings are rare. Acetone is not **carcinogenic.**[1] Acetone is considered to be of moderate **toxicity** (2).

The greatest threat from acetone is from releases to the environment. It is dangerous to aquatic life in high concentrations.[1]

EXPOSURE LIMITS:

Air: OSHA TWA 750 **ppm** (approximately 1800 **mg/m**^{3}).[4]

See "More About Exposure Limits."

ACETYLENE TETRACHLORIDE: *see Tetrachloroethane.*

ACETYLENE TRICHLORIDE: *see Trichloroethylene.*

ACRALDEHYDE:*see Acrolein.*

ACROLEIN CAS 107-02-8; **molecular weight** 56.06:

SYNONYMS: Acrylic aldehyde, Acyaldehyde, Propenal, 2-Propenal, Acraldehyde, Allyaldehyde.

TRADE NAMES: Aqualin, Aqaulin-biocide, Aqualin-slimicide.

Description: Acrolein is a colorless to light yellow liquid that floats on and mixes with water. The vapor is highly toxic and flammable with an acrid, pungent odor. The **odor threshold** is .2 **ppm**. Acrolein is not very **persistent** in the environment, as it **photodegrades** within hours. There is no significant **bioaccumulation** in aquatic systems, and no **food chain contamination** potential. In the environment acrolein would most likely be found dissolved in water.[1]

USES AND SOURCES: Acrolein is used in plastics, perfumes, in the manufacture of certain **organic** compounds and metals, and as an intermediate for synthetic glycerine, polyurethane, polyester resin, and methionine. It is used as a **warning agent** in methyl chloride, as a refrigerant, and as a pharmaceutical. It is used in material for the treatment of textile fibers, and in leather tanning. The military uses acrolein in a poison gas mixture.[1] It is also used in aquatic weed and mollusk control, in recirculating proven water systems, in slime control, in the protection of liquid fuels against microorganisms, and in photography. Acrolein is used as a builder in laundry and dishwater detergents.

HARMFUL EFFECTS AND SYMPTOMS: No **chronic exposure** is recommended. Symptoms of exposure include irritated eyes and nose (1 **ppm**), **pulmonary edema**, gastro-intestinal distress, nausea, vomiting, chronic respiratory diseases, and loss of consciousness if exposure is great or prolonged. Acrolein is a possible **carcinogen (C)**, and a potential **mutagen.**[1] It is considered to be of high **toxicity (3)**.[5]

Acrolein is harmful to aquatic life in very low concentrations.[1]

EXPOSURE LIMITS:

AIR: OSHA TWA .1 **ppm** (approximately .25 **mg/m**^{3}).[4]

WATER: Recommended drinking water limit 320 ppb.[1]

See "More About Exposure Limits."

ACRYALDEHYDE: *see Acrolein.*

ACRYLIC ALDEHYDE: *see Acrolein.*

ACRYLONITRILE CAS 107-13-1; **molecular weight** 53.05:

SYNONYMS: Cyanoethylene, Propenitrile, An, Vinyl cyanide.

TRADE NAMES: Fumigrain, Ventox.

DESCRIPTION: Acrylonitrile is a colorless to light yellow liquid. It has a mild, irritating, pungent odor resembling peach seed kernels. The odor threshold is 21.4 **ppm**, and is not a good warning. It is very flammable, and the heavy vapor can trail along the ground to an ignition source. There is no **bioaccumulation** and no **food chain contamination** potential.[1]

USES AND SOURCES: Acrylonitrile is used in the production of synthetic fibers, plastics, and acrylics, in apparel, carpets, upholstery, blankets, draperies, synthetic furs, wigs, plastics, and **fumigants**.[6] It is a component of cigarette smoke.[3]

In 1986, 2.2 billion pounds of acrylonitrile were produced and 943 million pounds exported. NIOSH estimates that 125,000 workers nationwide are potentially exposed to acrylonitrile annually.

HARMFUL EFFECTS AND SYMPTOMS: Routes of harmful **exposure** to acrylonitrile include ingestion, inhalation, and skin contact. Acrylonitrile is highly toxic in very low concentrations, and there is extreme danger if it burns, due to the release of cyanide gases. Symptoms of harmful exposure include irritated eyes, headaches, sneezing, weakness, dizziness, light-headedness, abdominal pain, nausea, vomiting, and suffocation. Acrylonitrile is a **mutagen**, a probable **carcinogen (B)**, and a **teratogen**.[1] It is considered to be of high **toxicity** (3).[5]

Acrylonitrile is harmful to aquatic life in very low concentrations.[1]

See "cyanide".

EXPOSURE LIMITS:

AIR: OSHA TWA (skin) 2 **ppm**.[1]

WATER: Recommended drinking water limit .2 **ppm**.[1] WA groundwater criteria .07 μg/l.

See "More About Exposure Limits."

ACTINOLITE: *see Asbestos.*

AEROTHENE MM: *see Methylene chloride.*

AGRITOX (trade name): *see MCPA.*

AGROXOHE (trade name): *see MCPA.*

AGROXONE (trade name): *see MCPA.*

ALACHLOR CAS 15972-60-8; **molecular weight** 269.77:

TRADE NAMES: Lasso, Alanex.

DESCRIPTION: Alachlor is a white crystalline solid formulated as an **emulsifiable** concentrate and in various mixed formulations. The soil **half-life** is about a week. It is highly **mobile** in soil.

USES AND SOURCES: Alachlor is a pre-emergence **herbicide** used for corn, soybeans, and peanuts. Annually 84 million pounds are used, which accounts for 18 percent of the nation's **herbicide** sales.

Alachlor has been found in the surface, tap, and groundwater of 11 states (up to 267 **ppb** in Iowa surface water, and up to 16.6 ppb in northeast Iowa groundwater).[9]

See "More About Pesticides".

HARMFUL EFFECTS AND SYMPTOMS: Routes of harmful exposure to alachlor include inhalation, ingestion, and skin contact. Alachlor irritates the skin and eyes. It is a suspected **carcinogen**, because it causes nasal, **thyroid**, and bronchial tumors in laboratory animals.[9] Laboratory evidence of **mutagenicity** is **equivocal**.[10] There are **data gaps** in its **chronic** effects, carcinogenic effects, **teratogenic** effects, and **tolerances** reassessments.[9] Alachlor is considered to be of moderate **toxicity** (2).[5]

EXPOSURE LIMITS:

INGESTION: **Tolerance** .1 to .2 **ppm** on a number of vegetables.[10]

See "More About Exposure Limits."

ALANEX: *see Alachlor.*

ALAR: *see Daminozide.*

ALBOCARBON: *see Naphthalene.*

ALDECARB: *see Aldicarb.*

ALDICARB CAS 116-06-3; **molecular weight** 190.25:

SYNONYMS: Aldecarb; 2-Methyl-2-(methylthio)-propionaldehyde o-(methylcarbamoyl)oxime; Methylcarbamic acid o-((2-methyl-2-(methylthio)propylidene)amino derivative; Carbanolate; 2-Methl-2-(methylthio)propanal o-[(methylamino)carbonyl]oxime.

TRADE NAMES: UC 21149, Temik, ENT-27093, WHO OMS-771, NCI-C08640.

DESCRIPTION: Aldicarb is a moderately flammable, odorless white crystal formulated into **granules** that are soluble in water. Aldicarb uptake by plants, primarily into the plant leaves, is rapid. It is transformed into another chemical, oxime sulfoxide, which **persists** up to 10 weeks, and is 76 times more toxic than aldicarb itself. In animals aldicarb is rapidly **metabolized** in the liver and excreted within a few days. Aldicarb has a soil **half-life** of 1 to 2 weeks, and is broken down by fungi. There is insufficient data to determine if water treatment processes remove aldicarb from water.[1] It leaches easily into water.

USES AND SOURCES: Aldicarb is a soil applied **systemic pesticide** for use on crops such as cotton, sugar beets, potatoes, peanuts, ornamentals, yams, bananas, oranges, pecans, dry beans, soybeans, and sugarcane.[1] Aldicarb residues have been detected in 5 percent of potatoes and 2 percent of bananas, none exceeding legal allowances. It has been found in the water supplies of 16 states, in concentrations from 1 to 500 **ppb**.[9,14]

See "More About Pesticides".

HARMFUL EFFECTS AND SYMPTOMS: Routes of harmful exposure to aldicarb include inhalation and ingestion. Symptoms of harmful exposure include headache, dizziness, constriction of the eye pupils, eye problems, salivation, sweating, lack of appetite, nausea, vomiting, diarrhea, loss of coordination, muscle twitching, convulsions, respiratory problems, wheezing, constriction of the bronchial tubes, **pulmonary edema**, abnormally slow heartbeat, heartblockage, and respiratory failure.[1] Aldicarb is considered to be of high **toxicity** (3).[5]

Several studies, both human and animal, indicate there might be adverse **immune system** effects associated with long term ingestion of aldicarb. In one study there was a significant alteration in the **lymphatic** system between women who were exposed for four years to about 16.1 **ppb** of aldicarb in their drinking water and women not exposed to that amount. In another study researchers discovered in laboratory animals that the **immune system** depression response occurred more at the 1 **ppb** level than at the 10 **ppb** level, a result which defies the classic dose-response effect in which **toxicity** levels increase with increasing dose levels.[9]

Compliance with registered uses may still result in produce contaminated to an extent that produces **systemic toxicity**, accompanied by symptoms like those listed above, in consumers. In illnesses included in the 1985 summer contamination epidemic of California watermelons, some cases of toxicity occurred for which aldicarb could not be detected. Further examination of information available on aldicarb indicates that contamination illnesses are indeed possible at and below the California Department of Food and Agriculture limit of detection of .2 **ppm**.

Aldicarb has not proved **teratogenic** or **carcinogenic** in laboratory animals, but it may be **mutagenic**.[1] **Data gaps** exist for skin contact and **tolerance** reassessment.[9,21] Aldicarb may be **fetotoxic**, as is suggested by a study of women in Suffolk, New York who drank from aldicarb-contaminated wells (maximum contamination over 500 ppb) and experienced a 50 percent rate of miscarriage.[9]

Aldicarb is highly toxic to mammals, birds, marine and freshwater organisms.[21] It may also be toxic to bees.[9]

EXPOSURE LIMITS:

ADI .003 **mg/kg/day.** TMRC .1120 **mg/day:** 62 percent of ADI.[21]

WATER: The recommended total **carbamate** and **organophosphate pesticide** concentration should not exceed 1 **ppm** in drinking water, since there is insufficient data to determine if water treatment procedures will remove the pesticides.[1] For aldicarb in particular, the drinking water limit is 10 ppb.[9]

See "More About Exposure Limits."

ALDRIN CAS 309-00-2; molecular weight 364.93:

SYNONYMS: Adrine; HHDN; Aldocit, Compound 118, Ent 15,949, Kortofin, NCI-C00044, SD 2794, Tatuzinho, Tipula.

TRADE NAMES: Octalene, Aldrex, Aldrosol, Drinox, Aldrite.

and

DIELDRIN CAS 60-57-1; **molecular weight** 380.93:

SYNONYMS: Compound-497; ENT 16225; Heod; Exo-dieldrin; Aldrin epoxide; Dildrin.

TRADE NAMES: Octalox, Alvit, Quintox, Diedrex, Dieldrite, Panaram D-31, Illoxal, Dielmoth, Dorytox, Insectlack, Kombi-Alberta, Moth Snub D, Red Shield, SD 3417, Termitox.

DESCRIPTION: Aldrin is a light to dark brown solution, solid crystals, or an emulsion with a mild chemical odor. The **odor threshold** is .041 **ppm**. The solid sinks in water, but the solution floats. It is not very flammable, but does emit highly toxic fumes. Dieldrin is a white nonflammable crystal with a mild chemical odor formulated into **wettable powders**, **emulsifiable** concentrates, dusts, **granules**, fertilizer mixtures, seed dressings, and solutions. Aldrin is rapidly converted to dieldrin by aquatic organisms and within the human body. Both chemicals are **bioaccumulative** in fatty tissues, and **bioconcentrate** in aquatic mollusks, clams, and oysters. There is high **food chain contamination** potential.[1]

In various **persistency** studies, both chemicals have proved to be persistent. In one study aldrin dropped to 20 percent of its original concentration in 8 weeks in river water. Dieldrin's **half-life** in water by **photolysis** is 2 months. Chemical decomposition is probably very slow; in one study 100 percent remained in river water after 8 weeks. The half-life of dieldrin in water by evaporation is a few hours to a few days. In one soil test, 26 percent of aldrin concentration remained after one year and 5 percent remained after 3 years. In another soil test, application of up to 25 pounds per acre of aldrin in cornsoils resulted in the retention of 10 percent after 4 years. Aldrin is relatively immobile in soils. The half-life of dieldrin in soil, in which it is relatively immobile, ranges from 5 to 25 years.[1]

USES AND SOURCES: Dieldrin and aldrin are used as **pesticides.** Dieldrin is **metabolically** converted from aldrin. Their use began in the 1950's. In 1974, the **EPA** restricted the use of aldrin to direct soil injection as an organochlorine pesticide for termite control for nonfood seed and plant treatment, and dieldrin's registration was canceled. In the past the primary use of dieldrin was for control of corn pests and by the citrus industry. Uses are now restricted to those where there is no effluent discharge. The manufacture of both chemicals is prohibited.[1]

Traces of dieldrin and aldrin are still common in the environment, in spite of severe reduction in use. The standard diet in the U.S. contains about 43 ng/g of dieldrin.[1] In a 1988 search of the U.S. **EPA** STORET Water Quality File, dieldrin has been found in 7,320 of 50,473 analyzed samples from 9,021 surface water locations in concentrations of .01 **µg/l** at the **85th percentile** of sample levels, and maximum concentrations of 301 µg/l). In 223 of 5,443 analyzed samples from 4,131 groundwater locations, concentrations at the **85th percentile** of sample levels measured .10 **µg/l**, with maximum concentrations of 10.8 **µg/l.** This survey was conducted across 48 states, Canada, and Puerto Rico. In a survey of water and sediment samples done by the United States Geological Survey (USGS), dieldrin was found in 10 to 20 percent of sediment samples at 160 to 180 pesticide monitoring network stations. The frequency of its detection gradually decreased from 1975 to 1980. In a survey of sediments in the San Joaquin River in California, dieldrin was found at 58 percent of the sites tested, in spite of little or no use in a decade. This is an indication that **toxicity** may **persist** in an environment long after the initial release has occurred.

See "More About Pesticides".

HARMFUL EFFECTS AND SYMPTOMS: Routes of harmful **exposure** to both chemicals include inhalation, ingestion, and skin contact. Symptoms of exposure to both chemical include headache, irritability, dizziness, blurred vision, depression, insomnia, nausea, vomiting, lack of appetite, loss of muscular coordination, convulsions, and loss of consciousness. **Acute** exposures may cause tumors in the liver, kidneys, and other organs. They are probable **carcinogens, mutagens**, and possible **teratogens.** They concentrate in fatty tissues.[1] Both aldrin and dieldrin are considered to be of high **toxicity (3).**[5]

Aldrin and dieldrin are harmful to aquatic life in very low concentrations.[1]

EXPOSURE LIMITS:

ADI (Aldrin and dieldrin) **FAO/WHO** .0001 **mg/kg.**[1]

AIR: Aldrin **OSHA PEL** .25 **mg/m^3**.[1] Dieldrin **OSHA TWA** .25 **mg/m^3 (skin).**[25]

WATER: Drinking water limit: due to the potential **carcinogenic** effect of aldrin and dieldrin, their concentration in drinking water should be zero. If this level is not attainable, levels which raise the human lifetime cancer **risk** to:

one in ten thousand = .7100 **mg/l;**
one in one million = .0710 mg/l;
one in ten million = .0071 mg/l.[1]

EPA (1980) ambient water quality criteria, dieldrin .71 **ng/l.** **WHO** (1982) guidance in drinking water .03 µg/l.[22] WA groundwater criteria aldrin and dieldrin .005 **µg/l.**[8]

See "More about Exposure Limits."

ALGOFRENE TYPE 1 (trade name): *see Fluorotrichloromethane.*

ALGOFRENE TYPE 2 (trade name): *see Difluorodichloromethane.*

ALGYLEN (trade name): *see Trichloroethylene.*

ALKRON (trade name): *see Parathion.*

ALLTOX: *see Toxaphene.*

ALLYALDEHYDE: *see Acrolein.*

ALLYLENE DICHLORIDE: *see Dichloropropene.*

ALPHA,BETA-DIBROMOETHANE: *see Ethylene dibromide.*

ALPHA,BETA-DICHLOROETHANE: *see Ethylene dichloride.*

ALPHA,BETA-DICHLOROETHYLENE: *see 1,2-Dichloroethylene.*

ALPHA,BETA;DICHLOROPROPANE: *see Propylene dichloride.*

ALPHA,BETA-OXIDOETHANE: *see Ethylene oxide.*

ALPHA,BETA-PROPYLENE DICHLORIDE: *see Propylene dichloride.*

ALUMINUM **atomic weight** 26.98; CAS 74-299-05; Chemical Symbol: Al

DESCRIPTION: Aluminum is one of 90 naturally occurring elements in nature, constituting nearly 8 percent of the earth's crust. When aluminum is digested, .1 percent is absorbed by the body.[2]

SOURCES AND USES: Aluminum is a metal used by itself or in alloys to make aircraft, utensils, apparatus, electrical conductors, in photography, in explosives, fireworks, paints, and in steel manufacture. Common products containing aluminum in high levels include baking powder, antacids, dietary supplements, aluminum cookware/storage containers, food additives, buffered aspirin, and cosmetics. Alum, a form of aluminum, is sometimes used in drinking water treatment to help purify water.[26] Aluminum is found at illegal drug laboratory **hazardous waste** sites, where LSD and psilocin have been processed.[2] **Exposure** through food is estimated to range from 1 to 100 mg/day, averaging 20 mg/day. In a nationwide survey aluminum was found in groundwater from .29 **mg/l** and in surface waters at .016 to 1.17 **mg/l**. In water finished with alum its aluminum concentration ranged from .014 to 2.7 **mg/day**, about 1 percent of the total daily exposure.[26]

HARMFUL EFFECTS AND SYMPTOMS: People at risk for health problems include dialysis patients. Symptoms of chronic aluminum exposure include softening of the bones and brain dysfunction. The question of whether overexposure to aluminum causes Alzheimer's Disease is a matter of research and debate.[26] Aluminum is considered to be of high **toxicity (3)**.[5]

EXPOSURE LIMITS:

WATER: SMCL 50 **ppb**.[26]

See "More About Exposure Limits."

AMATIN (trade name): *see Hexachlorobenzene.*

AMERICAN-CYANIMIDE-4049 (trade name): *see Malathion.*

AMIANTHUS: *see Asbestos.*

AMINOBENZENE: *see Aniline.*

4-AMINO-6-(1,1-DIMETHYLETHYL)-3-(METHYLTHIO)-1,2,4-TRIAZIN-5(4H)ONE: *see Metribuzin.*

AMINOPHEN: *see Aniline.*

4-AMINO-6-TERT-BUTYL-3-(METHYLTHIO)-AS-TRIAZIN-5(4H)-ONE: *see Metribuzin.*

AMMONIA CAS 7664-41-7; **molecular weight** 17.03:

SYNONYMS: Anhydrous ammonia.

DESCRIPTION: Ammonia is a colorless gas or liquid (in order to be a liquid it must be very cold, less than minus 33.5 degree centigrade; minus 31 degrees fahrenheit). As a liquid, it is lighter than water and easily dissolves in water. The **odor threshold** ranges from 21 to 46.8 **ppm**. Most freshly opened bottles of household ammonia range from 5 to 10 percent ammonia. Dilute ammonia water is 9 to 10 percent ammonia, and a strong ammonia solution is 27 to 30 percent ammonia. There is no **bioaccumulation**, nor is it **persistent** in the environment for more than a few days, because bacteria converts it to nitrates.[1]

See "nitrates".

USES AND SOURCES: Ammonia is used as a nitrogen source, to make fertilizers, pharmaceuticals, explosives, cosmetics, and synthetic fibers, in the paper industry, in metal manufacturing, in vehicle maintenance and equipment repair, in laboratories, in wood preservation, in chemical production, such as nitric acid, hydrogen cyanide, and acrylonitrile, in printing, and as a refrigerant.[1] Ammonia is found at illegal drug laboratory **hazardous waste** sites, where cocaine and LSD have been processed.[2] It is also a component of tobacco smoke.[3]

HARMFUL EFFECTS AND SYMPTOMS: Routes of harmful **exposure** to ammonia include inhalation, ingestion, and skin contact. By inhalation one retains 83 percent of the ammonia one breathes. People with eye and respiratory diseases should not be exposed to ammonia. The liquid produces severe burns in the eyes and on the skin by direct contact. Inhalation in high concentrations may cause violent coughing, severe lung irritation, **pulmonary edema**, and possibly death. Swallowing the liquid is corrosive to the digestive system, with nausea, vomiting, and pink frothing at the mouth. Its **carcinogenicity** is unknown **(D)**, but unlikely. Ammonia is not very **persistent**, and does not pose a human health threat at levels usually found in water surrounding point source discharges.[1] Ammonia is considered to be of high **toxicity (3)**.[5]

Ammonia is **chronically** and **acutely** toxic to aquatic life.[1]

EXPOSURE LIMITS:

AIR: ACGIH TLV-TWA 25 **ppm** (approximately 18 **mg/m^3**).[28]

WATER: Recommended drinking water limit .05 **ppm**.[1]

See "More about Exposure Limits."

AMOSITE: *see Asbestos.*

AN: *see Acrylonitrile.*

ANAMENTH (trade name): *see Trichloroethylene.*

ANYHYDROUS AMMONIA: *see Ammonia.*

ANILINE CAS 62-53-3; molecular weight 93.12:

SYNONYMS: Aminobenzene, Phenylamine, Aniline oil, Benzenamine, Aminophen, Kyanol, Blue Oil, Arylamine.

DESCRIPTION: Aniline is a moderately flammable, oily liquid that dissolves and sinks in water. It ranges in color from colorless to yellow-brown. Aniline has a peculiar odor perceptible at a range of 2 to 70 **ppm**. It is readily biodegradable, with no **bioaccumulation**. **Exposure** to aniline often includes exposure to dichloropropene.[1]

See "Dichloropropene."

USES AND SOURCES: Aniline is used as an intermediate in the manufacture of the **urethane** chemical MDI, rubber chemicals, **pesticides**, dyes, pharmaceuticals, photographic, and textile chemicals.[2,28] Aniline is found at illegal drug laboratory **hazardous waste** sites, where the drugs p-fluoro fentanyl, alpha-methyl fentanyl, and 3-methyl fentanyl have been processed.[2] It is a component of cigarette smoke.[3]

See "More About Pesticides".

HARMFUL EFFECTS AND SYMPTOMS: Routes of harmful **exposure** to aniline include inhalation, skin contact, and ingestion. Aniline is highly **toxic** by all routes, by **acute** and **chronic exposures**. Symptoms of harmful acute exposure, which might appear after inhaling concentrations of 7 to 53 **ppm**, include headaches, weakness, dizziness, **cyanosis**, insomnia, loss of appetite, nausea, vomiting, and loss of consciousness.[1,28] Symptoms of chronic exposure include irritability, drowsiness, eye irritation, visual disturbances, skin lesions, lack of muscular coordination, difficulty in breathing, rapid heartbeat, and loss of consciousness. Aniline is a possible **carcinogen** and is **fetotoxic**.[1] Aniline is considered to be of high **toxicity** (3).[5]

Aniline is dangerous to aquatic life in high concentrations.[1]

EXPOSURE LIMITS:

AIR: OSHA TWA 2 ppm (approximately 8 **mg/m^3**).[4]

WATER: Recommended drinking water limit 5 **ppm**.[1] WA groundwater criteria 14 µg/l.[8]

See "More about Exposure Limits."

ANILINE OIL: *see Aniline.*

ANKILOSTIN (trade name): *see Tetrachloroethylene.*

ANOFEX (trade name): *see DDT.*

ANPROLENE: *see Ethylene oxide.*

ANTHOPHYLITE: *see Asbestos.*

ANTHRACEN: *see PAHs.*

ANTHRACENE: *see PAHs.*

ANTHRACIN: *see PAHs.*

ANTICARIES (trade name): *see Hexachlorobenzene.*

ANTIMONY CAS 7440-36-0; **Atomic weight** 121.75; Chemical Symbol: Sb

SYNONYMS: Stibium.

DESCRIPTION: Antimony is a silver, gray metal, seldom found in pure form. The metal will sink, and most of its salts are insoluble. It is quite **persistent** in the environment.

Bioaccumulation occurs, particularly in marine life, where it can accumulate to **toxic** levels. The potential for **food chain contamination** is high.[1]

USES AND SOURCES: Antimony is used in the production of alloys, in chemical production, in dyeing, to make fireworks, ammunition, paints, lacquers, glass, pottery, enamels, glazes, matches, and pharmaceuticals.[42]

On the average, a person ingests 96.5 percent (700 μg/l) of their daily exposure in food, 3.3 percent (14 μg/l) in water and .2 percent (1.3 μg/l) through inhalation.[42]

HARMFUL EFFECTS AND SYMPTOMS: Harmful exposure to antimony may occur by inhalation, by ingestion, and by skin contact. Antimony and its compounds are highly toxic by chronic as well as by acute dosage. The gastrointestinal absorption rate for antimony is 10 percent of the amount ingested, while the absorption rate for the lungs is about 20 percent. The biological half-life in the body is about one month.[44] Symptoms include nose, throat, skin, and mouth irritation, lack of appetite, nausea, vomiting, cramps, and diarrhea.[1] Antimony is toxic to the gastrointestinal and respiratory tracts, the skin, the liver, and especially the heart. It has been reported to reduce longevity, reduce blood glucose levels, alter cholesterol levels, and is not considered to be **carcinogenic**. Antimony may have some type of reproductive impact on women.[42] Antimony is considered to be of high **toxicity** (3).[5]

EXPOSURE LIMITS:

AIR: OSHA PEL .5 mg/m^3.[25]

INGESTION: EPA ADI .028 mg/day.[25]

WATER: Drinking water level goal 3 μg/l.[25]

See "More about Exposure Limits."

ANTINONNIN (trade name): *see 4,6-Dinitro-o-cresol.*

ANTISAL 1 (trade name): *see Tetrachloroethylene.*

AQUALIN: *see Acrolein.*

AQUALIN-BIOCIDE: *see Acrolein.*

AQUALIN-SLIMICIDE: *see Acrolein.*

ARCTON 6 (trade name): *see Dichlorodifluoromethane.*

ARCTON-9 (trade name): *see Fluorotrichloromethane.*

AROCLOR (trade name): *see PCBs.*

ARSENIC CAS 7440-38-2; **atomic weight** 74.92; Chemical Symbol: As

DESCRIPTION: Arsenic is a silver, gray metal which turns black on **exposure** to air. It is **persistent** in the air for days after release. Plants do not take up much arsenic, and it is slowly **mobile** in soil. In water arsenic may be persistent. It is estimated that 12 to 25 percent of arsenic applied in **pesticides** to the soil are lost annually as evaporated arsenic compounds. There is limited **bioaccumulation**, with moderate **food chain contamination** potential. Arsenic is estimated to be **synergistic** with selenium in drinking water, with cigarette smoke when arsenic is in the form of an airborne compound, and with sulfur dioxide. It is difficult to determine synergy because the latency period for cancer with arsenic is so long.[1]

See "Selenium" and "Sulfur dioxide."

USES AND SOURCES: Arsenic is a nonmetallic impurity in many ores and is generally produced as a product in the smelting process. It is alloyed with copper and is used to make the compound gallium arsenide for dipoles and other electronic devices.[1] Seventy-four percent of its use is in wood preservation, 19 percent in agricultural chemicals, 3 percent in glass, 2 percent in nonferrous alloys, and 2 percent in other uses.[7] Arsenates, arsenites and other arsenic compounds are used in **pesticides**, pigment production, wood preservation, chemical production, manufacture of pharmaceuticals, glass and enamels, in laboratories, in auto repair shops, in textile printing, tanning, taxidermy, and in anti-fouling paints. They are also used to control sludge formation in lubricating oils, as an alloying agent to harden lead shot and in lead-base bearing materials. Arsenic and arsenic compounds are commonly found toxicants found at **hazardous waste** cleanup sites in Washington state.[44] Arsenic is a coal burning by-product. Currently no arsenic is being produced in the U.S.[7]

In 1987 1.2 million pounds of arsenic metal was imported, and 59.5 million pounds of arsenic trioxide was imported. **EPA** estimates that total environmental emissions of arsenic compounds amount to 18 million pounds annually. **NIOSH** estimates that 1.5 million workers are potentially **exposed** to arsenic annually.[7]

EPA's Rural Water Survey found arsenic to exceed **EPA** drinking water standards in less than 1 percent of rural wells sampled. These national statistics may underestimate conditions in certain local settings. Near Knott, Texas, 26 percent of the wells had elevated levels of arsenic, probably the result of arsenic **pesticide** use. Average daily intake of arsenic has decreased in recent years. The main source of arsenic is meat, fish, and poultry, largely due to the use of certain **organo**arsenical compounds that are used to stimulate growth or to prevent or treat diseases. The drop in arsenic is probably due to the decline in the use of arsenic-containing pesticides.[1]

The adult daily requirement of arsenic is .03 mg. Normal daily intake averages around .065 mg.[42]

See "More About Pesticides".

HARMFUL EFFECTS AND SYMPTOMS: Harmful **exposure** to arsenic may occur by inhalation, ingestion, and by skin contact. Arsenic is a chronic poison as well as an **acute** one. Symptoms of harmful exposure include weakness, loss of appetite, a sense of heaviness in the stomach, nausea, vomiting, diarrhea, pink eye, inflammation of the mucous membranes of the nose, throat, and respiratory passages, perforation of the nasal septum and skin, swelling of the nerves of the hands and feet, and paralysis of some toe and finger muscles. Arsenic is a **carcinogen (A)** by skin contact and inhalation, and a possible carcinogen (C) by ingestion, sometimes with a latency period of 20 to 30 years.[1] The evidence for skin and oral routes is limited. **Chronic exposure** to .35 **ppm** arsenic in drinking water has been associated with blackfoot disease, other **cardiovascular** disorders, skin lesions, skin cancer, darkening of the skin, chronic herpes, bronchiopulmonary disease, chronic coughing, abdominal pain, and chronic diarrhea. At the Tacoma smelter, occupational exposure has been linked to nervous system abnormalities. Arsenic interferes with the **thyroid** hormones. It is a mutagen, a potential **teratogen**, and an **accumulative** poison in the liver and kidneys.[1] Arsenic is considered to be of high **toxicity** (3).[5]

EXPOSURE LIMITS:

ADI: .2 mg.[42]

AIR: OSHA PEL .5 mg/m^3.[28]

WATER: Recommended drinking water limit 0.[25] WA groundwater criteria .05 µg/l.[8]

See "More about Exposure Limits."

ARYLAMINE: *see Aniline.*

ASBESTOS CAS 1332-21-4:

SYNONYMS: Chrysotile, Amosite, Crocidolite, Tremolite, Anthophylite, Actinolite, Calcium magnesium salt, Silicic acid, Blue asbestos, Mysorite, Brown asbestos, Calidiria RG Ferroanthophyllite, Cassiar AK, Avibest C, 7-45 Asbestos, Serpentine, Amianthus, White asbestos.

TRADE NAMES: Ascarite.

DESCRIPTION: Asbestos is a nonflammable fibrous material. Asbestos in water stays suspended a long time. For example, asbestos fibers released by the dumping into Lake Superior of taconite tailings have travelled at least 75 miles from the discharge point, where they are being **coagulated** and sedimented. Asbestos fibers may be contaminated with PAHs.[1]

See "PAHs".

USES AND SOURCES: Asbestos is used as a building and insulating material, and as a heat resistant insulator in fireproof gloves, clothes, and brake linings.[1] Friction products constitute 22 percent of asbestos use, roofing products 17 percent, air conditioning pipe 17 percent, coatings 15 percent, and paper 11 percent.[7]

In 1987 114.6 million pounds of asbestos was produced, 216 million pounds imported, and 127 million pounds exported.[7]

Nationwide 5 to 15 percent of all public schools use asbestos to insulate pipes and boilers. In Washington state more than half of public schools use asbestos. An EPA study reported that 90 percent are completing cleanup of asbestos, conducting a cleanup, or planning one. Less than 25 percent are cleaning up in a safe way. The dangers of asbestos **exposure** is of special concern for children. If they are exposed early in their lives, they will have plenty of time to develop asbestos induced cancers.[138]

OSHA reports that 2.5 million workers are potentially **exposed** to asbestos.[7] Exposure to asbestos fibers may occur throughout urban environments, mostly from the wearing of brake linings of cars. People living in the neighborhood of asbestos factories and mines and in households where asbestos workers live also develop more tumors than usual.[1] As many as 20 million North Americans have been exposed to asbestos, and 5.6 million of them may die of cancer or other asbestos related diseases. The EPA estimates that between 3,300 to 12,000 cancer cases related to asbestos exposure are diagnosed annually, almost all of which are fatal.

In urban air there is usually less than 10 **ng/m^3** of asbestos; in rural areas less than .01 **ng/m^3**. Average concentrations in drinking water range from .3 to 1.5 $\mu g/l$.[7]

HARMFUL EFFECTS AND SYMPTOMS: The primary route of **exposure** to asbestos is through inhalation.[1] Symptoms of harmful exposure include restricted breathing, coughing, indigestion, interstitial fibrosis (growth of fibrous connective tissue in an organ in excess of that naturally present) of the lungs, and **chronic** bronchitis. Asbestos is a **carcinogen** (A) by inhalation, causing cancer in the lungs (20 to 25 percent of all asbestos related cancers), in the lining of the abdominal cavity (7 to 10 percent), and the gastro-intestinal tract (8 to 9 percent), with a mesothelioma (tumor) latency period of 3.5 to 30 years, and a lung cancer latency period of 15 to 30 years. Of persons who have been heavily exposed to asbestos, 35 to 44 percent may die of asbestos-related cancers, while only 8 to 9 percent would have been expected to die of cancer had they not been **exposed.** A heavy **acute** dose of asbestos fibers, after several decades, may be as dangerous as **chronic** exposure to lower levels. By ingestion asbestos is of unknown **carcinogenicity** (D). Asbestos is a possible **mutagen** and **teratogen.**[1] Exposure to asbestos and cigarette smoking are **synergistic**. Smokers who have been exposed to asbestos have 5 times the chance of contracting lung cancer than someone who has not been exposed.[138] Heavy-smoking asbestos workers are 17 times more likely to die of lung cancer than nonsmoking asbestos workers. Asbestos is considered to be of high **toxicity** (3).[5]

EXPOSURE LIMITS:

AIR: OSHA TWA 2 fibers 5 microns in length per ml of air.[1]

WATER: Due to the **carcinogenic** effect of asbestos, its concentration in drinking water should be zero. If this level is not attainable, levels which raise the human lifetime cancer risk to

one in ten thousand = 300,000 fibers per **liter**;
one in one million = 30,000 fibers per liter;
one in ten million = 3,000 fibers per liter.[1]

See "More about Exposure Limits."

7-45 ASBESTOS: *see Asbestos.*

AQUA FORTIS: *see Nitric acid.*

AQUAZINE (trade name): *see Simazine.*

ARBOTRINE (trade name): *see Benomyl.*

ASCARITE (trade name): *see Asbestos.*

ASDICHLOROETHYLENE: *see Vinylidene chloride.*

ASYM-O-XYLENOL: *see 2,4-Dimethylphenol.*

ASYM-TRICHLOROBENZENE: *see 1,2,4-Trichlorobenzene.*

ATONIK (trade name): *see Nitrophenol.*

ATOXAN (trade name): *see Carbaryl.*

ATRANEX (trade name): *see Atrazine.*

ATRAZINE CAS 1912-24-9; molecular weight 216.06:

SYNONYMS: 6-Chloro-N-ethyl-N-(1-methylethyl)-1,3,5-triazine-2,4-diamine; 2-Chloro-4-ethylamino-6-isopropylamino-s-triazine.

TRADE NAMES: Gesaprim, Primatol, Aatrex, Atranex, Primatol A, Atred, Crisazine, Vectal SC.

DESCRIPTION: Atrazine resembles white or colorless crystals that sink in water. As a **herbicide** it works by inhibiting photosynthesis. Its **half-life** in many soils ranges from 2 months to 16 months, in groundwater is 15 months, and in neutral or basic water is about 2 years.[99,]

Atrazine is moderately to highly **mobile** in soils ranging from clay to gravelly sand.[99] Conventional municipal drinking water treatment does not remove it. There is no **food chain contamination** potential.[142] More than 2 dozen weed species have developed resistance to atrazine.

USES AND SOURCES: Atrazine is a **herbicide** often used on corn, sorghum, pineapple, sugarcane, in forestry, on rangeland, turf grass sod, Christmas tree plantations, and in rights-of-way treatment.[39,143]

Atrazine is one of the most common **pesticides** used in western Washington, and over the past 30 years the most heavily used **herbicide** in the United States.[31,99] Seventy-five to ninety million pounds of atrazine are used annually nationwide; constituting 10 percent of all pesticide use.

Atrazine has been found in the groundwater of 25 states, in every major watershed in Iowa, and in the drinking water of New Orleans.[39] In a survey done by the United States Geological Survey (USGS), atrazine was found in 5 percent of water and sediment samples in a network of 160 to 180 **pesticide** monitoring network stations.[23,99] In a 1988 search of the U.S. EPA STORET Water Quality File, atrazine has been found in 4,123 of 10,942 analyzed samples from 1,659 surface water locations across 31 states, in concentrations of 2.3 µg/l at the **85th percentile** of sample levels, with a maximum concentration of 2,300 µg/l. It has been found in 343 of 3,208 analyzed samples from 2,510 groundwater locations across 13 states, in concentrations of 1.9 µg/l at the 85th percentile of sample levels, with a maximum concentration of 700 µg/l.[99]

Formaldehyde is used in 4 formulations of atrazine. Hexachlorobenzene is an impurity in the production of atrazine.[1]

See "Formaldehyde" and "Hexachlorobenzene." See "More About Pesticides".

HARMFUL EFFECTS AND SYMPTOMS: Atrazine has low **toxicity** by skin contact, inhalation, and ingestion. Eighty percent of any amount ingested is absorbed.[99] Atrazine is irritating to the eyes, nose, and throat. Symptoms of large doses include abdominal distress, nausea, vomiting, and diarrhea. Large doses in animals causes anemia and impaired adrenal function. Atrazine combined with nitrite fertilizers form **carcinogenic** nitrosamine compounds. This same process occurs in the gasto-intestinal system when atrazine residues are combined with nitrite-treated foods and naturally occurring nitrite.[39] Agricultural workers **exposed** to atrazine and 2,4-D exhibited alterations of their **lymphatic system**. In a study with Kansas farmers, a significant increase in lymph cancer was recorded with the use of triazine **herbicides**, of which is atrazine is one.[144] Atrazine is considered to be of high **toxicity** (3).[5]

Atrazine is harmful to aquatic life in very low concentrations, at .5 to 2 **ppm**.

See "Nitrosamines."

EXPOSURE LIMITS:

ADI: .73 **mg/L**.[99]

AIR: ACGIH TWA 5 **mg/m**^{3}.[1]

WATER: TNMR .0770 **mg/day**.[148] Lifetime **Health Advisory** .003 **mg/l** (3 μg/l).[99]

See "More about Exposure Limits."

AVIBEST C: *see Asbestos.*

AVOLIN (trade name): *see Dimethyl phthalate.*

AZINPHOSMETHYL: *see Guthion.*

BA: *see PAHs.*

B(A)A: *see PAHs.*

BANES (trade name): *see Dicamba.*

BANEX (trade name): *see Dicamba.*

BANVEL D (trade name): *see Dicamba.*

BAP: *see PAHs.*

B(A)P: *see PAHs.*

BARIUM CHROMATE: *see Chromium.*

BATTERY ACID: *see Sulfuric acid.*

BAY 70143 (trade name): *see Carbofuran.*

BAY 94337 (trade name): *see Metribuzin.*

BAYER-9027 (trade name): *see Guthion.*

BAYER-17147 (trade name): *see Guthion.*

BAYER 19639 (trade name): *see Disulfoton.*

B(B)F: *see PAHs.*

BCEE: *see Dichloroethyl ether.*

BENLATE (trade name): *see Benomyl.*

BENOMYL CAS 17804-35-2; **molecular weight** 290.32:

TRADE NAMES: Benlate, Tersan, Arbotrine.

DESCRIPTION: Benomyl is a colorless crystalline solid that is slightly soluble in water.[1] There is no **bioaccumulation.**[9] Its **half life** in soil ranges from 3 months to a year. Sixty-nine of 70 species of fungi known to be resistent to **fungicides** are resistent to benomyl in particular.[9]

USES AND SOURCES: Benomyl is a systemic **fungicide**. It is used on ornamentals, flowers, vegetables, home lawns, fruits, nuts, and rice.[39] Its residues concentrate in orange juice, dried apricots, plums, and grape juice. Benomyl accounts for 55 percent of the $320 million worldwide fungicide market. Veterinarians use it to kill intestinal worms.[9]

See "More About Pesticides".

HARMFUL EFFECTS AND SYMPTOMS: Routes of harmful **exposure** to benomyl include inhalation, ingestion, and skin contact. **Acute** symptoms of poisoning may include headache, dizziness, weakness, twitching, tremor, nausea, and vomiting.[49] Laboratory tests show that it may cause chromosomal alterations, gene mutations, **teratogenicity**, and **carcinogenicity**. Benomyl is considered to be of high **toxicity** (3).[5]

Benomyl is highly toxic to earthworms and fish.[150]

EXPOSURE LIMITS:

AIR: OSHA TWA total dust 10 **mg/m^3**. **Respirable fraction** 5 **mg/m^3**.[4]

See "More about Exposure Limits."

1,2-BENZ(A)ANTHRACENE: *see PAHs.*

1,2-BENZACENAPHTHENE: *see PAHs.*

BENZ(ALPHA)PYRENE: *see PAHs.*

BENZANTHRACENE: *see PAHs.*

1,2-BENZANTHRACENE: *see PAHs.*

BENZANTHRENE: *see PAHs.*

1,2-BENZANTHRENE: *see PAHs.*

BENZ(A)PHENANTHRENE: *see PAHs.*

BENZ(E)ACEPHENANTHRYLENE: *see PAHs.*

BENZENE CAS 71-43-2; **molecular weight** 78.11

SYNONYMS: Benzol, Cyclohexatriene, Coal tar naphtha, Phenyl hydride, Phene, Polystream, Pyrobenzol, Benzole.

DESCRIPTION: Benzene is a very flammable, colorless liquid which initially floats, then dissolves in water and evaporates. Its gasoline-like and irritating odor is perceptible at 4.68 **ppm**. The vapor is heavier than air, and can trail along the ground to an ignition source. The **half-life** of benzene in the top meter of water is 40 minutes, due to evaporation.[1] Its half-life in the atmosphere is 1 to 2 days. There is no **food chain contamination** potential.[1]

USES AND SOURCES: Benzene is used as a constituent of 1 to 2 percent in gasoline and more in unleaded gas (.12 to 3.5 percent by weight), and motor oils.[30,42] In some countries gasoline consists of as much as 30 percent benzene.[30] Ninety percent of its production contributes to the production of **organic** chemicals.[30] The rest primarily is used in the manufacture of detergents, **pesticides**, solvents, and paint removers. Other uses occur in vehicle maintenance and equipment repair, in laboratories (discontinued), in textile manufacturing, in making cosmetics, in the extraction of oils from seeds and nuts, in chemical production, in photogravure printing, in furniture making and refinishing, and in thinners, degreasers, cleaners, explosives, pharmaceuticals, metals, and dyestuffs. Benzene is used as a chemical intermediate, and as a solvent for fats, inks, oils, paints, plastics, and rubber, [1,6,30,42] Benzene is used as an **inert ingredient** in some pesticides.[9] It is a commonly encountered toxicant at **hazardous waste** cleanup sites in Washington state.[44] Benzene is found at illegal drug laboratory hazardous waste sites, where amphetamines, cocaine, MDA, mescaline, methadone, and PCP have been processed.[2] It is a component of cigarette smoke, with the average smoker ingesting 2 **mg** daily.[3,7]

Use of benzene totals more than 11 billion gallons annually. In 1976, 1.3 billion pounds of benzene were released into the atmosphere.[7] Annually 840 million pounds of benzene is released in automobile exhaust, and 120,000 tons through evaporation from oil spills.[137]

Seventy-five percent of the population is **exposed** to benzene.[7] **NIOSH** estimates that 3 million workers nationwide are potentially exposed to benzene annually, 30,000 of them to 10 **ppm** or greater.[30,137] Concern also arises from the public exposure to the benzene content in gasoline.[44]

Levels of benzene in the air near gasoline pumps is 3 **ppm.**[137] Levels of benzene in the ambient atmosphere range from 1 to 100 **ppb**. The average individual ingests 250 **g**/day.[7]

See "Gasoline" and "Petroleum." See "More about Pesticides."

HARMFUL EFFECTS AND SYMPTOMS: Routes of harmful **exposure** to benzene, by **chronic** as well as **acute** dosage, include inhalation and skin contact. Symptoms of harmful exposure to benzene liquid and vapor include irritation to the skin, eyes, and upper respiratory tract, reddening, scaling, cracking, and burning skin, flushed face, headache, pupil dilation, dizziness, fatigue, speech problems, excitement, nervousness, giddiness, euphoria, insomnia, tingling of the hands and feet, nosebleeds, tightness in chest, tremors, nausea, loss of appetite, weight loss, anemia, central nervous system depression, menstrual disturbances, urine color changes, blood changes, convulsions, hemorrhage, **pulmonary edema**, **circulatory** problems, paralysis, loss of consciousness, and death.[1] Non-fatal symptoms may last up to 2 weeks after the exposure. Fatal poisonings may occur for exposures of 200 **ppm.**[137] Benzene is **bioaccumulative.** It is **carcinogenic** (A), as well as a **mutagen** and a **teratogen.**[1] EPA's Carcinogen Assessment Group claims that 90 cases of cancer diagnosed yearly are due to benzene exposure.[137] Benzene is considered to be of high **toxicity** (3).[5]

Benzene is harmful to aquatic life in very low concentrations.[1]

EXPOSURE LIMITS:

ADI: 235 µg/l (10-day **Health advisory**).[25]

AIR: ACGIH TLV .1 **ppm.**[136]

WATER: Due to the **carcinogenic** effect of benzene, its concentration in drinking water should be zero. If this level is not attainable, levels which raise the human lifetime cancer risk to

one in ten thousand = 6.600 **ppb**;
one in one million = .660 ppb;
one in ten million = 066 ppb.[1]

WA GROUNDWATER CRITERIA: 1 µg/l (ppb).[8]

See "More about Exposure Limits."

BENZENEAMINE: *see Aniline.*

BENZENE CHLORIDE: *see Chlorobenzene.*

1,2-BENZENEDICARBOXYLICACID: *see Dimethyl phthalate.*

BENZINOFORM (trade name): *see Carbon tetrachloride.*

BENZINOL (trade name): *see Trichloroethylene.*

BENZO(A)ANTHRACENE: *see PAHs.*

BENZO(A)PYRENE: *see PAHs.*

3,4-BENZO(A)PYRENE: *see PAHs.*

BENZO(B)PHENANTHRENE: *see PAHs.*

BENZO(DEF)CHRYSENE: *see PAHs.*

2,3-BENZOFLUORANTHENE: *see PAHs.*

3,4-BENZOFLUORANTHENE: *see PAHs.*

11,12-BENZOFLUORANTHENE: *see PAHs.*

11,12-BENZO(K)FLUORANTHENE: *see PAHs.*

2,3-BENZOPHENANTHRENE: *see PAHs.*

3,4-BENZOPYRENE: *see PAHs.*

2,3-BENZPHENANTHRENE: *see PAHs.*

BENZO(B)FLUORANTHENE: *see PAHs.*

BENZOEPIN (trade name): *see Endosulfan.*

BENZO(K)FLUORANTHENE: *see PAHs.*

BENZO(J,K)FLUORENE: *see PAHs.*

BENZOL: *see Benzene.*

BENZOLE: *see Benzene.*

1,2-BENZPHENANTHRENE: *see PAHs.*

1,2-BENZPYRENE: *see PAHs.*

3,4-BENZPYRENE: *see PAHs.*

BEOSIT (trade name): *see Endosulfan.*

BERYLLIUM CAS 7440-41-7; **atomic weight** 9.01218; Chemical Symbol: Be

SYNONYMS: Glucinium, glucinum.

DESCRIPTION: Beryllium is a slightly flammable gray-white metal which is odorless and sinks in water. There is some **persistency**, potential **bioaccumulation**, and potential **food chain contamination**. The **half-life** of beryllium in the human body is 180 days.[1]

USES AND SOURCES: Beryllium is used to make reactors, radio-tubes, and ceramics. It is a by-product of coal-burning.[1,28] Beryllium is a component of cigarette smoke, in amounts of .47 to .74 mg/cigarette.[7]

In 1987 560,000 pounds of beryllium were mined, 280,000 pounds imported, and 200,000 pounds exported. In 1985 3.3 million pounds of beryllium compounds were imported. EPA estimates that the total release of beryllium to the atmosphere from point sources like coal-burning plants and factories producing copper-beryllium alloys is 5,500 pounds per year nationwide.[7]

OSHA estimates that 25,000 workers nationwide are potentially exposed to beryllium annually. The 721,000 persons living within 12.5 miles of such sources are exposed to small amounts of beryllium in their air, drinking water, and food (especially if it is grown or processed within that radius).[7] On the average a person ingests 92 percent (.011 mg) of their total daily intake of beryllium in their food and 8 percent (.001 mg) in their drinking water.[42] Eastern U.S. urban air average concentration ranges from .3 to 3 ng/m^3. In rural areas the average concentration is 12 times lower.[7]

HARMFUL EFFECTS AND SYMPTOMS: Harmful exposure to beryllium may occur by inhalation, ingestion, and skin contact. **Acute** symptoms include respiratory problems. It irritates the skin and eyes on contact. **Chronic** symptoms include coughing, weakness, weight loss, anorexia, and chronic respiratory diseases.[1] It is a possible **carcinogen**, with sufficient evidence in animal studies, and limited evidence in human monitoring.[25] Diseases may take from 3 months to 15 years to appear after exposure.[1] Beryllium is considered to be of high **toxicity** (3).[5]

The effect of beryllium on aquatic life is unknown.[1]

EXPOSURE LIMITS:

AIR: OSHA TWA .002 ppm.[4]

INGESTION: NOAEL 5 ppm.[42]

See "More about Exposure Limits."

BETA-T (trade name): *see 1,1,2-Trichloroethane.*

BETA-TRICHLOROETHANE: *see 1,1,2-Trichloroethane.*

BHC: *see Hexachlorocyclohexane and/or Lindane.*

BIO 5462: *see Endosulfan.*

BIS(BETA-CHLOROETHYL) ETHER: *see Dichloroethyl ether.*

2,4-BIS(ETHYLAMINO)-6-CHLORO-S-TRIAZINE: *see Simazine.*

BIS-(2-ETHYLHEXYL)PHATHLATE: *see Dioctyl phthalate.*

BIS(S-(DIETHOXYPHOSPINOTHIOYL)MERCAPTO)METHANE: *see Ethion.*

B(K)F: *see PAHs.*

BLACOSOLV (trade name): *see Trichloroethylene.*

BLADAN (trade name): *see Ethion and/or Parathion.*

BLANCOSOLV (trade name): *see Trichloroethylene.*

BLUE ASBESTOS: *see Asbestos.*

BLUE COPPERAS (trade name): *see Copper naphthenate.*

BLUE OIL: *see Aniline.*

BLUESTONE (trade name): *see Copper naphthenate.*

BLUE VITRIOL (trade name): *see Copper naphthenate.*

BONOFORM: *see Tetrachloroethane.*

BOREA (trade name): *see Bromacil.*

BORER-SOL (trade name): *see Ethylene dichloride.*

BOV: *see Sulfuric acid.*

BP: *see PAHs.*

3,4-BP: *see PAHs.*

BROCIDE (trade name): *see Ethylene dichloride.*

BROMACIL CAS 314-40-9; **molecular weight** 261.11:

SYNONYMS: 5-Bromo-6-methyl-3-(1-methylpropyl)-2,4(1H, 3H)-pyrimidinedione; 5-Bromo-3-sec-butyl-6-methyluracil.

TRADE NAMES: duPont herbicide 976, Hyvar, Hyvar X, Uragon, Urox B, Urox HX, Krovar II, Borea, Hyvar X-L.

DESCRIPTION: Bromacil is a white crystalline solid slightly soluble in water formulated as an 80 percent **wettable powder** and a 50 percent water-soluble powder. It works by inhibiting photosyntheses. There is no **bioaccumulation.** It is moderately to highly **mobile** in soils. Its **half life** in soil ranges from 5 months to 2 years.

USES AND SOURCES: Bromacil is an **herbicide** used for weed control in citrus groves and in noncropland areas. It is one of the most commonly used **pesticides** in western Washington.[31]

See "More About Pesticides".

HARMFUL EFFECTS AND SYMPTOMS: No information was located on the health effects of bromacil in humans. In laboratory animals, bromacil irritates the eyes, skin, and respiratory tract. Bromacil is a possible **carcinogen** and a possible **mutagen.**[99] There is insufficient information to determine a **toxicity** rating for bromacil (D).[5]

Bromacil has low toxicity to fish and wildlife.[138]

EXPOSURE LIMITS:

ADI: .0125 **mg/kg/day.**[99]

AIR: OSHA **TWA** 1 **ppm** (approximately 10 **mg/m^3**).[4]

WATER: Lifetime **Health Advisory** .09 **mg/L** (90 µg/l).[99]

INGESTION: Residue tolerance on citrus fruits .1 **ppm.**

See "More about Exposure Limits."

BROMOFORM CAS 75-25-2; **molecular weight** 252.77:

SYNONYMS: Tribromomethane, Methyl tribromide, Methylene tribromide, Formyl tribromide.

DESCRIPTION: Bromoform is a colorless liquid that turns yellow with gradual decomposition (which is accelerated by sunlight and air). It has an odor like chloroform and a sweetish, chloroform-like taste. It is only slightly soluble in water, where it would be likely to be found in a layer on the bottom. It is nonflammable, but when it is heated to decomposition, highly **toxic** fumes are emitted. Its **half-life** in the troposphere (atmosphere nearest the earth) is 1 to 2 months. There is a tendency for it to accumulate in fatty tissues. **Bioconcentration** occurs in marine life, but the process is reversed within 48 hours.[1]

USES AND SOURCES: Bromoform is used as an intermediate for organic synthesis and pharmaceutical manufacture. It is used as a solvent for wax, grease, oil and fat, as a reagent for geochemical analysis, as an antitussive and for use in gage fluids, as an ingredient in fire resistant chemicals, and as a heavy liquid for use in solid separations based on differences in specific gravity.

See "Tetrachloroethane."

HARMFUL EFFECTS AND SYMPTOMS: Harmful exposure to bromoform may occur through diet, inhalation, and skin contact. Symptoms of harmful exposure by inhalation include irritated eyes, tearing, reddening of the face, saliva flow, dizziness, headache, shock, central nervous system depression, amnesia, liver damage, convulsions, **pulmonary edema**, loss of consciousness, and **cardiovascular** collapse. Abuse may lead to addiction. It is a **mutagen** and a potential **carcinogen.**[1] Bromoform is considered to be of high **toxicity** (3).[5]

EXPOSURE LIMITS:

AIR: OSHA TWA (**skin**) .5 **ppm** (approximately 5 **mg/m**^{3}).[1]

WATER: Due to the potential **carcinogenic** effect of bromoform, its concentration should be zero. If this level is not attainable, levels which raise the human lifetime cancer risk to

one in ten thousand = 1.900 **ppb**;
one in one million = .190 ppb;
one in ten million = .019 ppb.[1]

WA GROUNDWATER CRITERIA: 5 µg/l (ppb).[8]

See "More about Exposure Limits."

BROMOFUME:*see Ethylene dibromide.*

BROM-O-GAS: *see Methyl bromide.*

BROMOMETHANE: *see Methyl bromide.*

5-BROMO-6-METHYL-3-(1-METHYLPROPYL)-2,4(1H,3H)-PYRIMIDINEDIONE: *see Bromacil.*

5-BROMO-3-SEC-BUTYL-6-METHYLURACIL: *see Bromacil.*

BROMOSOL: *see Methyl Bromide.*

BRONCHOPULMONARY (trade name): *see Carbaryl.*

BROWN ASBESTOS: *see Asbestos.*

BROWN OIL: *see Sulfuric acid.*

BROZONE: *see Methyl Bromide.*

BUNT-CURE (trade name): *see Hexachlorobenzene.*

BUNT-NO-MORE (trade name): *see Hexachlorobenzene.*

1,3-BUTADIENE CAS 106-99-0; **molecular weight** 54.09:

DESCRIPTION: 1,3-Butadiene is a colorless, flammable gas that is insoluble in water. Its mild odor is perceptible at 1.3 **ppm.**[28]

USES AND SOURCES: 1,3-Butadiene is used to make butadiene-styrene **copolymer elastomer**, of which more than 60 percent is used for tire manufacture, to make other synthetic rubber products, and other elastomers that end up in food wrappings and latex paint. Since 1971 1.5 million metric tons has been produced annually.[28]

HARMFUL EFFECTS AND SYMPTOMS: 1,3-Butadiene is a probable **carcinogen** (B) and a potential **teratogen**. Some of its breakdown products are **mutagenic**.[28] 1,3-Butadiene is considered to be of high **toxicity**.[5]

1,3-Butadiene is not harmful to aquatic life.[1]

EXPOSURE LIMITS:

AIR: ACGIH TLV-TWA 10 **ppm**.[28]

See "More about Exposure Limits."

BUTANONE: *see Methyl ethyl ketone.*

2-BUTANONE: *see Methyl ethyl ketone.*

BVF (trade name): *see Formaldehyde.*

C-46: *see Hexachlorobutadiene.*

CALCIUM CHROMATE: *see Chromium.*

CADMIUM CAS 7440-43-9; **atomic weight** 112.4; Chemical Symbol: Cd

DESCRIPTION: Cadmium is a moderately flammable, silver, white metal that turns colorless in water and sinks.[1] The **half-life** of cadmium in the body is 2 years.[42] Cadmium is **persistent** in the environment and **bioaccumulates** in aquatic life and the food chain. It is removed from water by soil, in which it accumulates.[1]

USES AND SOURCES: Cadmium is used as a protective coating for iron, steel, copper, and other materials, as a neutron absorber in nuclear reactors, as a stabilizer for polyvinyl chloride plastics, as a deoxidizer in nickel plating, and as an amalgam in dentistry. It is used in soldering aluminum, in the electrodes of alkali storage batteries, in printing, in photography, in laboratories, in chemical production, in process engraving, and in the automobile and aircraft industries. Cadmium is used in the manufacture of fluorescent lamps, semiconductors, photocells, and jewelry.[1] Various cadmium compounds are used in **fungicides**, insecticides, nematocides, **polymerization catalysts**, pigments, paints, and glass.[44] Cadmium is a constituent of gasoline, from .01 to .07 **g/g**.[30] It is a contaminant of superphosphate fertilizers and is a coal-burning by-product. Cadmium is a component of tobacco smoke, in the amount of about 1.7 g/cigarette.[3,7] It is a commonly encountered toxicant found at **hazardous waste** cleanup sites in Washington state.[44]

World production of cadmium in 1982 was 20,000 tons.[141] In 1987 3.3 million pounds of cadmium were produced, 6.6 million pounds imported, and 396,000 pounds exported in the United States.[7] **NIOSH** estimates that 1.5 million workers nationwide are potentially exposed to cadmium annually.

EPA's Rural Water Survey found cadmium to exceed drinking water standards in about 16 percent of wells nationwide, with the highest frequencies occurring in rural wells in the West (27 percent).[95] In an **EPA** assessment, it was estimated that 65 percent of the discharge from large numbers of municipal wastewater treatment plants exceed water quality standards for cadmium. When low stream flows were analyzed, 65 to 84 percent of the plant discharges exceeded water quality standards.[32]

Six million pounds of cadmium is released into the air annually from coal and fossil fuel burning, production, and use.[7]

Cadmium poisoning has resulted from consumption of foods or liquids prepared and left in cadmium-plated containers. Daily intake of cadmium varies from 4 to 60 mg, depending on the food chosen.[1] Rice and wheat are particularly effective in absorbing cadmium from the soil. A Swedish study reports that the cadmium content of Swedish fall wheat has doubled in the last 50 years. Average daily intake in diet is 71.4 g.[141]

In an air monitoring survey, 17 percent of 285 air quality monitoring stations measuring cadmium showed statistically significant increases of concentrations of cadmium from 1970 to 1984 nationwide, while 2 percent showed declines.[34] No significant relationships were found between concentrations of cadmium and its natural occurrence, suggesting the importance of human activities. Atmospheric deposition was probably the a significant source, with fossil fuel combustion being the main contributor.[34] Cadmium concentrations in ambient air in rural areas averages less than 3 **ng/m^3**, in industrial areas around 50 ng/m^3.[7]

HARMFUL EFFECTS AND SYMPTOMS: Harmful routes of **exposure** to cadmium include inhalation, ingestion, and heavy smoking.[1] One to two percent of ingested cadmium is absorbed and 11 percent of inhaled cadmium is absorbed. Cadmium is dangerous in **chronic** as well as **acute** doses. It accumulates in the liver, pancreas, kidney, and **thyroid**. Symptoms of **acute toxicity** by ingestion include headache, abdominal pain, nausea, vomiting, and diarrhea. Symptoms of acute toxicity by inhalation of cadmium fumes or dust produced when cadmium is heated include dry throat, coughing, constriction of the throat, and chest pains.[1] Symptoms may be delayed. Eight to 24 hours following exposure severe pulmonary irritation may develop, with pain in the chest, cough, labored breathing, and generalized weakness. The mortality rate in acute cases is about 15 percent.[44] Other systemic changes due to cadmium absorption include damage to kidneys, forced excretion of calcium and thus weakening of the bones, dental changes, liver damage, and a form of anemia. **Chronic** cadmium poisoning can lead to respiratory damage.[141] It is a probable **carcinogen (B)** by inhalation, a **mutagen**, and a possible **teratogen.**[1]" It is not a carcinogen by the oral route.[42] Cadmium is considered to be of high **toxicity** (3).[5]

EXPOSURE LIMITS:

AIR: WHO 10 **g/m^3** for dust.

WATER: Drinking water limit goal 5 µg/l.[25] WA groundwater criteria .01 **mg/l.**[8]

See "More about Exposure Limits."

CALCIUM MAGNESIUM SALT: *see Asbestos.*

CALIDRIA RG FERROANTHOPHYLLITE: *see Asbestos.*

CALMATHION (trade name): *see Malathion.*

CAMPHENE, CHLORINATED: *see Toxaphene.*

CAPSINE (trade name): *see 4,6-Dinitro-o-cresol.*

CARBAMINE (trade name): *see Carbaryl.*

CARBANOLATE: *see Aldicarb.*

CARBARYL CAS 63-25-2; **molecular weightt** 201.22:

TRADE NAMES: Sevin, Carbamine, Denapon, Dicarbam, Hexavin, Karbaspray, Nac, Ravyon, Septene, Tercyl, Tricarnam, Atoxan.

DESCRIPTION: Carbaryl is a white crystalline odorless substance formulated as dusts, **wettable powders**, and **granules.**[1,4] There is varying evidence in the literature as to the **persistence** of carbaryl as a residue and in water. One source states that its **half life** in water ranges from 1 day to 4 months, and in soil from 7 to 9 days.[1] A study with different results reports that carbaryl did not significantly degrade on trees during a 75 day period following gypsy moth spraying. Carbaryl residues in woodland ponds have been detectable 4 months after spraying for the pest, spruce budworms, and the amphipod population in the ponds had not recovered after more than 3 years. Carbaryl has been detected up to 60 ppb after 2 months in groundwater and **persisted** through the eighth month.

USES AND SOURCES: Carbaryl is a **pesticide** used on forest lands, on rangelands, on bananas, corn, grapefruit, grapes, oranges, peaches, tomatoes, watermelon, cotton, pets, and poultry. It is commonly present in flea collars, dusts, and sprays.[1,] Almost everyone in the United States has come into contact with the chemical itself or products of its degradation. Carbaryl is one of the most common pesticides in western Washington.[31]

In a 1988 search of the U.S. EPA STORET Water Quality File, carbaryl has been found in 58 of 640 analyzed samples (concentrations at **85th percentile** of sample levels 260 µg/l. maximum 180,000 µg/l) from 185 surface water locations, across six states.[99]

See "More About Pesticides".

HARMFUL EFFECTS AND SYMPTOMS: Harmful routes of **exposure** to carbaryl include the skin (73.9 percent absorption rate), inhalation, and by ingestion (94 to 95 percent absorption rate).[99,] Symptoms of **acute** exposure to carbaryl include headache, dizziness, weakness, abdominal cramps, nausea, vomiting, and diarrhea. It **persists** in the human body for 9 hours.[1] Carbaryl may reduce learning ability, and aggravate viral diseases.' In laboratory animals carbaryl causes birth defects, and degrades to cancer-causing chemicals in the atmosphere and body.[28,65,] Laboratory animals show a depressed immune system response. Carbaryl is considered to be of **high toxicity** (3).[5]

Carbaryl is highly toxic to bees. It is harmful to aquatic life in very low concentrations, at .1 **ppm** for algae and 6 **ppb** for Dungeness crab.[1,] Birds are adversely affected by carbaryl.

Exposure Limits:

ADI .096 **mg/kg/day.**[99]

AIR: OSHA PEL 5 **mg/m^3**[4]

WATER: Recommended drinking water limit .1 **ppm.**[1] Lifetime **Health Advisory** .70 **mg/l** (700 **µg/l**).[99]

INGESTION: **Residue tolerances** .1 to 100 **ppm.**[99]

See "More about Exposure Limits."

CARBETHOXY MALATHION (trade name): *see Malathion.*

CARBETOX (trade name): *see Malathion.*

CARBOFOS (trade name): *see Malathion.*

CARBOPHOS (trade name): *see Malathion.*

CARBOFURAN CAS 1563-66-2; **molecular weight** 221.26:

SYNONYMS: 2,3-Dihydro-2,2-dimethyl-7-benzofuranyl **ester** of methyl-carbamic acid; 2,3-Dihydro-2,2-dimethyl-7-benzofuranol methyl**carbamate**; NIA 10242; Niagaral 242; ENT 27164; 2,2-dimethyl-7-coumaranyl n-methylcarbamate; Methylcarbamate.

TRADE NAMES: Furadan, Curaterr, Yaltox, Niagara 10242, OMS 864, BAY 70143.

DESCRIPTION: Carbofuran consists of white crystals that sink and are only slightly soluble in water. It can be formulated as **granular, wettable powders**, or flowable concentrates.[1,28] There is no **bioaccumulation.** Its soil **half-life** ranges from 46 to 177 days. Its **persistence** is decreased by high soil water content, high **pH**, and heavy soil texture.[1]

USES AND SOURCES: Carbofuran is an insecticide.[1]

HARMFUL EFFECTS AND SYMPTOMS: Carbofuran may be **toxic** by inhalation, ingestion, and skin contact. Symptoms of **exposure** may include headache, dizziness, weakness, anxiety, tremors of the tongue and eyelids, and blurring of vision. Prolonged contact may cause salivation, tearing, sweating, muscle twitching, stomach cramps, vomiting, **cyanosis**, convulsions, and death from respiratory difficulties. Carbofuran is not **mutagenic**, but it is a suspected **carcinogen.**[1] Skin contact toxicity data is not adequate.[13] Carbofuran is considered to be of high **toxicity** (3).[5]

Carbofuran is harmful in very low concentrations to earthworms, bees, and birds as long as 2 months after application.[1,]

EXPOSURE LIMITS:

AIR: OSHA TWA .1 **mg/m^3**.[4]

INGESTION: ADI .005 **mg/kg/day.**[13]

WATER: Drinking water exposure limit 5 **ppb.**[13]

See "More about Exposure Limits."

CARBOLIC ACID: *see Phenol.*

CARBON BICHLORIDE: *see Tetrachloroethylene.*

CARBON BISULFIDE: *see Carbon disulfide.*

CARBON CHLORIDE: *see Carbon tetrachloride.*

CARBON DICHLORIDE: *see Tetrachloroethylene.*

CARBON DIOXIDE CAS 124-38-9; **molecular weight** 44.01:

SYNONYMS: Carbonic acid gas, dry ice.

USES AND SOURCES: Carbon dioxide is used to carbonate beverages, as a propellant in aerosols, and as a refrigerant. It is used in water treatment, in making pharmaceuticals, in food preservation. Carbon dioxide is a by-product of burning fossil fuels and wood products.[3] It is found at illegal drug laboratory sites, where the drug phenyl-2-propanone has been processed.[2] Carbon dioxide is a component of cigarette smoke.[3]

Carbon dioxide atmospheric concentrations worldwide are increasing at about .5 percent annually.

HARMFUL EFFECTS AND SYMPTOMS: Routes of harmful **exposure** to carbon dioxide include inhalation and skin contact. Symptoms of harmful exposure include frostbite, dizziness, restlessness, sweating, weakness, headache, shortness of breath (at 5 percent concentration), elevated blood pressure, increased heart rate, convulsions, and loss of consciousness (at 10 percent concentration).[1] Carbon dioxide is considered to be of low **toxicity** (1).[5]

Although a matter of debate regarding causes and effects, carbon dioxide is estimated to contribute significantly to the possibility of the "greenhouse effect." The "greenhouse effect" is the idea that human activities (in addition to natural occurences such as the rotting of vegetable matter and animal digestive gases), particularly those involved with nitrogen oxide, methane, carbon dioxide, and chlorofluorocarbons (CFCs), might raise atmospheric temperatures beyond their natural limits. This increase could melt polar ice sheets, raise sea levels, and cause shifts in agricultural production among different regions.

See "CFCs", "nitrogen oxide", and "methane".

EXPOSURE LIMITS:

AIR: OSHA TWA 10,000 **ppm** (approximately 18,000 **mg/m^3**).[4]

See "More About Exposure Limits."

CARBON MONOXIDE CAS 630-08-0; **molecular weight** 28.01:

DESCRIPTION: Carbon monoxide is a flammable odorless colorless gas that evaporates quickly from water. There is no bioaccumulation.[1]

USES AND SOURCES: Carbon monoxide is used in nonferrous metallurgy, plastics manufacture, and chemical products.[1] It forms when fossil fuels, principally gasoline and diesel fuel, burn incompletely. Stationary sources of carbon monoxide emission include wood stoves, iron foundries, petroleum refineries, kraft paper mills, operations in carbon black plants, basic oxygen furnaces, and formaldehyde manufacture.[64]

In 1975 100 million metric tons of carbon monoxide emissions were emitted nationally, dropping to 86 million metric tons by 1984. People who have higher **exposures** include commuters, professional drivers, automobile mechanics, garage workers, and policemen.[64]

Based on readings from 157 sites, the **EPA** reports that the national composite average for carbon monoxide air concentrations decreased by 34 percent between 1975 and 1984. The number of times the ambient standard had been exceeded dropped 88 percent.[64]

See "formaldehyde."

HARMFUL EFFECTS AND SYMPTOMS: Symptoms of harmful **exposure** to carbon monoxide include initial paleness with flushing later, severe headache, nausea, vomiting, verigo, weakness, mental symptoms, confusion, loss of consciousness, and death. Exposures of 600 to 700 **ppm** for an hour may result in small effects. Exposures of 1000 to 1200 **ppm** is dangerous, and exposures of 4000 **ppm** may be fatal. Effects of **chronic exposure** may include auditory disturbances, tunnel vision, glucose in the blood, and heart disturbances.[1] Carbon monoxide is considered to be of high **toxicity** (3).[5]

Carbon monoxide is harmful to aquatic life in very low concentrations.[1]

EXPOSURE LIMITS:

AIR: OSHA TWA 35 **ppm** (approximately 40 **mg/m^3**).[4] Permissible ambient level 8 hr average 9 **ppm.**[64]

See "More About Exposure Limits."

CARBON TET: *see Carbon tetrachloride.*

CARBON TETRACHLORIDE CAS 56-23-5; **molecular weight** 153.84:

SYNONYMS: Tetrachloromethane, Methane tetrachloride, Perchloromethane, Carbon chloride, Carbona, Carbon tet, Tetrachlorocarbon, CCL ENT 4705.

TRADE NAMES: Necatorina, Nectorine, Benzinoform, Halon 104, Fasciolin, Flukoids, Freon 10, Tetrafinol, Tetraform, Tetrasol, Univerm, Vermoestricid.

DESCRIPTION: Carbon tetrachloride is a nonflammable colorless liquid. The liquid will sink in water to the bottom where it can remain indefinitely. It is very **persistent** in water, where it is unlikely to biodegrade. It evaporates very rapidly, with a **half-life** in well-aerated water of 30 minutes. The vapors tend to collect at the water surface. Its sweet, pungent odor similar to chloroform is perceptible at a range of 10 to 250 **ppm**. It moves readily through the soil into the groundwater. There is no evidence of **bioaccumulation**.[1]

USES AND SOURCES: Carbon tetrachloride is used as an industrial degreaser, as a process solvent, and as a dry-cleaning agent. It is used in the production of chlorofluorocarbons, which are used as refrigerants and **blowing agents**. It is used in fire extinguishers. It is used as a reaction medium and **polymer** intermediate in the manufacture of **organic** chemicals. Carbon tetrachloride is used in veterinary medicine, in printing, in photography, in paper production, in paint shops, in factories, in body shops, and in laboratories. Carbon tetrachloride is used as a formulation ingredient in grain **fumigants**.[1] It was banned as a grain fumigant in 1985, but it is still being used as an **inert ingredient** in other **pesticides**.[7,177] It is awaiting regulation on that basis.[177] Carbon tetrachloride is found at illegal drug laboratory **hazardous waste** sites, where the drug phenyl-2-propanone has been processed.[2]

OSHA estimates that nationwide 3.4 million workers are potentially **exposed** to carbon tetrachloride annually.[7]

In 1986 625 million pounds were produced in the United States. 5 million pounds per year are given off as emissions during manufacture and processing, and 60 million pounds per year escape as solvent emissions.[7]

Public exposure to carbon tetrachloride is widespread. Nineteen million people are exposed through ambient air, 20 million through contaminated drinking water, and 2 million through contaminated soil or landfills. Higher levels of **exposure**, averaging concentrations of .5 **g/m**^{3}, with peaks of 1580 g/m^3, are found for the 8 million people who live within 12.5 miles of manufacturing sites. In a survey, 10 percent of 113 surveyed public water systems, 45 percent of surface water supplies and 25 percent of groundwater supplies, contained this chemical in concentrations of .001 to .4 **mg/l**.[7]

Hexachlorobutadiene is a by-product in the manufacture of carbon tetrachloride.[1]

See "CFCs" and "Hexachlorobutadiene." See "More About Pesticides".

HARMFUL EFFECTS AND SYMPTOMS: Routes of harmful **exposure** to carbon tetrachloride include inhalation, ingestion, and skin contact.[1] Symptoms of overexposure include malaise, headache (at 600 **ppm** for 10 minutes), confusion, dizziness, blurred vision, skin irritation, loss of appetite, gastro-intestinal upset (45 to 97 **ppm** per day), nausea, diarrhea, **cyanosis**, central nervous system depression, anemia, jaundice (which can show up in about 4 days after a non-fatal exposure), **pulmonary edema**, loss of consciousness, and fatal **cardiac arrhythmias**. Liver and kidney damage may follow **acute** poisoning (26 to 54 **ppm** per 8 hours). It is a possible **carcinogen**, a potential **teratogen**, but not a **mutagen**.[1,25] Carbon tetrachloride is considered to be of high **toxicity** (3).[5]

The effect of carbon tetrachloride on aquatic life in low concentrations is unknown.[1]

Carbon tetrachloride in the atmosphere eventually diffuses into the stratosphere where it photodissociates to chlorine atoms and catalyzes destruction of the ozone layer.[1]

See "Ozone."

EXPOSURE LIMITS:

AIR: OSHA TWA 2 **ppm** (approximately 12.6 **mg/m**^{3}).[4]

WATER: WA groundwater criteria .3 µg/l.[8] Due to the potential **carcinogenic** effect of carbon tetrachloride, its concentration should be zero. If this level is not attainable, levels which raise the human lifetime cancer risk to

one in ten thousand = 4.00 **ppb**;
one in one million = .40 ppb;
one in ten million = .04 ppb.[1]

See "More About Exposure Limits."

CARBONA: *see Carbon tetrachloride.*

CARBONIC ACID GAS: *see Carbon dioxide.*

CASSIAR AK: *see Asbestos.*

CAUSTIC SODA: *see Sodium hydroxide.*

CCL ENT 4705: *see Carbon tetrachloride.*

CECOLENE (trade name): *see Trichloroethylene.*

CELFUME: *see Methyl bromide.*

CELLON: *see Tetrachloroethane.*

CELLUFLEX DPB (trade name): *see N-butyl phthalate.*

CELLUFLEX DOP (trade name): *see Dioctyl phthalate.*

CFCs: *see Dichlorodifluoromethane and Fluorotrichloromethane.*

CHAMBER ACID: *see Sulfuric acid.*

CHEMATHION (trade name): *see Malathion.*

CHIPTOX (trade name): *see MCPA.*

CHLOPHEN (trade name): *see PCBs.*

CHLORDANE CAS 57-74-9; **molecular weight** 409.80:

SYNONYMS: Toxichlor; Octra-Klor; 1068.

TRADE NAMES: Ortho-Klor(Chevron), Velsicol-1068(Velsicol), Dow-Klor(Dow), Belt, CD68, Chlordan, Gamma Chlordan, Chlorindan,Chlor Kil, Chlorodane, Corodant, ENT 9932, ENT 25552-X, Kypchlor, M140, M410, Corodane, Dowchlor, HCS3260, Niran, Oktaterr, Topichlor, Topichlor 20, Kipchlor, Topiclor, Octaclor, SD5532, Synklor, Tat Chlor 4.

and

HEPTACHLOR CAS 76-44-8; **molecular weight** 373.35:

TRADE NAMES: Velsicol-104, Heptamul, E3314, Heptagran, Drinox, ENT 15152, H, H-34, Rhodiachlor, AAHEPTA, Agroceres, GPKH, NCI-COO180.

DESCRIPTION: Chlordane is a colorless to amber, viscous liquid, which comes in oil emulsions, **emulsifiable concentrates**, **granular** or **wettable powders**, dusts, or dispersible liquids. It will sink to the bottom in bodies of water unless it is in the form of a wettable powder or it is combined with an **emulsifier**. In river water and soil, chlordane concentration has been known to drop to 85 percent within 2 weeks and remain at this level through 8 weeks. Fifty-five percent may remain after 1 year, and 15 percent after 3 years. In some reports, 15 percent of the original concentration has **persisted** for 15 to 21 years. Chlordane will be held by soils of **organic** content, but sand will pass it through to the water table.[1] Chlordane has been detected in the indoor air of homes up to 15 years after treatment, in concentrations of.8 to 610,000 **ng/m^3**. It remains in the body for months or even years.

Missing **environmental fate** studies for chlordane include **photolysis** in water and dissipation in air.[180]

Heptachlor is a waxy solid or white crystalline solid formulated as dusts, **granules**, or **emulsifiable concentrates** that will sink in bodies of water. Its camphor-like odor is perceptible at .02 **ppm**. The **half life** of heptachlor in soil is reported in wide variance: from 7 to 12 years, 9 to 10 months at agricultural rates of application, and less than 42 days. It is relatively **immobile** in soils, but may be found in surface waters. Heptachlor is **persistent** in river water for about two weeks. It evaporates from water and sorbs to sediments, but is not subject to chemical decomposition in water.[1] Human fat residues of heptachlor epoxide, a **metabolic** product of heptachlor, are roughly the same magnitude as levels in rats following feeding, with the lowest level tested and found to be **carcinogenic**, at .5 **ppm**.

Residues of heptachlor and chlordane degradation products are found in virtually all body fat samples, from levels of .1 to 10 **ppm** for heptachlor and .2 **ppm** to 2 **ppm** for chlordane. Both chemicals are **bioaccumulative** and there is high **food chain contamination** potential.[1]

USES AND SOURCES: Chlordane and heptachlor are **pesticides** that have been used to protect houses from termites and to protect corn and other crops from insects. After 1983 registration of chlordane was cancelled, but any chlordane that had already been bought or was still on the store shelves could be used above the ground until April 1988. By the fall of 1987, chlordane could only be used outside buildings to kill termites.[180] Heptachlor was banned completely in April 1988.[177] Chlordane has been found in at least 46 of 1177 **hazardous waste** sites on the National Priorities List.[180] It has been used in more than 30 million homes, possibly **exposing** about 52 million people.[180]

In 1986 3.5 to 4 million pounds of chlordane were distributed.[180]

In a survey by the United States Geological Survey, chlordane was found in 8 to 10 percent of samples taken at a network of 160 to 180 **pesticide** monitoring network stations analyzing water and sediment samples for some pesticides.[23] The frequency of its detection gradually decreased from 1975 to 1980.[23]

People especially at risk are children with high milk consumption, those who eat a lot of fish and shellfish, particularly freshwater, people living downwind from treated fields, and people living in houses treated with chlordane **pesticide** control agents.[180] Concentrations in indoor air in treated houses may range from .06 to 3300 **ppt**. Concentrations in treated basements and crawlspaces may amount to 36,400 ppt.[180] Average intake in 1981-82 for infants was .002 **g/kg** body weight/day.[180]

See "More About Pesticides".

HARMFUL EFFECTS AND SYMPTOMS: Routes of harmful **exposure** for both chemicals include diet, inhalation, and skin contact.[1] The National Academy of Science states that the Committee determining safe levels of exposure to chlordane and heptachlor concluded that it could not determine a level of exposure to these chemicals below which there would be biological effects. Symptoms of **acute** exposure to either chemical include dry, red skin, blurred vision, confusion, delerium, loss of sense of smell, nervousness, irritability, coughing, stomach pain, nausea, vomiting, diarrhea, loss of coordination, tremors, convulsions, **anuria,** and loss of consciousness.[6] Both chemicals are considered to be of high **toxicity** (3).[5]

Heptachlor has been found in human milk, fetal blood, and placenta.[6]

Chlordane has been shown to be **neurotoxic** in humans as well as animals.

Both chemicals are probable **carcinogens** (B), and possible **mutagens** and **teratogens.**[75,] They accumulate in fatty tissue.[1]

There are no human or animal studies concerning **genotoxicity** by any route. No human or animal studies exist of levels of **exposure** resulting in death by inhalation, **immune system toxicity, developmental** and **reproductive** toxicity, or **carcinogenicity** by inhalation or skin exposure. No human studies exist concerning **intermediate systemic** toxicity by oral and skin exposure, or immune system, developmental, and reproductive toxicity, or carcinogenicity by oral exposure. No animal studies exist concerning **acute** or **chronic systemic** toxicity or **neurologic** toxicity by inhalation or skin exposure.[180]

Both chemicals are harmful to aquatic life in very low concentrations.[1]

EXPOSURE LIMITS:

For chlordane:

AIR: **OSHA TWA .5 mg/m^3**.[4] NRC recommendation for indoor air for military housing **5 g/m^3 (.0003 ppm)**.[180]

WATER: WA groundwater criteria .06 **µg/l.**[8] Due to the potential **carcinogenic** effect of chlordane, its concentration should be zero. If this level is not attainable, levels which raise the human lifetime cancer risk to

one in ten thousand = 4.800 **ppt**;
one in one million = .480 ppt;
one in ten million = .048 ppt.[1]

INGESTION: **Tolerance** level .3 **ppm.**[1]

For heptachlor:

ADI: .5 **g/kg/day.**[25]

AIR: **OSHA TWA** .5 **mg/m^3**.[4]

WATER: WA groundwater criteria .02 **µg/l.**[8] **Chronic** aquatic **toxicity** limit .0038 **ppb.** Due to the potential **carcinogenic** effect of heptachlor, its concentration should be zero. If this level is not attainable, levels which raise the human lifetime cancer risk to

one in ten thousand = 2.780 **ppt**;
one in one million = .280 ppt;
one in ten million = .028 ppt.[1]

See "More About Exposure Limits".

CHLORENTOL (trade name): *see PCBs.*

CHLOREX *see Dichloroethyl ether.*

CHLOREXTOL (trade name): *see PCBs.*

CHLORILEN (trade name): *see Trichloroethylene.*

CHLORINATED CAMPHENE *see Toxaphene.*

CHLORINE CAS 7782-50-5; **atomic weight** 17; Chemical Symbol: Cl

DESCRIPTION: Chlorine is a nonflammable yellow-green, very reactive gas that clings to the ground and floats on water. It is **persistent** in the water for only a few days.[1] Its pungent, bleach-like irritating odor is perceptible at a range of .2 to .4 **ppm**.[28] There is no **food chain contamination**. Chlorine is highly corrosive in the presence of moisture.[1]

USES AND SOURCES: Chlorine is used in the treatment of water and sewage, in disinfecting and bleaching all kinds of fabric, in producing **organic** chemicals, pulp and paper, and in making insecticides.[1] It is a constituent of gasoline, from 80 to 300 **g/g**.[30] Fifteen thousand metric tons of chloroform are emitted into the air annually by treating water with chlorine at water treatment plants and pulp and paper mills. Industrial uses of chlorine which allows it to interact with phenol may produce dioxin as a side reaction.[6] Hexachlorobutadiene is a by-product in the manufacture of chlorine.[1]

See "Gasoline", "Chloroform", "Phenol", "Dioxin", and "Hexachlorobutadiene."

HARMFUL EFFECTS AND SYMPTOMS: Routes of harmful **exposure** to chlorine include inhalation and skin contact. Symptoms may include burning of the eyes, nose, and mouth, skin problems, tearing of the eyes, inflammation of the nasal mucous membranes, coughing (30 **ppm**), choking, headache, dizziness, nausea, vomiting, abdominal pain, **pulmonary edema**, fainting, **hypoxemia**, pneumonia, and death as a result of suffocation.[1] Chlorine is considered to be of high **toxicity** (3).[5]

Chlorine is harmful to aquatic life in very low concentrations.[1]

EXPOSURE LIMITS:

AIR: OSHA TWA .5 **ppm** (approximately 1.5 **mg/m^3**).[28]

WATER: EPA MCL 250 **mg/l**.[42]

See "More About Exposure Limits".

CHLOROBEN (trade name): *see 1,4-Dichlorobenzene.*

CHLOROBENZENE CAS 108-90-7; **molecular weight** 112.56:

SYNONYMS: Monochlorobenzene, Chlorobenzol, Phenyl chloride, Benzene chloride.

DESCRIPTION: Chlorobenzene is a colorless, very flammable, watery liquid that sinks in water. It is very **persistent**, and may remain on the bottom of water courses for long periods of time.[1] Its faint almond-like odor is perceptible at .21 **ppm**. Chlorobenzene is **biocccumulative**.[8]

USES AND SOURCES: Chlorobenzene is used as a solvent for **pesticide** formulations, in chemical manufacture, and for degreasing autobile parts.

In 1987 112,000 metric tons of chlorobenzene were produced. Production is expected to decline from this volume.[186]

HARMFUL EFFECTS AND SYMPTOMS: Routes of harmful exposure to chlorobenzene include inhalation, skin contact, and ingestion.[1] The major exposure route is through water.[6] Symptoms may include irritated skin, eyes, nose, and mucous membranes, drowsiness, confusion, twitching, rapid respiration, **cyanosis**, red urine, liver, lung and kidney damage (in laboratory animals, repeated exposures at 1000 **ppm**), central nervous system depression, and cardiac irregularities.[1,28] Chlorobenzene is considered to be of moderate **toxicity** (2).[5]

Chlorobenzene is harmful to aquatic life in very low concentrations.[1]

EXPOSURE LIMITS:

AIR: OSHA PEL 75 ppm (approximately 350 mg/m^3).[4]

INGESTION: ADI 1.008 mg/day.[25]

See "More About Exposure Limits".

CHLOROBENZOL: *see Chlorobenzene.*

1-CHLORO-2-(BETA-CHLOROETHOXY)ETHANE): *see Dichloroethyl ether.*

2-CHLORO-4,6-BIS(ETHYLAMINO)-S-TRIAZINE: *see Simazine.*

CHLORODIBROMOMETHANE: *see Dibromochloromethane.*

1-CHLORO-2,2-DICHLOROETHYLENE: *see Trichloroethylene.*

CHOLORDIPHENYL: *see PCBs.*

CHLOROETHENE: *see Vinyl chloride.*

2-CHLORO-4-ETHYLAMINO-6-ISOPROPYLAMINO-S-TRIAZINE: *see Atrazine.*

CHLOROETHYLENE: *see Vinyl chloride.*

CHLOROFLUOROCARBONS: *see Dichlorodifluoromethane and Fluorotrichloromethane.*

CHLOROFORM CAS 67-66-3; **molecular weight** 119.38:

SYNONYMS: Trichloromethane, Formyl trichloride, Methane trichloride, Methenyl trichloride, Methyl trichloride, NCI-CO2686, Trichloroform.

TRADE NAMES: Freon 20, R20.

DESCRIPTION: Chloroform is a colorless, slightly flammable, watery liquid that sinks in water. Its pleasant, sweet odor is perceptible at .3 **mg/m**^{3}.[28] Chloroform can remain on the bottom of water courses for extended periods of time, as it does not degrade easily. Its **half-life** in water in the dark is 18 months and in the light is 15 months. Evaporation is the main route of its removal from water. Its atmospheric lifetime is about 2 to 3 months. It is potentially **bioaccumulative.** Average concentrations of chloroform in human tissue is 1 to 68 **g/kg** wet tissue.[1]

USES AND SOURCES: Chloroform is a chemical used in metal manufacturing, in printing, in laboratories, in paint shops, in factories, in body shops, and in the synthesis of chlorodifluoromethane. It is used as an intermediate in the production of cosmetics, dyes, insecticidal grain **fumigants**, refrigerants, plastics, and pharmaceuticals. Chloroform is used as an industrial degreaser, as a process solvent, and as an anesthetic.[1] It is found at illegal drug laboratory **hazardous waste** sites, where cocaine, hash oil, heroin, LSD, mescaline, methadone, and morphine have been processed.[2] It is widely distributed in the environment, primarily as a result of chlorination.

In 1986 422 million pounds of chloroform were produced nationwide. In 1985, 33.4 million pounds were imported.[7]

Fifteen thousand metric tons of chloroform are emitted into the air annually by treating water with chlorine at water treatment plants and pulp and paper mills.[185] Average concentrations of chloroform in outdoor air range from .02 to 13 **g/m**^{3}, and in indoor air from .07 to 3.6 g/m^3. Average concentrations in municipal drinking water range from less than .3 to 311 **ppb**. Average concentrations in food range from .4 to 180 **g/kg.**[187]

See "Chlorine."

HARMFUL EFFECTS AND SYMPTOMS: Routes of harmful **exposure** to chloroform include ingestion, inhalation, and skin contact.[1] Symptoms of harmful exposure include eye and skin irritation, dizziness, mental dullness, dilation of pupils, a warm feeling, headache, anesthesia, fatigue, memory loss, tremors, slowing respiration, nausea, and central nervous system depression. **Chronic exposure** may be accompanied by these symptoms as well as weakness, blurred vision, loss of appetite, anemia, liver and kidney damage. Severe exposure can result in paralysis and eventual death by cardiac and respiratory failure. Concentrations of 500 **ppm** produces symptoms of illness, and 2000 **ppm** produces severe toxic effects.[1,6] Chloroform is **embryotoxic.**[28] It is a probable **carcinogen** (B), and a possible **mutagen** and **teratogen.**[1,6] Chloroform is considered to be of high **toxicity** (3).[5]

The effect of low concentrations of chloroform on aquatic life is unknown.[1]

EXPOSURE LIMITS:

AIR: OSHA PEL 2 **ppm** (approximately 9.78 **mg/m^3**).[4]

WATER: Recommended drinking water level 22 ppm.[1] WA groundwater criteria 7 µg/l.[8]

See "More About Exposure Limits."

CHLOROMETHANE: *see Methyl chloride.*

4-CHLORO-2-METHYLPHENOXY)ACETIC ACID: *see MCPA.*

6-CHLORO-N-ETHYL-N-(1-METHYLETHYL)-1,3,5-TRIAZINE-2,4-DIAMINE: *see Atrazine.*

[(4-CHLORO-O-TOLYL)OXY] ACETIC ACID: *see MCPA.*

CLORPYRIFOS CAS 2921-88-2; **molecular weight** 350.57:

TRADE NAMES: Dursban, Lorsban, Killmaster, ENT 27311.

DESCRIPTION: Chlorpyrifos is a colorless crystalline compound that is fairly insoluble in water.[1] It has a mild odor. Its **half life** in soil is about 279 days. Chlorpyrifos is fairly **immobile** in soils. Chlorpyrifos can be taken up by plants such as carrots and radishes for a year after application.

USES AND SOURCES: Chlorpyrifos is an **organophosphate pesticide** used as a crack and crevice insecticide. It is used to control parasites on cattle, sheep, and poultry. It is used on vegetables, cereals, tobacco, cotton, and rice.[188] Chlorpyrifos is one of the most commonly used pesticides in western Washington.[31]

Seven to eleven million pounds of chlorpyrifos are used annually in the United States. Fifty-seven percent of its use occurs in corn, and 6 percent in cotton, Twenty-two percent of its use occurs in commercial pest control, and lawn and garden services. Thirteen percent of its use occurs in domestic household, and lawn and garden use. Miscellaneous uses constitute its remaining distribution.[189]

See "More About Pesticides".

HARMFUL EFFECTS AND SYMPTOMS: Routes of harmful **exposure** to chlorpyrifos include ingestion, inhalation, and skin contact.[1] Symptoms of **acute** exposure to chlorpyrifos include irritated eyes and skin, salivation, vertigo, confusion, drowsiness, giddiness, headache, vision disturbances, muscle twitching, stomach cramps, nausea, loss of coordination, convulsions, loss of consciousness, and respiratory arrest. Small doses at frequent intervals are largely additive.[1,190] It is a possible **fetotoxin.** There are **data gaps** concerning its **chronic effects**, tumor production, and **mutagenic** effects.[13] Chlorpyrifos is considered to be of high **toxicity** (3).[5]

Chlorpyrifos is extremely toxic to fish, birds, and bees.[1]

EXPOSURE LIMITS:

AIR: OSHA TWA .2 mg/m^3 (skin).[4]

INGESTION: ADI .003 mg/kg/day.[13]

See "More About Exposure Limits".

CHLORTHEPIN (trade name): *see Endosulfan.*

CHLORYLEA (trade name): *see Trichloroethylene.*

CHLORYLEN (trade name): *see Trichloroethylene.*

CHORYLEN (trade name): *see Trichloroethylene.*

CHROMIC ANHYDRIDE: *see Chromium.*

CHROMIC ACID: *see Chromium.*

CHROMIC OXIDE (CrO_3): *see Chromium.*

CHROMIC CHLORIDE ($CrCl_3$): *see Chromium.*

CHROMIC COMPOUNDS (Cr_{3+}): *see Chromium.*

CHROMIC POTASSIUM SULFATE ($KCr[SO_4]_2$): *see Chromium.*

CHROMIC SULFATE ($Cr_2[SO_4]_3$): *see Chromium.*

CHROMITE ORE ($FeOCr_2O_3$): *see Chromium.*

CHROMIUM CAS 7440-47-3; **atomic weight** 51.996; Chemical Symbol: Cr

RELATED COMPOUNDS: Chromous compounds (Cr_{2+}): chromous chloride ($CrCl_2$), chromous sulfate ($CrSO_4$).

Chromic compounds (Cr_{3+}): chromic oxide (CrO_3), chromic sulfate($Cr_2[SO_4]_3$), chromic chloride ($CrCl_3$), chromic potassium sulfate ($KCr[SO_4]_2$), chromite ore ($FeOCr_2O_3$).

Hexavalent chromium compounds (Cr_{6+}): chromium trioxide (CrO_3), the anydride of chromic acid chromates (e.g., $NaCrO_4$), dichromates (e.g., $Na_2Cr_2O_7$), polychromates.

Water soluble hexavalent chromium compounds: chromic acid, chromic anhydride, monochromates and dichromates of sodium, potassium, ammonium, lithium, cesium, and rubidium.

Water insoluble hexavalent chromium compounds: zinc chromate, calcium chromate, lead chromate, barium chromate, strontium chromate, sintered chromium trioxide.

DESCRIPTION: Chromium is a steel-gray lustrous metal.[28] Chromic oxides are bright green extremely hard crystals that are insoluble in water. Chromium acetate is a grey-green powder or a bluish-green pasty mass that is soluble in water. Chromium trioxides are odorless dark purplish to red rhombus crystals.[7] There is **bioconcentration** and **food chain contamination.**[1]

USES AND SOURCES: Chromium compounds are used in chrome plating, photography, electric batteries, etching, hospitals, copper stripping, aluminum anodizing, refractories, **organic** synthesis, printing, vehicle maintenance and equipment repair, chemical production, wood preservation, paint removal and paint preparation, and laboratories. They are used as **catalysts.**[1] Thirty-nine percent of all chromium produced in the United States is used for chromium trioxide metal plating and treatment, 44 percent for wood treatment and preservatives, and 11 percent is exported. Six percent goes to miscellaneous used.[7] Hexavalent chromium is a commonly encountered toxicant at **hazardous waste** cleanup sites in Washington state.[44] Chromium trioxide is found at illegal drug laboratory hazardous waste sites, where the drug phenmetrazine has been processed.[2]

In 1987 200 million pounds of chromium were produced, 640 million pounds imported, and 6 million pounds exported. **NIOSH** estimates that nationwide 2.5 million workers are potentially **exposed** to chromium compounds annually.[42]

Sixty-four percent of chromium emissions come from coal.[7]

Chromium concentration averages in rural air are less than .01 **g/m^3**. In urban air averages range from .01 to .03 **g/m^3**.[7] **EPA**'s Rural Water Survey found chromium to exceed drinking water standards in less than 1 percent of wells nationwide.[95] Tapwater concentrations of chromium range from .4 to .8 **mg/l**, and river/lake water from 1 to 10 **mg/l**.[7] In an EPA assessment, it was estimated that 4 to 10 percent of the discharge from large numbers of municipal wastewater treatment plants exceed water quality standards for chromium.[32] The average adult intake of chromium is .12 **mg**, 13 percent of that figure from drinking water and the rest primarily from food.[42]

See "More About Pesticides".

HARMFUL EFFECTS AND SYMPTOMS: Chromium compounds may be **toxic** by ingestion, inhalation, and skin contact.[1] Chromium compounds are irritating, corrosive to the skin and the mucous membranes, and they cause acne, bad burns, lesions, and ulcers. Chromium trioxide causes these symptoms at concentrations of .06 **mg/m^3**.[1,28] Hexavalent chromium compounds are the most toxic of chromium compounds. They have been reported to cause kidney damage in workers where absorption through damaged skin has occurred. There is an increased incidence of lung cancer among workers in the chromate-producing industry and possibly also among chromium platers and chromium alloy workers. Other symptoms include perforation of the nasal septum and skin ulceration. Workers with these symptoms were **exposed** to .01 to .15 **mg/m^3** of water soluble chromium, and .1 to .58 mg/m^3 of water insoluble chromium.[28] Chromium compounds are **mutagenic**.[42] Hexavalent chromium compounds are **carcinogens (A)**. Barium chromate, calcium chromate, chromium trioxide, lead chromate, sodium dichromate, and strontium chromate are probable carcinogens **(B)**.[7] Chromium and chromium compounds are considered to be of high **toxicity** (3).[5]

Chromium compounds are harmful to aquatic life in very low concentrations.[1]

EXPOSURE LIMITS:

AIR: OSHA TWA Chromium metal 1 **mg/m^3**. OSHA TWA Chromous compounds .5 **mg/m^3**. OSHA TWA Chromic compounds .5 **mg/m^3**.[4] **ACGIH TLV-TWA** hexavalent chromium compounds .05 **mg/m^3**.[28]

WATER: Recommended drinking water limit .05 **ppm**. WA groundwater criteria .05 **mg/l**.[8]

See "More About Exposure Limits".

CHROMIUM ANHYDRIDE (e.g., $NaCrO_4$): *see Chromium.*

CHROMIUM TRIOXIDE (CrO_3): *see Chromium.*

CHROMOUS CHLORIDE ($CrCl_2$): *see Chromium.*

CHROMOUS COMPOUNDS (Cr_{2+}): *see Chromium.*

CHROMOUS SULFATE ($CrSO_4$): *see Chromium.*

CHRYSENE : *see PAHs.*

CHRYSOTILE: *see Asbestos.*

CINNEMENE: *see Styrene.*

CIRCOSOLV (trade name): *see Trichloroethylene.*

CIS-DICHLOROPROPENE: *see Dichloropropene.*

CIS-1,3-DICHLOROPROPENE: *see Dichloropropene.*

CIS-1,3-DICHLORO-1-PROPENE: *see Dichloropropene.*

1,3-CIS-DICHLORO-PROPYLENE: *see Dichloropropene.*

CLOPHEN (trade name): *see PCBs.*

CLOREX: *see Dichloroethyl ether.*

CLOROBEN (trade name): *see 1,4-Dichlorobenzene.*

COAL OIL: *see Kerosene.*

COAL TAR NAPHTHA: *see Benzene.*

COLPHEN (trade name): *see PCBs.*

COMPOUND-3956: *see Toxaphene.*

COMPOUND 4049 (trade name): *see Malathion.*

CO-OP HEXA (trade name): *see Hexachlorobenzene.*

COPPER SULPHATE CAS 7758-98-7;

TRADE NAMES: Bluestone, Blue vitriol, Komeen, Koplex, Blue copperas, Triangle.

DESCRIPTION: Copper sulphate are blue (white if anhydrous, that is, "without water"—not the common form) crystals that dissolve in water. Copper accumulates in soils, and concentrates in marine and fresh water organisms. There is high **food chain contamination** potential.[1]

USES AND SOURCES: Copper sulphate is used as a preventive foilage **fungicide**, in anti-fouling paint for ships, and in tile drains and sewer pipes.[39] It is found at illegal drug laboratory **hazardous waste** sites, where methamphetamine has been processed.[2]

In 1982, 8,295,000 pounds were used. Thirty-six percent of its use occurs on oranges and 26 percent on tomatoes. The rest goes to the uses listed above.[13]

See "More About Pesticides".

HARMFUL EFFECTS AND SYMPTOMS: Copper sulphate is corrosive to the eyes, mucous membranes, skin, and gastro-intestinal tract. Symptoms of ingestion include dizziness, cramps, gastric pain, nausea, vomiting, convulsions, shock, loss of consciousness, and death. It is a **chronic** poison.[1,39] Copper sulphate is considered to be of high **toxicity** (3).[5]

Copper sulphate is harmful to aquatic life in very low concentrations.[1,39]

EXPOSURE LIMITS:

WATER: DWEL .001 ppm.[1]

INGESTION: **Tolerance** allowance 3 **ppm** on pears.[1]

See "More About Exposure Limits".

CORNOX M (trade name): *see MCPA.*

COROTHION (trade name): *see Parathion.*

CRAWHASPOL (trade name): *see Trichloroethylene.*

CRESOL CAS 1319-77-3; **molecular weight** 108.13:

SYNONYMS: Methylphenol, Hydroxytoluene, Methylhydroxybenzene.

Cresol consists of mixtures of 3 **isomers**:

M-cresol **CAS** 108-39-4
O-cresol CAS 95-48-7 and
P-cresol CAS 196-44-5.

DESCRIPTION: Cresol is a slightly flammable clear to yellow liquid and/or solid that sinks in water and dissolves slowly. Its sweet, tarry odor is perceptible at .25 **ppm.**[4] Cresol biodegrades at a moderate rate and may **bioaccumulate.**[1]

USES AND SOURCES: The various **isomers** of cresol are used in **fumigation** compounds, to make solvents, explosives, phenol, resins, and wood preservatives, and for metal cleaning.[1]

In 1975, 151 million pounds of cresol and cresylic acid were produced in the U.S.

Cresol is a degradation product in the air of toluene.

see "Toluene." See "More About Pesticides".

HARMFUL EFFECTS AND SYMPTOMS: Routes of harmful **exposure** to cresol include inhalation, ingestion, and skin contact, by **chronic** and **acute** doses.[1] Symptoms include skin and eye burns, skin eruptions, headache, confusion, indigestion, nausea, vomiting, hypertension, weak pulse, depression, irregular shallow breathing, **pulmonary edema,** respiratory failure, and death.[192] Exposure may lead to liver and kidney damage. **Carcinogenicity** is not indicated.[1] Cresol is considered to be of high **toxicity** (3).[5]

Cresol is harmful to aquatic life in very low concentrations.[1]

EXPOSURE LIMITS:

AIR: OSHA TWA **(skin)** 5 **ppm** (approximately 22 **mg/m**^{3}).[4]

WATER: Recommended drinking water limit .001 **ppm.**[1]

See "More About Exposure Limits".

CRESYLIC ACID: *see Cresol.*

CRISAZINE (trade name): *see Atrazine.*

CRISULFAN (trade name): *see Endosulfan.*

CURATERR (trade name): *see Carbofuran.*

CYANAMID (trade name): *see Malathion.*

CYANIDE CAS 57-12-5; Chemical Symbol: CN

RELATED COMPOUNDS: Sodium cyanide (Symbol: NaCN) CAS 151-50-8; **molecular weight** 65.11. Potassium cyanide (Symbol: KCN) CAS 143-39-9; **molecular weight** 49.02.

DESCRIPTION: There is little **bioaccumulation** of cyanide, because organisms either **metabolize** cyanide quickly or die from its effects. It is probably not very **persistent** in the environment. Cyanide is fairly **mobile** in soil. In water, it dissipates primarily by evaporation and biodegradation.[1]

USES AND SOURCES: Cyanide is a commonly encountered toxicant at **hazardous waste** cleanup sites in Washington state.[25] It is a component of tobacco smoke, in the compound hydrogen cyanide.[3] Sodium and potassium cyanides are used primarily in the extraction of ores, in electroplating, in metal treatment, in printing, in **fumigation**, in photography, and various other manufacturing processes.[1]

In an EPA assessment, it was estimated that 30 percent of the discharge from large numbers of municipal wastewater treatment plants exceed water quality standards for cyanide.[32] The average concentration of cyanide in drinking water is .09 µg/l.[1]

HARMFUL EFFECTS AND SYMPTOMS: Routes of harmful **exposure** to cyanide include inhalation, ingestion, and skin contact.[1] Fatal doses can be absorbed through the skin, if there are cuts.[42] Symptoms of exposure include eye and skin irritation, weakness, headaches, confusion, dizziness, numbness, rapid pulse, nausea, vomiting, slow gasping respiration, convulsions, loss of consciousness, suffocation, and death.[1] Cyanide may be **teratogenic**, but does not appear to be **mutagenic** or **carcinogenic**.[42] Cyanide is considered to be of high **toxicity** (3).[5]

EXPOSURE LIMITS:

AIR: OSHA TWA 5 **mg/m^3**.[4]

WATER: Recommended drinking water limit .2 **ppm**.[1]

See "More About Exposure Limits".

CYANOETHYLENE: *see Acrylonitrile.*

CYCLODAN (trade name): *see Endosulfan.*

CYCLOHEXTRIENE: *see Benzene.*

CYTHION (trade name): *see Malathion.*

2,4-D CAS 94-75-7; **molecular weight** 221.04:

SYNONYMS: 2,4-D acid; Hedonal; 2,4-Dichlorophenoxy acetic acid.

TRADE NAMES: Weed-B-Gone; Super-D-Weedone, Herbical, Miracle, Lawn Keep.

DESCRIPTION: 2,4-D is a white to tan nonflammable odorless solid. It sinks in water and dissolves very, very slowly, unless it is accompanied by an **emulsifier** or a **wetting agent**. 2,4-D **persists** in soil from several days to a month.[1] It is highly **mobile** in soils. On sprayed vegetables it persists from 1 to 3 weeks. In water it persists from several days to many years.[1,194] 2,4-D contamination of groundwater 5 miles from the source and 14 years later has been documented. There is little uptake by fish, and no **bioaccumulation**.[1] There are **data gaps** concerning wildlife and **environmental fate**.

USES AND SOURCES: 2,4-D is used as a **herbicide** for broad-leaf and woody plants.[1] It is a component of Agent Orange, the defoliant used in Vietnam.[194] 2,4-D is one of the most commonly used **pesticides** in western Washington.[31] More than 60 million pounds are used annually. Fifty-seven percent is used in agriculture on wheat, corn, sorghum, and the rest is used on industrial/commercial sites and lawn/turf applications.[194,195]

2,4-D may be contaminated by dioxin and/or nitrosamines. In one study, 30 percent of the 2,4-D amine products tested contained dioxin from 20 to 278 **ppb** and 95 percent of 2,4-D ester products tested contained dioxin from 120 ppb to 8.7 **ppm**.

2,4-D may contaminate surface and groundwater. In a review of U.S. Forest Service sampling records for that agency's northwestern region, it was found that between 1970 and 1977, 61 of

136 samples from streams flowing out of sprayed areas were contaminated. Similar statistics exist for agricultural areas, in concentrations up to 18 **ppb**.

See "Dioxin" and "Nitrosamines." See "More About Pesticides".

HARMFUL EFFECTS AND SYMPTOMS: Routes of harmful **exposure** to 2,4-D include inhalation, ingestion, and skin contact.[1] Symptoms of exposure include skin problems, and skin, eye, and mucous membrane irritation, headache, disturbed menstrual cycles, weakness, stupor, muscular twitching, gastro-intestinal disturbances, nausea, vomiting, chest pain, convulsions, and liver, kidney, muscle, and nerve tissue damage.[1,195] 2,4-D commercial formulations are linked with cancer, including lung cancer, stomach cancer, leukemia, Hodgkin's disease, non-Hodgkin's **lymphona** and soft tissue sarcomas. It is unclear whether 2,4-D acid and/or some of the formulations and contaminants, such as nitrosamines and dioxin, are the causative agents of cancer.[197] 2,4-D is absorbed by the placenta and can cause abnormal fetal growth. It may be **mutagenic**. 2,4-D is **neurotoxic**. It is considered to be of high **toxicity** (3).[5]

There are **data gaps** in skin **tolerance**, **chronic** toxicity, **metabolism**, tumor production, **teratogenecity**, neurotoxicity, and **mutagenicity**, with possible adverse effects in teratogenicity and mutagenicity.[197]

2,4-D is dangerous to aquatic life in high concentrations.[1]

EXPOSURE LIMITS:

ADI: .003 **mg/kg/day**.[195]

AIR: OSHA TWA 10 **mg/m.**[3,4]

WATER: Recommended drinking water limit: .002 **ppm**.[1] WA groundwater criteria .10 **mg/l**.[8]

See "More About Exposure Limits."

2,4-D ACID: *see 2,4-D.*

DBA: *see PAHs.*

DB(A,H)A: *see PAHs.*

DBD: *see Guthion.*

DBP (trade name): *see N-butyl phthalate.*

DCB: *see 1,2-Dichlorobenzene or this chemical may be 3,3-Dichlorobenzidine, which is not included in this manual.*

1,1-DCE: *see Vinylidene chloride.*

DCEE: *see Dichloroethyl ether.*

DCP: *see Propylene dichloride.*

DCT: *see Simazine.*

D-D/PIC (trade name): *see Dichloropropene.*

D-D PICFUME (trade name): *see Dichloropropene.*

D-D PILFUME (trade name): *see Propylene dichloride.*

D-D SOIL FUMIGANT (trade name): *see Propylene dichloride and Dichloropropene.*

DDT CAS 50-29-3; **molecular weight** 354.50:

SYNONYMS: P,P'-dichlorodiphenyltrichloroethane, Chlorophenothane, Dicophane, Pentachlorin, Gesarol, Chlorophenothane, ENT 1506, Persistospray, Santobane.

TRADE NAMES: Neocid, P,P-DDT, Anofex, Neocoid, Zerdane, Dinocide, Gespon, Gesarex, Guespon, Guesarol, Pentech, Arkotine, Gyron, Ixodex, Neocidol, DND, GNB, GNB-A, Gesarol.

DESCRIPTION: DDT is a colorless nonflammable solid formulated as white powder, **wettable powder,** in emulsions, solutions, aerosols, and dusts. Its **odor threshold** is .2 **ppm.**[1]

DDT is very **persistent** in the environment. In soil DDT decomposes at a rate of 5 percent per year. Its **half-life** in sandy loam is 15 years. There is heavy **sorption** to suspended sediments and bottom muds. In an orchard, 40 percent of the DDT originally applied was still present after 20 years. Under certain conditions it breaks down to DDD and DDE, which also resist further degradation. In water DDTs half-life by chemical decomposition is 81 days. The half-life of DDE in water by chemical decomposition is 120 years. DDT evaporates quickly into the atmosphere, where its half-life by **photolysis** is 150 years. DDE evaporates within hours to the atmosphere, where its half-life by photolysis is several days. All three chemicals are **bioaccumulative** and **bioconcentrative**. They contaminate the **food chain**. DDT may be **synergistic** with dieldrin, which increases the rate of accumulation of DDT. DDT is also synergistic with 2,4-D.[1]

See "Dieldrin" and "DDT".

USES AND SOURCES: DDT is a **pesticide.**[1] The use of DDT was restricted by the **EPA** in 1972, but from 1946 to 1972, DDT was one of the most widely used agricultural insecticides in the United States and other countries.

1.2 billion pounds of DDT were used domestically from 1946 to 1972.[7]

DDT **exposure** is widespread. In a project by the United States Geological Survey (USGS), DDD and DDE, degradation products of DDT, were found in 10 to 20 percent of the sediment samples taken from a network of 160 to 180 **pesticide** monitoring network stations analyzing water and sediment samples. DDT was found in 8 to 10 percent of the samples. The frequency of detection of DDT, dieldrin, and chlordane gradually decreased from 1975 to 1980.[23] In some places, like the San Joaquin River in California, DDT was found at all of the sites tested, and at 9 of 24 sites concentrations of the chemical exceeded **EPA** aquatic life exposure limits.

See "More About Pesticides".

HARMFUL EFFECTS AND SYMPTOMS: Routes of harmful **exposure** to DDT include ingestion of contaminated food, inhalation, and skin contact.[1] Symptoms of exposure include nausea, diarrhea, tremors, loss of body position sense, numbness, rapid respiration, convulsions, and partial paralysis of the extremities.[1,207] With smaller doses, symptoms usually appear within 2 to 3 hours of ingestion.[1] DDT causes changes in liver tissue and kidneys, and causes brain and nerve damage. DDT is stored in the body fat and passes into breast milk. It is a possible **carcinogen**, a possible **mutagen**, but not a **teratogen.**[1,208,209]

DDE, a degradation product of DDT, contributes to the thinning of the eggshells of birds. All three are harmful to aquatic life in very small quantities.[1]

EXPOSURE LIMITS:

AIR: ACGIH TWA 1 **mg/m.**[3,28]

WATER: WA groundwater criteria .3 μg/l.[8] Due to the potential **carcinogenic** effect of DDT, its concentration should be zero. If this level is not attainable, levels which raise the human lifetime cancer risk to

one in ten thousand = .2400 **ppt**;
one in one million = .0240 ppt;
one in ten million = .0024 ppt.

INGESTION: FAO/WHO standard conditional daily intake: 0.005 **mg/kg** daily.[1]

See "More About Exposure Limits".

DEE-SOLV (trade name): *see Tetrachloroethylene.*

DEKRYSIL (trade name): *see 4,6-Dinitro-o-cresol.*

DELUSAL (trade name): *see Zinc phosphide.*

DEMETON: *see Systox.*

DEMETON-O: *see Systox.*

DEMETON-S: *see Systox.*

DEMOX: *see Systox.*

DENAPON (trade name): *see Carbaryl.*

DENSINFLUAT (trade name): *see Trichloroethylene.*

DESMODUR T80 (trade name): *see Toluene-2,4-dissocyanate.*

DESTRUXOL BORER-SOL

(trade name): *see Ethylene dichloride.*

DETAL (trade name): *see 4,6-Dinitro-o-cresol.*

DETMOL MA 96%] (trade name): *see Malathion.*

DEZODORATOR: *see Naphthalene.*

DIANAT (trade name): *see Dicamba.*

DIAZINON CAS 333-41-5; **molecular weight** 304.36:

SYNONYMS: O,O-diethyl O-(2-isopropyl-6-methyl-4-pyrimidinyl)phosphorothioate.

TRADE NAMES: Diazajet, Diazide, Diazitol, Diazol, Dicid, Exodin, Flytrol, Galesan, Kayazinon, Dimpylat, Dizinon, Dyzol, D-Z-N, Diazinon 14G, Geigy Spectracide, Lawn and Garden Insect Control, Basudin, Bazudin, Ciazinon, Ducutox, Cassitox, Dazzel, Dianon, Diater, Diater-fos, Necidol, Nucidol, R-Fos.

DESCRIPTION: Diazinon is a colorless, oily, nonflammable, amber-brown liquid that dissolves very slowly in water. It is sold as a **wettable powder**, dust, **emulsifiable concentrate**, microencapsulate, soluble concentrate, **granular**, oil solution, aerosol spray, and spray concentrate. It is used in impregnated materials, as a liquid ready-to-use, and as pressurized liquid.[1]

Chemical decomposition in water occurs within 37 hours. Seventy-five percent of diazinon breaks down within 3 months in the soil, but residues **persist** at a low level for years.[1,210] **Leaching** from soil may occur. There is no **bioaccumulation** or **food chain contamination.**[1]

USES AND SOURCES: Diazinon is a **pesticide** that has been on the market for 35 years. It is used on bananas, carrots, cauliflower, cherries, onions, nuts, and in forestry, including on Christmas tree plantations. It is used for livestock, lawns, turf, household, and in commercial indoor sites, including in food handling establishments.[39] Diazinon is one of the most commonly used pesticides in western Washington.[31]

National use in 1974 totalled 5 million pounds.[188]

In 1987 in samples taken in 46 states, diazinon was found in 3 percent of the groundwater and 31 percent of the surface water samples. In a project by the United States Geological Survey (USGS), diazinon was found in 1 to 2 percent of samples taken from a network of 160 to 180 **pesticide** monitoring network stations.[23] In a 1988 search of the U.S. EPA STORET Water Quality File, diazinon has been found in 6,026 of 22,291 analyzed samples from 3,555 surface water locations, in concentrations of .01 **µg/l** at the **85th percentile** of sample levels, with a maximum concentration of 33,400 **µg/l**. It was found in 74 of 3,633 analyzed samples from 2,835 groundwater locations, at concentrations of .25 **µg/l** at the 85th percentile of sample levels, with a maximum level of 84 µg/l.[99] Diazinon is one of the most commonly found compounds in ambient air.

The **inert ingredients** in Diazinon PT-260, which comprise 99 percent of the total volume, have been found to include methylene chloride and 1,1,1-trichloroethane. Diazinon is contaminated with sulfotepp. Sulfotepp is a much more **toxic** and **persistent** chemical than diazinon itself.

See "Methylene chloride" and "1,1,1-Trichloroethane." See "More About Pesticides".

HARMFUL EFFECTS AND SYMPTOMS: Routes of harmful **exposure** to diazinon include inhalation, ingestion, and skin contact. It has been known to permeate protective clothing, as well. Symptoms of exposure may include headache, blurred vision, giddiness, confusion, nervousness, sweating, discomfort in chest, increased heartbeat, salivation, runny nose, nausea, cramps, diarrhea, incontinence, irregular menstruation, muscle twitching, hallucinations, convulsions, paralysis, respiratory arrest, and death.[1]

There is incomplete data in cancer, **teratogenic**, **reproductive**, **mutagenic**, and chromosome alterations.[214] Research thus far indicates that it may be teratogenic and mutagenic.[1] It does not appear to be **carcinogenic.**[99]

Diazinon is highly **toxic** to fish and aquatic invertebrates, and to birds, even when applied according to directions.[1]

EXPOSURE LIMITS:

ADI: .002 **mg/kg/day** (NAS).[99]

AIR: OSHA TWA .1 **mg/m^3**.[4]

WATER: Recommended drinking water level .1 **ppm.**[1] Lifetime **Health Advisory** .00063 **mg/l** (.6 µg/l).[99]

See "More About Exposure Limits".

DIBENZ(A,H)ANTHRACENE: *see PAHs.*

1,2,5,6-DIBENZANTHRACENE: *see PAHs.*

1,2,7,8-DIBENZANTHRACENE: *see PAHs.*

DIBENZO(A,H)ANTHRACENE: *see PAHs.*

1,2,5,6-DIBENZONAPHTHALENE: *see PAHs.*

DIBROMOCHLOROMETHANE CAS 124-48-1:

SYNONYMS: Chlorodibromomethane.

DESCRIPTION: Dibromochloromethane is a clear to pale yellow heavy liquid that is insoluble in water. There is a tendency to **bioaccumulate.** Its **half-life** in water by chemical decomposition is 274 years. Evaporation occurs, though not rapidly.[1]

USES AND SOURCES: Dibromochloromethane is used to manufacture fire extinguishing agents, aerosol propellants, refrigerants, and **pesticides,** and in **organic** synthesis.[1]

See "More About Pesticides".

HARMFUL EFFECTS AND SYMPTOMS: Very little **toxicity** information is available on dibromochloromethane. It is a possible **carcinogen.**[25] Dibromochloromethane is a **mutagen.**[1] Dibromochloromethane is considered to be of moderate **toxicity** (2).[5]

EXPOSURE LIMITS:

WATER: Recommended drinking water limit 18 **ppm.**[1] WA groundwater criteria .5 µg/l.[8]

See "More About Exposure Limits".

DIBROMOETHANE: *see Ethylene dibromide.*

DIBUTYL ESTER 1,2-BENZENEDICARBOXYLIC ACID: *see N-butyl phthalate.*

DIBUTYL ESTER PHTHALIC ACID: *see N-butyl phthalate.*

DIBUTYL PHTHALATE: *see N-butyl phthalate.*

DICAMBA CAS 1918-00-9; **molecular weight** 221.04:

SYNONYMS: 3,6-Dichloro-o-anisic acid;2-Methoxy-3,6-dichlorobenzoic acid; 3,6-Dichloro-o-anisic; 3,6-Dichloro-2-methoxybenzoic acid; 3,6-Dichloro-2-methoxy-benzoic acid.

TRADE NAMES: Velsicol compound "R", Velsicol 58-CS-11, Dianat, Dianate, Banlen, Mondak, Banes, Banex, Banvel D, Mediben.

DESCRIPTION: Dicamba is an odorless white or brown crystal that sinks and dissolves in water. There is no **food chain contamination** potential. Dicamba degrades over a period of a year in soil, with faster degradation occurring with the higher temperatures and higher content of **organic** soils than clay or sand.[1] In one study 90 percent of 1 **ppm** dicamba **persisted** in dry soil for 9 months. Under moist conditions 10 percent **leached** out after four months. It shows a tendency to leach.[1] Dicamba persists 32 days undegraded in water. It does not **biomagnify** in food chain organisms.

There are missing data studies in **metabolism,** dissipation in soil and aquatic systems, degradation in sunlight, **leaching,** and volatility. Little is known of the damage dicamba may cause to organisms, because, for the most part, only **acute toxicity** tests have been completed.

USES AND SOURCES: Dicamba is an **herbicide** used for brush control on rights-of-way along highways, small grain crops, and rangeland. It is contaminated with dioxin (up to 50 **ppb**) and nitrosamines (less than 1 **ppm**).[222,223] Dicamba is one of the most commonly used **pesticides** in western Washington.[31] Cigarettes contaminated with up to 280 ppm (average 1.4 ppm) dicamba have been recorded.

In a 1988 search in the U.S. **EPA STORET** Water Quality File, dicamba has been found in 262 of 806 samples analyzed from 151 surface water locations, in concentrations at the **85th**

percentile of sample levels of .15 μg/l, with a maximum concentration of 3.3 μg/l. It has been found in 2 of 230 analyzed samples from 192 groundwater locations, at concentrations at the 85th percentile of sample levels of .07 μg/l, with a maximum concentration of .07 μg/l.[99] In an experiment in 1979, dicamba evaporating from a sprayed site damaged plants 60 meters away, and others for 3 days afterwards.

See "Dioxin" and "Nitrosamines". See "More About Pesticides".

HARMFUL EFFECTS AND SYMPTOMS: Routes of harmful **exposure** to dicamba include ingestion, inhalation, and skin contact.[1] Symptoms of exposure include irritated and burned eyes and skin, dizziness, weakness, headache, difficult breathing, nausea, and vomiting.[1,7] Dicamba is considered to be of moderate **toxicity** (2).[5]

There are **data gaps** concerning its **chronic**, **carcinogenic**, **teratogenic** and **reproductive** effects, with adverse effects indicated so far in carcinogenicity. Because there is inadequate evidence of carcinogenicity in animal studies, dicamba is not classifiable as to carcinogenicity.[99]

On of the dioxins which contaminates dicamba causes heart tissue birth defects in laboratory animals.[222]

Dicamba is dangerous to aquatic life in high concentrations, and to bees.[1]

EXPOSURE LIMITS:

ADI: .00125 **mg/kg/day**.[99]

WATER: Lifetime **health advisory** .2 **mg/l** (200 μg/l).[99]

INGESTION: Residue tolerances .05 to 40 **ppm**.[99]

See "More About Exposure Limits".

DICARBAM (trade name): *see Carbaryl.*

DI-CHLOR-MULSION (trade name): *see Ethylene dichloride.*

1,2-DICHLOROBENZENE CAS 95-50-1; **molecular weight** 147.01:

SYNONYMS: O-dichlorobenzene, Orthodichlorobenzene, Dichlorobenzol, DCB, O-dichlorobenzol, ODB, ODCB, Orthodichlorobenzol.

TRADE NAMES: Dowtherm E, Chloroben, Cloroben, Dizene. and

1,3-DICHLOROBENZENE CAS 541-73-1:

SYNONYMS: M-dichlorobenzene. and 1,4-Dichlorobenzene **CAS** 106-46-7; **molecular weight** 147.01; P-dichlorobenzene; PDCB; PDB; Paradichlorobenzene; Parazene; Paradichlorobenzol; P-dichlorobenzol.

TRADE NAMES: Dichlorocide, Paracide, Paradow, Paramoth, Santochlor.

DESCRIPTION: 1,2-Dichlorobenzene and 1,3-Dichlorobenzene are slightly flammable colorless to pale yellow heavy liquids that are slightly soluble and will sink in water. Their odors are pleasant. The **odor threshold** for 1,3-dichlorobenzene is 50 **ppm**.

1,4-Dichlorobenzene is a moderately flammable colorless or white crystal that is slightly soluble and will sink in water. Its very distinctive aromatic moth-ball like odor is perceptible at a range of 15 to 30 **ppm**. One source states that dichlorobenzene in the atmosphere will **persist** around 39 days. Another source maintains that the **half life** of 1,2-dichlorobenzene in air is 3 days. Evaporation from aerated waters of 1,3-dichlorobenzene occurs in 4 hours, and in unaerated water takes 3 days. Dichlorobenzenes are probably absorbed substantially by suspended **organic** particulates when in water. All three **bioconcentrate** in fatty tissues and show some tendency to **bioaccumulate**.[1]

USES AND SOURCES: 1,2-Dichlorobenzene is used as a solvent, as a disinfectant, and as a heat transfer medium. It is used in degreasers and in the manufacturing of toluene diisocyanate.[1] Thirty-four percent of the use of dichlorobenzene is in **fumigants**, and 27 percent is in electrical and electronic products. The rest of its use occurs in the ways described above.[7]

In 1986 81.6 million pounds of dichlorobenzene were produced in the U.S.[7]

Indoor ambient air average concentrations of dichlorobenzene ranges from 5.5 to 56 **g/m^3**. Outdoor ambient air average concentrations range from .3 to 2.2 g/m^3.[7]

There is a potential of dichlorobenzene **exposure** by skin contact and ingestion from the residues in polyphenylene sulfide coatings of articles intended for repeated contact with food.[7]

See "More About Pesticides".

HARMFUL EFFECTS AND SYMPTOMS: Routes of harmful **exposure** to all three **isomers** of dichlorobenzene include inhalation, ingestion, and skin contact. Symptoms of harmful exposure include nose, eyes, mucous membranes, and skin irritation, pink eye, cataracts, skin blisters, eczema, headache, dizziness, lack of appetite, nausea, vomiting, swelling of hands, feet, or ankles, liver and kidney damage, jaundice, anemia, fine finger tremors, and increased deep tendon reflexes. All three are **mutagens**, potential **carcinogens** suspected in leukemia, and potential **teratogens**. 1,2-Dichlorobenzene is believed to be the most **toxic** of the three **isomers**. High concentrations of 1,2- and 1,3-dichlorobenzene may cause central nervous system depression.[1] Dichlorobenzene is considered to be of high **toxicity** (3).[5]

1,3-dichlorobenzene is harmful to aquatic life in very low concentrations. The effect of 1,2-dichlorobenzene on aquatic life is unknown.[1]

EXPOSURE LIMITS:

For 1,2- and 1,3-dichlorobenzene:

AIR: OSHA PEL 50 **ppm** (approximately 300 **mg/m^3**).[4]

WATER: Proposed maximum level contaminant goal 600 **µg/l.**[25]

For 1,4-dichlorobenzene:

AIR: OSHA TWA 75 **ppm** (approximately 450 **mg/m^3**).[4]

WATER: Drinking water limit .002 **ppm.**[1] WA groundwater criteria 4 **µg/l.**[8]

See "More About Exposure Limits."

DICHLOROBENZOL: *see 1,2-Dichlorobenzene.*

1,1-DICHLORO-2-CHLOROETHYLENE: *see Trichloroethylene.*

DICHLORO-(9CI)1-PROPENE: *see Dichloropropene.*

DICHLOROCIDE (trade name): *see 1,4-Dichlorobenzene.*

1,2-DICHLORO-(9CI)ETHENE: *see 1,2-Dichloroethylene.*

1,3-DICHLORO-CIS-1-PROPENE: *see Dichloropropene.*

1,1-DICHLORO-2,2-DICHLOROETHANE: *see Tetrachloroethane.*

DICHLORODIETHYL ETHER: *see Dichloroethyl ether.*

DICHLORODIFLUOROMETHANE CAS 75-71-8; **molecular weight** 120.92:

SYNONYMS: Difluorodichloromethane.

TRADE NAMES: Fluorocarbon 12, Freon-12, Genetron-12, Frigen 12, Arcton 6, Halon, Halon 122, Isotron 2, F 12 FC 12, Algofrene Type 2, Electro-CF 12, Freon F-12, Isceon 122, Ledon 12, Propellant 12, Refrigerant 12, Ucon 12.

DESCRIPTION: Dichlorodifluoromethane is a colorless gas that clings to the ground. There is potential for **bioaccumulation** under constant **exposure**. It is not degradable. Dichlorodifluoromethane is very stable in the **troposphere** with a lifetime of 110 years.[1,46]

USES AND SOURCES: Dichlorodifluoromethane is used as an aerosol propellant, a refrigerant gas, in plastics as a **blowing agent**, a low-temperature solvent, and for freezing foods.[1]

Worldwide atmospheric concentrations of chlorofluorocarbons (**CFCs**), of which dichlorodifluoromethane is one, are increasing at about 5 percent annually.[46]

HARMFUL EFFECTS AND SYMPTOMS: Harmful **exposure** to dichlorodifluoromethane may occur by inhalation.[1] Dichlorodifluoromethane is a non-toxic gas except at very high concentrations. There is no evidence for **carcinogenicity** from direct exposure and slight **toxicity** from **chronic exposure** and very little data on prolonged exposure.[6] Dichlorodifluoromethane is considered to be of low **toxicity (1)**.[5]

Dichlorodifluoromethane is damaging environmentally. It migrates to the stratosphere where it breaks down under light rays to chlorine atoms which adversely affects the ozone.[6]

Ozone, the major component of smog, is undesirable near the earth's surface, but its presence in the stratosphere serves to reduce the amount of ultraviolet light reaching the earth's surface. The ozone layer protects people from skin cancer and other harmful effects, such as reduced agricultural and marine productivity.[47]

Chlorofluorocarbons (**CFCs**), of which dichlorodifluoromethane is one, may contribute to the possibility of the "greenhouse effect."

See "Carbon dioxide", "CFCs", "Methane", "Nitrogen oxide", and "Ozone".

EXPOSURE LIMITS:

AIR: OSHA TWA 1000 **ppm** (approximately 4950 **mg/m^3**).[4]

WATER: Recommended drinking water limit 2.8 **ppm.**[1]

See "More About Exposure Limits".

DICHLORO-1,2-ETHANE: *see Ethylene dichloride.*

1,2-DICHLOROETHANE: *see Ethylene dichloride.*

DICHLOROETHENE: *see Vinylidene chloride.*

1,2-DICHLOROETHENE: *see 1,2-Dichloroethylene.*

DICHLOROETHER: *see Dichloroethyl ether.*

1,1-DICHLOROETHYLENE: *see Vinylidene chloride.*

1,2-DICHLOROETHYLENE CAS 540-59-0; **molecular weight** 96.95:

SYNONYMS: Acetylene dichloride; Alpha, beta-dichloroethylene; SYM-1,2-dichloroethylene; 1,2-Dichloro-(9CI)ethene; Dioform; 1,2-Dichloroethene.

This chemical is a mixture of two **isomers:**

CIS CAS 156-59-2

SYNONYMS: (Z)-1,2-Dichloroethylene; (Z)-1,2-Dichloroethene;

and

TRANS CAS 156-60-5:

SYNONYMS: (E)-(9CI)1,2-dichloroethene; (E)-1,2-dichloroethylene; Trans-1,2-dichloroethylene; Trans-1,2-dichloroethene; 1,2-trans-dichloroethene; (E)-1,2-dichloroethene).

DESCRIPTION: 1,2-Dichloroethylene consists of a mixture of two **isomers**. Technically the proportion is 60 percent cis isomer and 40 percent trans isomer, but the real proportions depends on production conditions. 1,2-Dichloroethylene is a quite flammable, colorless, viscous liquid that sinks in water and is nearly insoluble. Its slightly acrid, ether-like odor is not a good warning for over**exposure**. Gradually 1,2-dichloroethylene decomposes in the presence of air, light, and moisture. The **half-life** of the trans **isomer** in the air is less than 1 day. Removal from water is almost entirely by evaporation. There is no **bioaccumulation** and no **food chain contamination** potential.[1]

USES AND SOURCES: 1,2-Dichloroethylene is used as a general solvent for **organic** materials such as fats, phenols, and camphor. It is also used in dye and caffeine extraction, in the making of perfumes, lacquers, thermoplastics, and organic compounds. It is a by-product of chlorination reactions, and is recycled as an intermediate in the making of certain chlorinated compounds.[1]

In groundwater trichloroethylene and tetrachloroethane may be transformed into 1,2-dichloroethylene, which is 5 times more potent than trichloroethylene.[127]

See "Tetrachloroethylene" and "Trichloroethylene".

HARMFUL EFFECTS AND SYMPTOMS: Routes of harmful **exposure** to 1,2-dichloroethylene may occur through diet, inhalation and skin contact. The trans **isomer** is twice as toxic as the cis. Direct contact can burn the eyes and skin. Exposures to high concentrations of the vapor can cause weakness, dizziness, irritation of the respiratory system, pink eye, cramps, nausea, vomiting, tremor, central nervous system depression, and loss of consciousness. There is evidence of fatty degeneration of the liver in laboratory animals. **Chronic** or repeated exposures in any form may be **hazardous. Carcinogenic** risk in humans is unknown. 1,2-Dichloroethylene is a possible **mutagen.**[1] Dichloroethylene is considered to be of high **toxicity** (3).[5]

EXPOSURE LIMITS:

AIR: (trans) OSHA PEL 200 **ppm** (approximately 790 **mg/m^3**).[4]

WATER: Proposed maximum contaminant level goal 100 µg/l.[25]

See "More About Exposure Limits".

DICHLOROETHYL ETHER CAS 111-44-4; **molecular weight** 143.02:

SYNONYMS: Bis-(2-chloroethyl) ether, 2,2-Dichloroethyl ether, Bis(beta-chloroethyl)ether, Dichlorodiethyl ether, Di-(2-chloroethyl)ether, 1-Chloro-2-(beta-chloroethoxy)ethane, Dichloroether, DCEE, Chlorex, Clorex, BCEE, Dichloroethyl oxide, Sym-dichloroethyl ether.

TRADE NAMES: ENT 4,504.

DESCRIPTION: Dichloroethyl ether is a colorless liquid that sinks in bodies of water and is insoluble.[28] Its nauseating odor is perceptible at 1 **ppm**. Dichloroethyl ether is **persistent**, and there is potential for **bioaccumulation.**[1] This chemical **bioconcentrates** in fatty tissues.[8]

USES AND SOURCES: Dichloroethyl ether is used as a solvent for fats, waxes, and greases, as a scouring agent for textiles, and as a soil **fumigant**. It is used in the manufacture of paint, varnish, lacquer, and soap, in drycleaning, and in insecticides.[1]

Exposure to this chemical often includes **exposure** to dichloropropene.[1]

Dichloroethyl ether has been found in rivers and drinking waters of many U.S. cities. It is found in high concentrations in the wastewater from chemical plants producing glycol products, rubber and insecticides.[6]

See "Dichloropropene." See "More About Pesticides".

HARMFUL EFFECTS AND SYMPTOMS: Routes of harmful **exposure** to dichloroethyl ether include ingestion, inhalation, and skin contact. The odor is a good warning for overexposure.[1] Inhalation may cause tearing of the eyes, and irritation of the nose and throat.[6] Vapors of 3 **ppm** are distinctly irritating, concentrations of 100 ppm may cause nausea and vomiting, and concentrations of 500 to 1000 ppm cause severe irritation.[1,6] **Chronic exposure** may cause liver and kidney damage. Dichloroethyl ether is a suspected human **carcinogen.**[1] Dichloroethyl ether is considered to be of high **toxicity** (3).[5]

The effect of dichloroethyl ether on aquatic life is unknown.[1]

EXPOSURE LIMITS:

AIR: OSHA TWA 5 **ppm** (approximately 30 **mg/m^3**).[4]

WATER: Recommended drinking water limit 1.5 **ppm.**[1]

See "More About Exposure Limits".

DI-(2-CHLOROETHYL)ETHER: *see Dichloroethyl ether.*

2,2-DICHLOROETHYL ETHER: *see Dichloroethyl ether.*

DICHLOROETHYL OXIDE: *see Dichloroethyl ether.*

DICHLOROMETHANE: *see Methylene chloride.*

3,6-DICHLORO-2-METHOXYBENZOIC ACID: *see Dicamba.*

DICHLOROMETHYL BROMIDE: *see Bromodichloromethane.*

3,6-DICHLORO-O-ANISIC: *see Dicamba.*

3,6-DICHLORO-O-ANISIC ACID: *see Dicamba.*

(2,4-DICHLOROPHENOXY) ACETIC ACID: *see 2,4-D.*

DICHLOROPROPANE: *see Propylene dichloride.*

1,2-DICHLOROPROPANE: *see Propylene dichloride.*

DICHLOROPROPENE CAS 542-75-6; **molecular weight** 110.98:

SYNONYMS: Dichloro-(9CI)1—propene; Allyene dichloride; (Van)dichloride; (S)dichloride; N.O.S. Dichloropropene; Dichloropropylene; N.O.S. Dichloropropylene; 1,3-Dichloropropene.

This compound is made of two **isomers,**

TRANS-1, and 3-DICHLOROPROPENE CAS 10061-02-6:

SYNONYMS: (E)-(9CI)1,3-dichloro-1-propene; (E)-(8CI)1,3-Dichloropropene; (E)-1,3-Dichloropropene; Trans-1,3-Dichloro-1-propene; 1,3-Trans-dichloro-propylene; 1,3-Dichloro-trans-1-propene;

and

CIS-1,3-DICHLOROPROPENE CAS 10061-01-5:

SYNONYMS: 1,3-Dichloro-1-propene; Cis-1,3-dichloro-1-propene; Cis-dichloropropene; 1,3-Cis-dichloro-propylene;1,3-Dichloro-cis-1-propene.

TRADE NAMES: This compound is found, mixed with others, in the following commercial formulations: Vorlex, Vorlex 201, EP-201, Morton EP-201, Di-trapex, D-D Picfume, Terr-o-cide 30-D, Terr-o-gas 57/431, Pic-Clor 60, Telone C, Vidden DC, Ethylene dibromide, Dorlone, New Fieldfume, Perchloroethylene, D-D soil **fumigant**, Dowfume NC, Vidden D, Nemex, Telon C-17, D-D/Pic, Bis(2-chloroethyl)ether, Aniline.

DESCRIPTION: Dichloropropene is a light straw-colored, clear liquid. Its chloroform-like odor is perceptible at a range of 1 to 3 **ppm**.[28] Its **half-life** in the soil ranges from 20 to 70 days.[1] Dichloropropene is **mobile** in soil.[9] It evaporates from water within hours.[1] In one study its half-life in water at 10°C is reported to be 51 days, and at 20°C ranges from 10 to 13 days.[99] There is potential for **bioaccumulation** under **chronic** conditions.[1]

USES AND SOURCES: Dichloropropene is used as a soil **fumigant** for the control of **nematodes**, in potatoes, tomatoes, carrots, tobacco, cotton, and citrus fruits.[1]

In 1985, 52 million pounds of dichloropropene were produced. Seven percent of that figure was imported. Two million pounds were used on pineapple fields in Hawaii in 1985.[7] From 1984 to 1985, 34 to 40 million pounds of **pesticides** containing dichloropropene were used.[99]

Dichloropropene has been found in shallow and deep wells of 6 states, including Washington.[7] In a 1988 search in the U.S. EPA STORET Water Quality File, dichloropropene has been found in 41 of 1,088 samples analyzed from 800 surface water locations, in concentrations of 1.3 μg/l at the **85th percentile** of sample levels. It has been found in 2 of 230 analyzed samples from 192 groundwater locations, in concentrations of 3.4 μg/l at the 85th percentile of sample levels, with a maximum concentration of 90 μg/l.[99]

See "More About Pesticides".

HARMFUL EFFECTS AND SYMPTOMS: Routes of harmful **exposure** to dichloropropene include ingestion, inhalation, and skin contact. It erodes leather and rubber, which may render protective clothing useless.[1] The odor may not be a good warning, as the smell wears off in **chronic** conditions. Ninety percent of dichloropropene that is ingested is absorbed.[99] Symptoms of harmful exposure include skin, eye, and mucous membrane irritation, in concentrations of 1000 **ppm** in laboratory animals, pink eye, burns, rashes, blisters, weakness, dizziness, headaches, abdominal cramps, liver and kidney damage, respiratory problems (in concentrations of 2700 **ppm** in laboratory animals), pneumonia, loss of consciousness, and death (in concentrations of 100 **ppm** for 2 hours in laboratory animals).[28] Dichloropropene is a probable **carcinogen** and a **mutagen**.[1] Dichloropropene is considered to be of high **toxicity** (3).[5]

The effect of dichloropropene on aquatic life is unknown.[1]

EXPOSURE LIMITS:

AIR: OSHA TWA 1 **ppm** (approximately 5 **mg/m^3**).[4]

WATER: Recommended drinking water limit .087 **ppm**.[1] Lifetime **health advisory** .011 **mg/l** (10 μg/l).[99] WA groundwater criteria .2 μg/l.[8]

INGESTION: No **tolerances** or exemptions from tolerances for dichloropropene residues in or on food or feed commodities have been established.

See "More About Exposure Limits."

1,3-DICHLOROPROPENE: *see Dichloropropene.*

1,3-DICHLORO-1-PROPENE: *see Dichloropropene.*

DICHLOROPROPYLENE: *see Dichloropropene.*

1,3-DICHLORO-TRANS-1-PROPENE: *see Dichloropropene.*

DICHROMATES (e.g., $Na_2Cr_2O_7$) of Sodium, Potassium, Ammonium, Lithium, Cesium, and Rubidium: *see Chromium.*

DIDAKENE (trade name): *see Tetrachloroethylene.*

DIELDRIN: *see Aldrin.*

DIETHION: *see Ethion.*

DIETHYLENE DIOXIDE: *see Dioxane.*

DIETHYLENE ETHER: *see Dioxane.*

DIETHYLENE OXIDE: *see Dioxane.*

DIETHYL HEXYL PHTHALATE: *see Dioctyl phthalate.*

DIETHYL 4-NITROPHENYL THIONOPHOSPHATE: *see Parathion.*

DIETHYL PARATHION: *see Parathion.*

DIETHYL-P-NITROPHENYL MONOTHIOPHOSPHATE: *see Parathion.*

DIETHYL P-NITROPHENYL THIOPHOSPHATE: *see Parathion.*

DIFLUORODICHLOROMETHANE: *see Dichlorodifluoromethane.*

1,2-DIHYDROACENAPHTHYLENE: *see PAHs.*

2,3-DIHYDRO-2,2-DIMETHYL-7-BENZOFURANOL METHYLCARBAMATE: *see Carbofuran.*

2,3-DIHYDRO-2,2-DIMETHYL-7-METHYL-CARBAMIC ACID: *see Carbofuran.*

DIHYDROOXIRENE: *see Ethylene oxide.*

2,4-DIISOCYANATO-1-METHYL-(9CI)BENZENE: *see Toluene-2,4-dissocyanate.*

2,4-DIISOCYANATO-1-METHYLBENZENE: *see Toluene-2,4-diisocyanate.*

2,4-DIISOCYANATOTOLUENE: *see Toluene-2,4-diisocyanate.*

DIMETHYLBENZENE: *see Xylene.*

DIMETHYL 1,2-BENZENEDICARBOXYLATE: *see Dimethyl phthalate.*

DIMETHYL BENZENE-O-DICARBOXYLATE: *see Dimethyl phthalate.*

2,2-DIMETHYL-7-COUMARANYL N-METHYLCARBAMATE: *see Carbofuran.*

DIMETHYLENE OXIDE: *see Ethylene oxide.*

DIMETHYL ESTER: *see Dimethyl phthalate.*

DIMETHYL ESTER PHTHALIC ACID: *see Dimethyl phthalate.*

DIMETHYL KETONE: *see Acetone.*

DIMETHYLNITROSAMINE: *see Nitrosamines.*

1,2,4-DIMETHYLPHENOL CAS 105-67-9; **molecular weight** 122.16::

SYNONYMS: 2,4-Xylenol; 1-Hydroxy-2,4-dimethylbenzene; 4-Hydroxy-1,3 -dimethylbenzene; 2,4-DMP; M-xylenol; M-4-xylenol; Asym-o-xylenol.

DESCRIPTION: 2,4-Dimethyl phenol is a yellow-brown liquid or a colorless, crystalline solid. Its **odor threshold** ranges from .1 to .4 **ppm**. It is biodegradable in fertile soil, but may not degrade rapidly in water. Photo oxidation may be important.[1]

USES AND SOURCES: 2,4-Dimethylphenol is used as a chemical feed stock for a wide range of commercial products for industry and agriculture, such as phenolic antioxidents, disinfectants, solvents, pharmaceuticals, insecticides, **fungicides**, plasticizers, rubber chemicals and dye stuffs. It is a constituent of or additive to lubricants and gasoline.[1] This compound occurs naturally in plants and has been detected in tea, and tobacco and cigarette smoke.[6]

See "Gasoline."

HARMFUL EFFECTS AND RISKS: Routes of harmful **exposure** to 2,4-dimethylphenol include inhalation, ingestion, and skin contact. Symptoms of exposure include severe skin and eye irritation, headache, dizziness, exhaustion, stomach pain, nausea, and vomiting. **Chronic** exposures may cause liver and kidney damage. 2,4-Dimethylphenol is a possible **carcinogen.**[1] It is considered to be of high **toxicity** (3).[5]

EXPOSURE LIMITS:

WATER: Recommended drinking water limit .4 **ppm.**[1]

See "More About Exposure Limits".

DIMETHYL PHTHALATE CAS 131-11-3; **molecular weight** 194.19:

SYNONYMS: DMP; Dimethyl 1,2-benzedinicarboxylate; 1,2-Benzenedicarboxylic acid; Dimethyl ester; Dimethyl ester phthalic acid; Methyl phthalate; Dimethyl benzene-o-dicarboylate.

TRADE NAMES: Avolin, ENT 262, Fermine, Solvanom, Mipax, NTM, Palatinol M, Solvarone.

DESCRIPTION: Dimethyl phthalate is a flammable moderately viscous white or light straw colored liquid that sinks in water and dissolves slowly. It may be formulated into creams. Its **half-life** in still water by chemical decomposition ranges from 3 to 6 months. By biodegradation its half-life is a week, and by evaporation is a few hours. Its half-life in organisms is 1 to 2 days. **Bioaccumulation** is more likely in aquatic organisms than in warm-blooded animals, but many higher organisms have concentrated phthalic **esters** as a result of biosynthesis or diet.[1]

USES AND SOURCES: Dimethyl phthalate is used as an insect repellent, and as a solvent and plasticizer for polyvinyl film and **elastomers**. It is used in plastics, pigments, lacquers, perfumes, resins, rubber, solid rocket propellants, and in safety glasses.[1]

Phthalates, of which dimethyl phthalate is one, are everywhere in the environment, due to their many sources, including water sources, air, food, consumer products, and medical devices, such as tubing and blood bags.[6]

HARMFUL EFFECTS AND SYMPTOMS: Routes of harmful **exposure** to dimethyl phthalate include ingestion, inhalation, skin contact, and parenteral administration (blood bags and tubes).[1,6] Laboratory tests have indicated that phthalates are less dangerous in **acute** than in **chronic** doses.[6] Symptoms of exposure include irritated nasal passages and upper respiratory system, coughing, pink eye, eczema, dizziness, vomiting, diarrhea, central nervous system depression, liver damage, loss of consciousness, and paralysis.[1,6] Ingestion may cause gastrointestinal irritation and loss of consciousness.[28] Dimethyl phthalate is a potential **teratogen.**[1] It is considered to be of moderate **toxicity** (2).[5]

EXPOSURE LIMITS:

AIR: OSHA TWA 5 mg/m^3.[4]

WATER: Drinking water limit 313 ppm.

See "More About Exposure Limits".

1,1-DIMETHYL-S-(4-OXOBENZOTRIAZINO-3-METHYL)PHOSPHORODITHIOATE:*see Guthion.*

[(DIMETHOXYPHOSPHINOTHIOYL)THIO]BUTANEDIOIC ACID DIETHYL ESTER:*see Malathion.*

DI-N-BUTYL PHTHALATE:*see N-butyl phthalate.*

2,4-DINITRO(8CI)TOLUENE:*see 2,4-Dinitrotoluene.*

DINITROGEN MONOXIDE:*see Nitrogen oxide.*

DINITROL (trade name): *see 4,6-Dinitro-o-cresol.*

2,4-DINITRO-1-METHYLBENZENE:*see 2,4-Dinitrotoluene.*

2,4-DINITROTOLUENE CAS 25321-14-6; **molecular weight** 182.14:

SYNONYMS: DNT; 1-Methyl-2,4-(9CI)benzene; 2,4-Dinitro(8CI)toluene; O,P-Dinitrotoluene; NCI-CO1865; 1-Methyl-2,4-dinitrobenzene; 2,4-Dinitro-1-methylbenzene; 2,4-Dinitro-1-methylbenzene; 2,4-Dinitrotoluol; 2,4-DNT

and

2,6-DINITROTOLUENE CAS 606-20-2:

SYNONYMS: 2,6-DNT; 2-Methyl-1,3-dinitro-(9CI)benzene.

DESCRIPTION: Dinitrotoluenes occur as cast solids, as molten yellow liquids and in yellow to red **granules**. They have a slight odor. 2,4-Dinitrotoluene is often prepared in a 65:35 ratio with 2,6-Dinitrotoluene.. When spilled in water, the liquid solidifies and sinks. Their **half-life** in water ranges from 3 to 42 hours. Some degradation also occurs through oxidation and chemical decomposition. **Microbial degradation** is reported to occur slowly.[1]

USES AND SOURCES: Dinitrotoluenes are used as intermediates in the production of polyurethane foam, as ingredients for explosives for commercial and military use, as chemical stabilizers in the manufacture of smokeless powder, and as raw materials for dye stuffs.[1,6] Dinitroluenes are found at illegal drug laboratory **hazardous waste** sites, where the drug psilocin has been processed.[2] Industrial and military settings are the primary causes of **exposure**.[1]

HARMFUL EFFECTS AND SYMPTOMS: Routes of harmful **exposure** to dinitrotoluenes include ingestion, inhalation, and skin contact. People at higher risk include those with liver damage and blood disorders, as dinitrotoluenes aggravate those conditions. **Acute** symptoms might be delayed up to 4 hours. Symptoms, both **chronic** and acute, include irritation of the skin and eyes, burns, headache, weakness, dizziness, drowsiness, insomnia, tremor, lack of appetite, nausea, vomiting, anemia, difficulty in breathing, **cyanosis**, heart irregularities, joint pain, jaundice, paralysis, and loss of consciousness. Even a small amount absorbed through the skin from contaminated clothing or shoes may be **toxic**. They are possible **mutagens**.[1] Dinitrotoluenes are possible **carcinogens** by the oral route. There is not enough information to determine if the inhalation is carcinogenic, but there is no evidence thus far. There is no information on carcinogenicity by skin **exposure**. Dinitrotoluenes are considered to be of high **toxicity** (3).[5]

EXPOSURE LIMITS:

AIR: OSHA TWA 1.5 mg/m^3.[4]

WATER: Aquatic plant **toxicity** 27 **ppm.**[4] WA groundwater criteria .1 µg/l.[8] Due to the potential **carcinogenic** effect of dinitrotoluenes, their concentration should be zero. If this level is not attainable, levels which raise the human lifetime cancer risk to

one in ten thousand = 1.100 **ppb**;
one in one million = .110 ppb;
one in ten million = .011 ppb.[4]

See "More About Exposure Limits".

2,4-DINITROTOLUOL: *see 2,4-Dinitrotoluene.*

DINNAMOL: *see Styrene.*

DINOCIDE (trade name): *see DDT.*

DI-N-OCTYL PHTHALATE: *see Dioctyl phthalate.*

DI-N-PROPYLNITROSAMINE: *see Nitrosamines.*

DIOCTYL ESTER 0-BENZENEDICARBOXYLIC ACID: *see Dioctyl phthalate.*

DIOCTYL 0-BENZENEDICARBOXYLATE: *see Dioctyl phthalate.*

DIOCTYL PHTHALATE CAS 117-81-7; **molecular weight** 390.54:

SYNONYMS: Bis-(2-ethylhexyl)phthalate; Dioctyl **ester** o-benzenedicarboxylic acid; Diethyl hexyl phthalate; Dioctyl o-benzenedicarboxylate; Octyl phthalate; Di-n-octyl phthalate.

TRADE NAMES: Celluflex DOP, Polycizer 162, PX-138.

DESCRIPTION: Dioctyl phthalate is a light colored oily liquid that is insoluble in and floats on bodies of water.[1,28] Its **half-life** in water is 5 days. In water it is sorbed onto **organic** residues and solid surfaces. It is biodegradable by soil microorganisms. There is potential for **bioaccumulation** and **food chain contamination.**[1] In one study elimination of dioctyl phthalate from the bodies of laboratory mice required 35 days.[28]

USES AND SOURCES: Dioctyl phthalate is used as a plasticizer, and as a denaturant for alcohol.[1] It is present in medical devices, such as tubing and blood bags. It is present in water sources, air, food, and consumer products.[6]

HARMFUL EFFECTS AND SYMPTOMS: Routes of harmful **exposure** to dioctyl phthalate include ingestion of food and water, inhalation, skin contact, and parenteral administration (blood bags and tubes).[1,6] Laboratory tests on animals indicate that phthalate **esters**, of which dioctyl phthalate is one, are less dangerous in **acute** doses than they are chronically. Dioctyl phthalate irritates the eyes, mucous membranes, and central nervous system.[6] It appears to have an **accumulative** effect.[1] The liver is the primary organ damaged by dioctyl phthalate.[6] It is a potential **carcinogen, mutagen**, and **teratogen.**[1] Dioctyl phthalate is considered to be of high **toxicity** (3).[5]

Dioctyl phthalate is toxic to aquatic organisms in higher concentrations.[1]

EXPOSURE LIMITS:

AIR: OSHA TWA 5 **mg/m^3**.[4]

WATER: Chronic aquatic **toxicity** limit .3 **ppb.**[1]

See "More About Exposure Limits".

DIOFORM: *see 1,2-Dichloroethylene.*

DIOXANE CAS 123-91-1; **molecular weight** 88.10:

SYNONYMS: 1,4-Dioxane; Diethylene dioxide; Diethylene ether; Dioxan; P-Dioxane; Diethylene oxide.

DESCRIPTION: Dioxane (not to be confused with dioxin) is a colorless, quite flammable liquid which sinks in bodies of water and dissolves. Its faint, pleasant odor is perceptible at 170 **ppm**. There is potential for **bioaccumulation**. Dioxane does not biodegrade well.[1]

USES AND SOURCES: Dioxane is used in laboratories. It is used as a solvent for resins, oils, lacquers, plastics, varnishes, paints, dyes, waxes, greases, and polyvinyl **polymers**. Dioxane is used as a stablizer in chlorinated solvents.[1,28] It is found at illegal drug laboratory **hazardous waste** sites, where the drugs chlordiazepoxide, diazepam, and psilocin have been processed.[2] Products contaminated with dioxane include **pesticide surfactants**, with dioxane concentrations as high as 20,000 **ppm**, and antistatic textile agents, with dioxane concentrations ranging from 15,000 to 20,000 **ppm**.

OSHA estimates that 466,000 workers nationwide are potentially **exposed** to dioxane annually. One hundred thousand of them are exposed through dioxane contamination of methylchloroform.[7]

See "Methylchloroform."

HARMFUL EFFECTS AND SYMPTOMS: Routes of harmful **exposure** to dioxane include inhalation, ingestion, or by skin contact. There is high skin rate absorption. The odor is a good warning for **acute** exposures, but not for **chronic** exposures.[1] Irritation of the eyes and skin begins at .1 to 3 percent concentration followed by drowsiness, nausea, vomiting, liver damage, kidney failure, central nervous system depression, **pulmonary edema**, and death. Repeated **exposures** to low concentrations may cause central nervous system depression and liver and kidney damage. It is a potential **carcinogen** and **teratogen**, and is acutely toxic.[1,234] Dioxane is considered to be of high **toxicity** (3).[5]

The effect of low concentrations of dioxane on aquatic life is unknown.[1]

EXPOSURE LIMITS:

AIR: OSHA TWA 25 **ppm** (approximately 90 **mg/m^3**).[4]

WATER: WA groundwater criteria .0000005 µg/l.[8]

See "More About Exposure Limits".

1,4-DIOXANE: *see Dioxane.*

DIOXIN CAS 1746-01-6; **molecular weight** 321.96:

SYNONYMS: 2,3,7,8-tetrachlorodibenzo-p-dioxin; P-dioxin; Hexachlorodibenzo-p-dioxin; TCDD; 2,3,7,8-Tetrachlorodibenzo-(9CI)dibenzo[b,e][1,4]dioxin; TCDBD; 2,3,7,8-Tetrachlorodibenzo-1,4-dioxin.

DESCRIPTION: The chemical known as "dioxin" is actually one of a family of compounds, chlorinated dioxins. Dioxin's **half life** in surface waters is more than a year. Its estimated half life on soil surfaces is 1 to 3 years, and in **anaerobic** soils 10 to 12 years. Dioxin's **persistency** in the atmosphere is so long that not even a half life estimate is available. Another source estimated that the atmospheric half life of dioxin as a particulate and not a gas may be a few days.[235] Dioxin strongly adsorbs to materials like soil, and is unlikely to **leach** through it.[235] It **bioaccumulates** in the fatty tissues, muscle and skin of mammals, with its **half life** in the body calculated to be 5 to 7 years.[235]

USES AND SOURCES: Dioxin has no commercial uses. It has been found in the environment, in the products and emissions of chemical plants manufacturing chlorinated phenols, and in the ash residues and emissions of municipal waste incinerators. Emissions of dioxin may occur from pulp and paper manufacturing plants, depending upon their use of chlorine and manufacturing processes. It may be released through industrial accidents, combustion, and automobile exhaust from cars using leaded gas.[235] Dioxin in amounts of parts per trillion has been found in milk stored in bleached paper cartons, and in paper products like napkins, diapers, facial tissues, towels, tampons, sanitary napkins, office stationery, coffee filters, and food packaging." Its presence is traced to the bleaching process used in the manufacture of paperboard.[6] Dioxins leak from abandoned dumpsites that contain the manufacturing wastes of a certain **pesticide**, 2,4,5-T.[238] Due to analysis difficulties, dioxin is not routinely analysed in environmental samples. Where there has been reason to conduct the analysis, it has been often found in Washington state **hazardous waste** cleanup sites.[44] It has been found in at least 28 of 1,177 hazardous waste sites on the National Priorities List (NPL). Dioxin can be present in urban soils.[235] It is a by-product and contaminant of the manufacture of many pesticides, among which are 2,4-D and 2,4,6-trichlorophenol. Agent Orange, a pesticide used in the Vietnam war, contained .02 to 54 **g/g** dioxin.

It is estimated that 80 pounds of dioxin yearly are released into the environment nationwide.[7]

Ambient air concentration of dioxin averages 1100 **ppt**. In a 1986 U.S. National Human Adipose Tissue (fat) Survey, dioxin was found in 76 percent of the population sampled, averaging 5 to 6 **ppt**, but sometimes as much as 1100 ppt, in their bodies.[235,242]

See "2,4-D" and "2,4,6-Trichlorophenol." See "More About Pesticides".

HARMFUL EFFECTS AND SYMPTOMS: Routes of harmful **exposure** to dioxin include ingestion, inhalation, and skin contact.[6] Dioxin causes **chloracne**, especially on the face. There is suggested evidence that dioxin causes liver damage, loss of appetite, weight loss, and digestive disorders, but these effects might also have resulted from exposure to the chemicals contaminated by dioxin or the solvents in which they are usually dissolved. In animal studies **immune system** and **reproductive toxicity** (including miscarriages), **carcinogenicity**, and **teratogenicity** have been demonstrated. These effects have occurred from doses as small as one-trillionth of body weight.[235] Symptoms of headache, dizziness, tiredness, blurred vision, abdominal pain, nausea, vomiting, constipation, diarrhea, aches and pains of muscles and joints, nervous system and psychiatric effects, irritation of the essential **enzyme** systems, and loss of libido have also been claimed.[44] Dioxin is a probable carcinogen.[25] A 1988 study of pulp and paper mill workers in New Hampshire shows increased deaths from digestive tract and **lymph** tissue cancer, compared to the United States population as a whole. The study cites similar findings for mill workers in five other studies in the United States and Sweden. Some studies of Vietnam war veterans **exposed** to dioxin as a contaminant of Agent Orange exhibit increased cancer incidence. Those involved in spraying Agent Orange have increased dioxin fat concentrations of 49.4 **ppt** compared to 5.2 ppt in a control group. The **EPA** has concluded that the **epidemiological** data provides limited evidence that exposure to phenoxyacetic acid **herbicides** and/or chlorophenols (which are contaminated with dioxin) causes increased frequency of cancer, but none of the data yet are sufficient to implicate dioxin alone.[235] Dioxin is considered to be of high **toxicity** (3).[5]

There is no information about human **exposure** to dioxin by oral and inhalation exposures. There is some, but not enough information to be conclusive concerning its **acute** and **chronic systemic toxicity, developmental** and **reproductive** toxicity, and **carcinogenecity** by skin exposure. There is no information about levels of exposure causing death and **intermediate systemic** toxicity by skin exposure. In animal studies there are large differences among species in reaction to dioxin, and there is a lack of adequate data describing which species is the most sensitive to dioxin, and which species is most representative of humans. Overall there is not enough information concerning chronic systemic toxicity by oral **exposure**, and levels of exposure causing death, **acute** and intemediate systemic toxicity, and carcinogenicity by skin exposure. There is no information about toxicity by inhalation exposure, or chronic systemic, **developmental**, and reproductive toxicity by skin exposure.[235]

EXPOSURE LIMITS:

ADI .003 **mg/kg/day.**[25]

WATER: Proposed maximum contaminant level in drinking water 0.[25] Lifetime **health advisory** for adult .035 **ppt.**[235] WA groundwater criteria .0000006 μg/l.[8]

See "More About Exposure Limits".

DIPROPYLNITROSAMINE: *see Nitrosamines.*

DISIPTON (tradename): *see Disulfoton.*

DISULFOTON CAS 298-04-4; **molecular weight** 274.38:

SYNONYMS: Phosphorodithoic acid; O-O-diethyl S-[2(ethylio)ethyl] dithiophosphate; O-O-diethyl S-[2-(Ethlio)ethyl]ester; O,O-diethyl S-[2-(Ethlio)ethyl]phophorodithioate.

TRADE NAMES: Ethyliometon B, Di-Syston, Frumin Al, Solvirex, M74, Bayer 19639, Dithiodemeton, Dithiosystox, Frumin G, Thiodemeton, Frumin, Glebofos, Vuagt 1964, Disipton, ENT 23437, Ethyl Thiometon, Vuagt 1-4.

DESCRIPTION: Disulfoton is a pale yellow oil which sinks in water, formulated into various products. It is non**persistent**. Its **half-life** in silt loam soil is 32 days or less.[1] In sunlight its half-life is 2 to 4 days on soil and in surface water. In water its half-life ranges from 13 to 1174 days. It is not very **mobile** in soils. Disulfoton is not **bioaccumulative.**[1]

USES AND SOURCES: Disulfoton is a **systemic pesticide.** It is used on grain crops, cabbage crops, root crops, cotton, strawberry and pineapple, forage, field and vegetable crops, sugarcane, seed crops, forest plantings, ornamentals, and potted plants.’ Its use is restricted to certified applicators.[249]

In a 1988 search in the U.S. EPA STORET Water Quality File, disulfoton has been found in 1 of 368 samples analyzed from 93 surface water locations, in a concentration of .34 **μg/l**. It has been found in none of 1,182 analyzed samples from 1,080 groundwater locations. In monitoring studies conducted in 1973 and 1974, disulfoton was found in average concentrations of 13.8 **ppb** in sediment samples taken from areas receiving irrigation and rainfall runoff water from corn fields where the soil type was silt loam.[99]

See "More About Pesticides".

HARMFUL EFFECTS AND SYMPTOMS: Routes of harmful **exposure** to disulfoton include inhalation, ingestion, and skin contact. Disulfoton will not irritate the skin, but a few drops absorbed through the skin can be fatal. Signs and symptoms of exposure may begin within 30 to 60 minutes and are at a maximum in 2 to 8 hours. Symptoms include headache, dizziness, weakness, anxiety, tremors of the tongue and eyelids, sweating, salivation, tearing, visual distortions, shortness of breath, slow pulse, lack of appetite, abdominal cramps, nausea, vomiting, respiratory difficulty, fever, **pulmonary edema, cyanosis**, convulsions, and loss of consciousness.[1] Signs of **chronic toxicity** may include flu-like symptoms, loss of appetite, weakness, uneasiness, irritability, delayed reaction times, anxiety, slowness of thinking, and memory defects. Disulfoton is a possible **mutagen.**[250] It is considered to be of high **toxicity** (3).[5]

No long-term human studies were found for disulfoton.[99] In 1984 data gaps about disulfoton included **chronic effects, carcinogenic, teratogenic**, and mutation studies.[13]

Disulfoton is harmful to aquatic life, mammals, bees, and birds in very low concentrations.[1]

EXPOSURE LIMITS:

ADI NAS (1977) .0001 **mg/kg/day.** WHO (1976) .002 mg/kg/day.[99]

AIR: **OSHA TWA .1 mg/m^3 (skin).**[1]

INGESTION: TMRC .2544 mg/day. ADI .0025 mg/kg/day.[249]

WATER: DWEL .004 mg/l.

See "More About Exposure Limits".

DI-SYSTON (trade name): *see Disulfoton.*

DITHIOCARBONIC ANHYDRIDE: *see Carbon disulfide.*

DITHIODEMETON (trade name): *see Disulfoton.*

DITHIONIC ACID: *see Sulfuric acid.*

DITHIOSYSTOX (trade name): *see Disulfoton.*

DI-TRAPEX (trade name): *see Dichloropropene.*

DITROSOL (trade name): *see 4,6-Dinitro-o-cresol.*

DIURON CAS 330-54-1; **molecular weight** 233.10:

TRADE NAMES: DCMV, DMV, Krovar II (27%), Karmex (80%), Marmer, Dichlorfenidim, Urox, Vonduron, Dynex, Unidon, Cekiruon, Di-on, Dailon, Diurox, Diater, Diurol, Drexel Diruon 4L.

DESCRIPTION: Diuron is a white crystalline solid, manufactured into various formulations. One source reports that it **persists** 3 to 24 months in soil, with little or no **leaching.**[1] Another source states that it has the potential to leach into groundwater.[99] In water applications, residues on vegetation have persisted 95 days.[1] Degradation of diuron residues is 28 to 50 percent slower in flooded soil than in **aerobic** soil. In one study diuron was detectable, in concentrations of 3 to 74 **ppb** in run-off water sediment and soil samples for up to 3 years after application.[99] Diuron **bioconcentrates** in aquatic organisms that live on the bottom.

USES AND SOURCES: Diuron is a **systemic pesticide** used to control annual grasses, broadleaf weeds in plantings of alfalfa, artichokes, asparagus, barley, bermuda grass pastures, berries, corn, cotton, grapes, grass-seed crops, peppermint, pineapple, sorghum, sugarcane, and winter wheat. It is used on industrial sites, rights-of-way, and irrigation and drainage ditches. Diuron is one of the most commonly used pesticides in western Washington.[31]

In a 1988 search of the U.S. EPA STORET Water Quality File, diuron has been found in none of 25 samples analyzed from 22 surface water locations and in none of 1,337 analyzed samples from 1,292 groundwater locations.[99]

See "More About Pesticides".

HARMFUL EFFECTS AND SYMPTOMS: **Exposure** to diuron may cause skin and eye irritation, abdominal pain, weight loss, liver damage, central nervous system depression, and death by respiratory failure. There is inadequate evidence to determine **carcinogenicity**. Studies thus far indicate that diuron may be a carcinogen and a **mutagen.**[1,99] Diuron is considered to be of high **toxicity** (3).[5]

Diuron is harmful to aquatic life in very low concentrations.[1]

EXPOSURE LIMITS:

ADI .002 **mg/kg/day.**[99]

AIR: OSHA TWA 10 **mg/m^3**.[4]

WATER: DWEL .07 **mg/l.**[99]

INGESTION: **Residue tolerances** .1 to 7 **ppm.**[99]

See "More About Exposure Limits".

DIZENE (trade name): *see 1,2-Dichlorobenzene.*

DMN: *see Nitrosamines.*

DMNA: *see Nitrosamines.*

DMP: *see Dimethyl Phthalate.*

2,4-DMP: *see 2,4-Dimethylphenol.*

DNP: *see 2,4-Dinitrophenol.*

DNT: *see 2,4-Dinitrotoluene.*

2,4-DNT: *see 2,4-Dinitrotoluene.*

2,6-DNT: *see 2,6-Dintirotoluene.*

DNTP (trade name): *see Parathion.*

DORLONE (trade name): *see Propylene dichloride and Dichloropropene.*

DOWCLENE EC (trade name): *see Tetrachloroethylene.*

DOWFUME (trade name): *see Ethylene dichloride.*

DOWFUME 40 (trade name): *see Ethylene dibromide.*

DOWFUME 75 (trade name): 70.2% Ethylene dichloride and 29.8% Carbon tetrachloride, each listed separately.

DOWFUME EB-5 (trade name): 29.2% Ethylene dichloride, 63.6% Carbon tetrachloride, and 7.2% 1,2-Dibromethane, all listed separately.

DOWFUME EB-15 (trade name): 19.65 Ethylene dichloride, 60 % Carbon tetrachloride, and 20.4% 1,2-Dibromomethane, all listed separately.

DOWFUME EDB (trade name): *see Ethylene dibromide.*

DOWFUME MC-2: *see Methyl bromide and/or Ethylene dibromide.*

DOWFUME MC-33: *see Methyl bromide.*

DOWFUME NC (trade name): *see Propylene dichloride and Dichloropropene.*

DOWFUME(W8) (trade name): *see Ethylene dibromide.*

DOWFUME(W10) (trade name): *see Ethylene dibromide.*

DOWFUME(W15) (trade name): *see Ethylene dibromide.*

DOWFUME(W40) (trade name): *see Ethylene dibromide.*

DOWFUME(W85) (trade name): *see Ethylene dibromide.*

DOWICIDE EC-7 (trade name): *see Pentachlorophenol.*

DOWICIDE 2S: *see 2,4,6-Trichlorophenol.*

DOWICIDE-7 (trade name): *see Pentachlorophenol.*

DOWICIDE-G (trade name): *see Pentachlorophenol.*

DOW-PER (trade name): *see Tetrachloroethylene.*

DOWTHERM E (trade name): *see 1,2-Dichlorobenzene.*

DOW-TRI (trade name): *see Trichloroethylene.*

DPN: *see Nitrosamines.*

DPNA: *see Nitrosamines.*

DPP (trade name): *see Parathion.*

DREXEL PARATHION 8E (trade name): *see Parathion.*

DRIPPING ACID: *see Sulfuric acid.*

DUKEROM (trade name): *see Trichloroethylene.*

DU PONT HERBICIDE 976 (trade name): *see Bromacil.*

DURSBAN (trade name): *see Chlorpyrifos.*

DUTCH LIQUID (trade name): *see Ethylene dichloride.*

DYKANOL (trade name): *see PCBs.*

E 1059: *see Systox.*

EB: *see Ethylbenzene.*

(E)-(9CI)1,2-DICHLOROETHENE: *see 1,2-Dichloroethylene.*

(E)-(8CI)1,3-Dichloropropene: *see Dichloropropene.*

(E)-(9CI)1,3-DICHLORO-1-PROPENE: *see Dichloropropene.*

(E)-1,2-DICHLOROETHENE: *see 1,2-Dichloroethylene.*

(E)-1,2-DICHLOROETHYLENE: *see 1,2-Dichloroethylene.*

(E)-1,3-DICHLOROPROPENE: *see Dichloropropene.*

EDC: *see Ethylene dichloride.*

EDB: *see Ethylene dibromide.*

E-D-BEE (trade name): *see Ethylene dibromide.*

EFFUSAN (trade name): *see 4,6-Dinitro-o-cresol.*

ELAOL (trade name): *see N-butyl phthalate.*

ELECTO-CF-11 (trade name): *see Fluorotrichloromethane.*

ELECTRO-CF 12 (trade name): *see Difluorodichloromethane.*

ELGETOL (trade name): *see 4,6-Dinitro-o-cresol.*

EMBAFUME: *see Methyl bromide.*

EMBATHIO (trade name): *see Ethion.*

EMMATOS EXTRA (trade name): *see Malathion.*

ENDOCEL (trade name): *see Endosulfan.*

ENDOSOL (trade name): *see Endosulfan.*

ENDOSULFAN CAS 115-29-7; **molecular weight** 406.95:

TRADE NAMES: OMS 570, HOE 2671, BIO 5462, Thiodan, Malix, SD 4314, Chlorothepin, Endosulpham, Beosit, Cyclodan, Kop-thiodan, Tiovel, Thiorex, Nia 5462, Thifor, Thiosulfan, Tionel, Thimul Thiofur,Thiomul, Benzoepin, FMC 5462, Crisulfan, Endocel, Endosol, Hildan, Thioulfan.

DESCRIPTION: Endosulfan is a tan flammable solid that will sink in bodies of water. It is formulated as dust, **emulsifiable concentrate, wettable powder,** or **granule.** The wettable forms will dissolve. It is **persistent** in the soil for several months to 2 years. In one study of river water samples, 5 percent remained after 2 weeks. Its **half-life** by chemical decomposition is 1 to 6 months, depending on the **pH** (the more acidic the environment, the longer the process). There is **bioconcentration**, but organisms eliminate it rapidly. There is no **food chain contamination** potential.[1]

USES AND SOURCES: Endosulfan is used as a pesticide for fruits, potatoes, peas, ornamentals, cotton, vegetables and tobacco.[1,6] Xylene is often a vehicle for the application of this chemical.[1] Some endosulfan may be contaminated by dioxin.[52]

See "Dioxin" and "Xylene." See "More About Pesticides".

HARMFUL EFFECTS AND SYMPTOMS: Routes of harmful **exposure** to endosulfan include inhalation, by ingestion and by skin contact, especially when endosulfan is dissolved in alcohol or in aromatic solvents like xylene. Symptoms of harmful exposure include headache, restlessness, irritability, nervousness, agitation, central nervous system stimulation, vertigo, stupor, disorientation, difficulty in breathing, tremors, depression, liver and kidney damage, **cyanosis**, foaming at the mouth, convulsions, loss of consciousness, respiratory failure, and death. Endosulfan is a potential **carcinogen**, a possible **mutagen**, and a possible **teratogen.**[1] There are **data gaps** in its reproductive effects, and there is only partial data on its neurological, **chronic**, and mutation effects. Endosulfan is considered to be of high **toxicity** (3).[5]

Endosulfan is harmful to aquatic life in low concentrations.[1]

EXPOSURE LIMITS:

AIR: OSHA TWA **(skin)** .1 **mg/m**^{3}.[4]

WATER: Recommended drinking water limit: 74 **ppb.**[1]

INGESTION: ADI .0075 **mg/kg.**[1] TMRC .62314 mg/day.[258]

See "More About Exposure Limits".

ENDOSULPHAM (trade name): *see Endosulfan.*

ENT 262 (trade name): *see Dimethyl phthalate.*

ENT 1,656 (trade name): *see Ethylene dichloride.*

ENT 1860 (trade name): *see Tetrachloroethylene.*

ENT 4,504 (trade name): *see Dichloroethyl ether.*

ENT 15,108 (trade name): *see Parathion.*

ENT 15,349 (trade name): *see Ethylene dibromide.*

ENT 15,406: *see Propylene dichloride.*

ENT 17034 (trade name): *see Malathion.*

ENT 23437 (trade name): *see Disulfoton.*

ENT 23979 (trade name): *see Endosulfan.*

ENT 24,105 (trade name): *see Ethion.*

ENT 27093 (trade name): *see Aldicarb.*

ENT 27164: *see Carbofuran.*

ENT 27311: *see Chlorpyrifos.*

EO: *see Ethylene oxide.*

EP-201 (trade name): *see Propylene dichloride and Dichloropropene.*

EPN: *see Malathion.*

1,2-EPOXYETHANE: *see Ethylene oxide.*

ESKIMON 11 (trade name): *see Fluorotrichloromethane.*

ESSENCE OF MIRBANE: *see Nitrobenzene.*

ETHANE, 1-(CHLORO-2-(BETA-CHLOROETHOXY): *see Dichloroethyl ether.*

ETHANE DICHLORIDE: *see Ethylene dichloride.*

ETHANE TRICHLORIDE: *see 1,1,2-Trichloroethane.*

ETHANOIC ACID: *see Acetic acid.*

ETHER, BIS(BETA-CHLOROETHYL)ETHER: *see Dichloroethyl ether.*

ETHER, BIS (2-CHLOROETHYL): *see Dichloroethyl ether.*

ETHINYLTRICHLORIDE: *see Trichloroethylene.*

ETHIOLACAR (trade name): *see Malathion.*

ETHION CAS 563-12-2; **molecular weight** 384.48:

SYNONYMS: O,O,O,O-tetraethyl S,S-methylene diphosphorodithioate; Diethion; Ethyl methylene phosphorodithioate; Bis(S-(diethoxyphosphinothioyl)mercapto)methane; S,S-dimethanedithioate O,O-diethyl phosphorodithioate; 0,0,0,0-tetraethyl S,S-methylenebis (dithiophosphate; Tetraethyl S,S-methylene bis(phosphorothiolothionate); O,O,O,O-Tetraethyl S,S-methylene di(phosphorodithioate).

TRADE NAMES: Niagara 1240, Rodocide, Hylemax, Rodocid, Fosfatox E, Phosphotox E, Hylemox, RP 8167, ENT 24,105, Nialate, Vegfru Fosmite, Nia 12 40, AC 3422, Bladan, Embathio, Ethodan, FMC-1240, Fosfono 50 Itopaz, Kwit, Soprathion.

DESCRIPTION: Ethion is a nonflammable colorless to amber, odorless liquid that sinks in bodies of water. Its **half-life** in soil is about 420 days. In one study, 90 percent remained in raw river water samples after 1 week, 75 percent remained after 2 weeks, and 50 percent remained after 4 and 8 weeks. There is **bioconcentration**, but organisms eliminate it rapidly. There is no **food chain contamination** potential.[1]

USES AND SOURCES: Ethion is used as a pesticide, primarily on citrus fruits, deciduous fruits, nuts, and cotton. It is also used as a cattle dip.[1]

See "More About Pesticides".

HARMFUL EFFECTS AND SYMPTOMS: Routes of harmful **exposure** to ethion include inhalation and skin contact. Small doses at frequent intervals have an additive effect. Symptoms of harmful exposure include headaches, weakness, dizziness, salivation, tearing, blurred vision, respiratory difficulty, lack of appetite, abdominal cramps, nausea, vomiting,

pulmonary edema, convulsions, and loss of consciousness. Skin absorption alone may deliver toxic doses.[1] Ethion is considered to be of high **toxicity** (3).[5]

In 1982, **data gaps** existed for ethion concerning its **neurotoxocity, chronic, carcinogenic, teratogenic, reproductive**, and mutation effects.[13]

Ethion is harmful to aquatic life in very low concentrations.[1]

EXPOSURE LIMITS:

AIR: ACGIH TLV TWA **(skin)** .4 **mg/m^3**.[1]

INGESTION: TMRC .773 **mg/day**.[13]

See "More About Exposure Limits".

ETHODAN (trade name): *see Ethion.*

ETHYLBENZENE CAS 100-41-4; **molecular weight** 106.16:

SYNONYMS: Phenylethane, EB.

DESCRIPTION: Ethylbenzene is a colorless liquid that is only slightly soluble in and floats on bodies of water.[1,28] Its **odor threshold** is .25 **ppm**.[1]

USES AND SOURCES: Ethylbenzene is used as a constituent of gasoline, in concentrations of .36 to 2.86 percent by weight. It is used in chemical production, in the plastic and rubber industries, in agricultural sprays for insecticides, and in gasoline blends. It is used as a solvent, as a dilutent in the paint industry.[6,30] Motor vehicle exhaust contains significant quantities.[6]

See "More About Pesticides".

HARMFUL EFFECTS AND SYMPTOMS: Routes of harmful **exposure** to ethylbenzene include diet, inhalation, and skin contact.[1] Symptoms of harmful exposure include skin, throat, nose, and mucous membrane irritation, dizziness, headache, constriction in the chest, nausea, and loss of consciousness. In experimental animals given **acute lethal** doses, death occurred by respiratory failure with congestion of the brain and lungs. No data is available on the **chronic** or the **carcinogenic** effects of ethylbenzene. Liver and kidney damage is likely, since they are the organs that **metabolize** ethylbenzene. **Bioconcentration** data is unknown; however, it is known to **persist** in humans for days after exposure.[6] Ethylbenzene is considered to be of moderate **toxicity** (2).[5]

EXPOSURE LIMITS:

ADI 1.6 **mg/day**.[25]

AIR: OSHA TWA 100 **ppm** (approximately 435 **mg/m^3**).[25]

WATER: Recommended drinking water limit 2 **ppm**.[1]

See "More About Exposure Limits".

ETHYLENE CHLORIDE: *see Ethylene dichloride.*

ETHYLENE DIBROMIDE CAS 106-93-4; **molecular weight** 187.88:

SYNONYMS: EDB; 1,2-Dibromoethane; Ethylene bromide; Dibromoethane; S-dibromoethane; Alpha,beta-dibromoethane; Glycol dibromide; Sym-dibromomethane.

TRADE NAMES: Bromofume, Dowfume 40, Dowfume EDB, Dowfume MC-2, Dowfume(W8), Dowfume(W85), E-D-Bee, ENT 15,349, Dowfume(W10), Dowfume(W15), Dowfume(W40), Fumo-gas, Iscobrome D, Kopfume, Pestmaster, Pestmaster EDB-85, Soilbrom-85, Soilfume, Unifume.

DESCRIPTION: Ethylene dibromide is a colorless liquid that will sink to the bottom in bodies of water and dissolve slowly.[1] It is **persistent** in the soil for at least 20 years.

USES AND SOURCES: Ethylene dibromide was used as a **fumigant** for ground pest control, for strawberries and potatoes, and for grain storage. Its use as a pesticide was suspended in 1983.[6] It continues to be used as an additive of leaded gasoline, in concentrations of .7 to 177.2 **ppm**, and as a solvent for **celluloid**, fats, oils, and waxes. It is used in fire extinguishers, gauge fluids, and waterproofing preparations.[30,64] Ethylene dibromide continues to be used for termite control. It is used for fumigation of storage vaults, beehive supers, and felled logs. Ethylene dibromide is commonly encountered at **hazardous waste** cleanup sites in Washington state.[44]

Exposure to this compound often includes exposure to propylene dichloride and dichloropropene.[1]

In 1984 use of ethylene dibroimide amounted to 200,000 pounds.

See "propylene dichloride" and "dichloropropene". See "More About Pesticides".

HARMFUL EFFECTS AND SYMPTOMS: Routes of harmful **exposure** to ethylene dibrmoide include inhalation, diet, and skin contact. It can permeate most protective clothing, rubber and plastic as well.[1] Inhalation of the vapor may result in pink eye, headache, loss of appetite, vomiting, **acute** respiratory injury, kidney and liver injury, damage to the **circulatory system**, and central nervous system depression.[1,44] It is a **mutagen**, a possible **teratogen**, and a suspected **carcinogen**.[1,28] Ethylene dibromide is considered to be of high **toxicity** (3).[261]

There were **data gaps** in 1986 in its **chronic**, reproductive, and **teratogenic** effects, with possible adverse effects indicated in chromosome and DNA alteration.[5]

Ethylene dibromide is harmful to aquatic life in very low concentrations.[261]

EXPOSURE LIMITS:

AIR: OSHA TWA 20 **ppm**.[1]

WATER: WA groundwater criteria .001 μg/l.[1]

See "More About Exposure Limits".

ETHYLENE DICHLORIDE CAS 107-06-2; **molecular weight** 98.96:

SYNONYMS: Ethylene chloride; S-dichloroethane; Alpha, beta-dichloride; Ethane dichloride; Dichloro-1,2-ethane; Ethylidene chloride; 1,2-Dichloroethane; EDC; glycol dichloride.

TRADE NAMES: Brocide, Destruxol borer sol, Di-chlor-mulsion, Dutch liquid, ENT 1,656, NCI-COO511, Borer sol, Dowfume.

DESCRIPTION: Ethylene dichloride is a colorless flammable liquid that sinks in and dissolves slowly with water. Its highly **toxic** vapors hug the ground. Its chloroform-like odor is perceptible at a range of 20 to 100 **ppm**. Its **half-life** in water by evaporation is 30 minutes. There is little **bioaccumulation** in mammals, due to rapid elimination through the lungs and urine. Ethylene dichloride is **synergistic** when **exposure** occurs to propylene dichloride and o-dichlorobenzene as well.[8]

See "Propylene dichloride" and "Dichlorobenzene".

See "Propylene dichloride" and "Dichlorobenzene".

USES AND SOURCES: Ethylene dichloride is a chlorinated hydrocarbon used in making paints, coatings, adhesives, pharmaceuticals, color film, and cosmetics. It is used in photography, in the processing of animal fats, in dry-cleaning, in copper extraction from its ores, and in the production of vinyl chloride, methyl chloroform, trichloroethylene, perchloroethylene, ethylene **amines**, and polysulfide compounds. It is used for varnishing. Ethylene dichloride is used as a gasoline additive, in concentrations of 150 to 300 **ppm**. It is used as an extraction agent for caffeine, and as a formulation ingredient for grain **fumigants** and insecticides.[1,30] Its use as a **pesticide** was banned in 1986. Ethylene dichloride is found at illegal drug laboratory **hazardous waste** sites, where LSD has been processed.[2]

In 1986 12.9 billion pounds of ethylene dichloride were produced, 104.7 million pounds imported and 583 million pounds exported.[7]

In a survey, 25 percent of surface water samples near heavily industrialized areas contained ethylene dichloride, from 1 to 90 **ppb**.[7]

See "Vinyl chloride", "Methylchloroform", "Trichloroethylene", and "Perchloroethylene. "See "More About Pesticides".

HARMFUL EFFECTS AND SYMPTOMS: Routes of harmful **exposure** to ethylene dichloride include diet, inhalation, and skin contact, including through rubber protective gear. Symptoms of **acute** exposure (75 to 125 **ppm**) include a lingering metallic taste, malaise, fatigue, dizziness, confusion, headache, gastro-intestinal upset, nausea, vomiting, diarrhea, jaundice, central nervous system depression, **pulmonary edema**, internal bleeding, low blood sugar, low platelet count, convulsions, and **circulatory** and respiratory failure. Symptoms of **chronic** poisoning, lower than 25 **ppm**, may include tremors, loss of appetite, nausea, vomiting, and low blood sugar levels. Kidney, lungs, blood, bone marrow, and liver damage have been recognized.[1,262] Ethylene dichloride is a possible **carcinogen** and **mutagen**, and a **teratogen.**[1,25] Ethylene dichloride is considered to be of high **toxicity** (3).[5]

Ethylene dichloride is dangerous to aquatic life in high concentrations.[1]

EXPOSURE LIMITS:

AIR: OSHA TWA 1 **ppm** (approximately 4 **mg/m^3**).[4]

WATER: Due to the potential **carcinogenic** effect of ethylene dichloride, its concentration should be zero. If this level is not attainable, levels which raise the human lifetime cancer risk to

one in ten thousand = 9.400 **ppb**;
one in one million = 0.940 ppb;
one in ten million = 0.094 ppb.

There is insufficient data to establish a **chronic** aquatic **toxicity** limit, but ethylene dichloride is still toxic chronically in freshwater at 118 **ppm.**[1] WA groundwater criteria: 0.5 µg/l.[8]

See "More About Exposure Limits".

ETHYLENE MONOCHLORIDE: *see Vinyl chloride.*

1,8-ETHYLENENAPTHALENE: *see PAHs.*

ETHYLENE OXIDE CAS 75-21-8; **molecular weight** 44.65.

SYNONYMS: Anprolene, Dihydrooxirene, EO, ETO, Oxane, Oxacyclopropane, Oxidoethane, Alpha,beta-oxidoethane, Oxiran, Oxirane, Dimethylene oxide, 1,2-epoxy ethane.

TRADE NAMES: ETOX.

DESCRIPTION: Ethylene oxide is a very flammable colorless solution or gas that dissolves in water. Its ether odor is perceptible at a range of 50 to 700 **ppm.**[1,28] There is no **bioaccumulation.**[1]

USES AND SOURCES: Ethylene oxide is used in processing foodstuffs and textiles. It is used as a **fumigant** and a **fungicide.** Ethylene oxide is used to sterilize surgical equipment (about .24 percent of use). It is used in chemical production, and in making drugs.[1,28]

In 1981 5.11 billion pounds of ethylene oxide were produced.

NIOSH reports that between 75,000 and 100,000 health care workers are potentially **exposed** to ethylene oxide annually.[28]

See "More About Pesticides".

HARMFUL EFFECTS AND SYMPTOMS: Routes of harmful **exposure** to ethylene oxide include inhalation, ingestion, and skin contact. Symptoms of harmful exposure include eye, nose, and throat burns and irritation, **pulmonary edema**, nausea, and vomiting.[1] Studies with laboratory animals suggest that exposure to short bursts of gas, rather than low levels over long periods may result in more severe genetic damage. It is a probable **carcinogen (B)** and **mutagen.**[1] Ethylene oxide is considered to be of high **toxicity** (3).[5]

The effect of ethylene oxide on aquatic life is unknown.[1]

EXPOSURE LIMITS:

AIR: ACGIH TLV-TWA 1 **ppm** (approximately 2 **mg/m^3**).[4]

See "More About Exposure Limits."

ETHYLENE TETRACHLORIDE: *see Tetrachloroethylene.*

ETHYLENE TRICHLORIDE: *see Trichloroethylene.*

ETHYLIDENE CHLORIDE: *see Ethylene dichloride.*

ETHYLMETHYLENE PHOSPHORODITHIOATE: *see Ethion.*

ETHYL METHYL KETONE: *see Methyl ethyl ketone.*

ETHYL PARATHION: *see Parathion.*

ETHYL THIOMETON (trade name): *see Disulfoton.*

ETHYLTHIOMETON B (trade name): *see Disulfoton.*

ETO: *see Ethylene oxide.*

ETOX (trade name): *see Ethylene oxide.*

EXAGAMA (trade name): *see Lindane.*

EXO-DIELDRIN: *see Dieldrin.*

F-11 (trade name): *see Fluorotrichloromethane.*

F-12 (trade name): *see Dichlorodifluoromethane.*

FANNOFORM (trade name): *see Formaldehyde.*

FASCIOLIN (trade name): *see Carbon tetrachoride.*

FC-11 (trade name): *see Fluorotrichloromethane.*

FC 12 (trade name): *see Dichlorodifluoromethane.*

FEDAL-UN (trade name): *see Tetrachloroethylene.*

FENCLOR (trade name): *see PCBs.*

FENVALERATE CAS 51630-58-1; **molecular weight** 419.92:

TRADE NAMES: Ectrin, Pydrin, Sumicidin, Blockade, Tribute, Evercide.

DESCRIPTION: Fenvalerate is a clear viscous yellow liquid, formulated as **emulsifiable concentrates**, and ready to use liquids and concentrates. In sunlit water its **half-life** is 41 days. In surface (**aerobic**) soil its half-life ranges from 65 days to 8 months, and in subsurface (**anaerobic**) soil its half-life is 6 months. It is not very **mobile** in soils. Fenvalerate **bioaccumulates** in fish, with slow elimination of the chemical.

USES AND SOURCES: Fenvalerate is a pesticide used on animals. It is also used on crops like cotton, soybeans, corn, vegetables, apples, peaches, pears, and nuts.[263] It is used in and around commercial and residential areas such as hospitals, supermarkets, motels, hotels, homes, buses, boats, ships, trains, airplanes, utilities, food processing plants, and restaurants. Fenvalerate is used to control termites, cockroaches, crickets, and ticks.

See "More About Pesticides".

HARMFUL EFFECTS AND SYMPTOMS: Symptoms of harmful **exposure** to fenvalerate include itchy, burning skin, sneezing, runny nose, cough, difficult breathing, eye irritation, and tingling and burning sensations in the hands and face which recede within 24 hours.[263] It appears to not be **carcinogenic** or **mutagenic**.[265] Fenvalerate is considered to be of high **toxicity** (3).[5]

Fenvalerate is extremely toxic to bees and fish.[263] Data is lacking concerning its effects on aquatic invertebrates.[265]

EXPOSURE LIMITS:

ADI .025 mg/kg/day.[265]

See "More About Exposure Limits."

FERMINE (trade name): *see Dimethyl phthalate.*

FERTILIZER ACID: *see Sulfuric acid.*

FLECK-FLIP (trade name): *see Trichloroethylene.*

FLOCK-FLIP (trade name): *see Trichloroethylene.*

FLUKOIDS (trade name): *see Carbon tetrachloride.*

FLUORANTHENE: *see PAHs.*

FLUATE (trade name): *see Trichloroethylene.*

FLUORIDES CAS 16984-48-8; Chemical Symbol: Fl

USES AND SOURCES: Fluoride compounds are used as pesticides.

In a 1984 survey of 40 groundwater contaminants in 2,654 households representative of rural populations in the United States, fluoride was found in 1,000 to 2,000 supplies in excess of the EPA drinking water standard. Natural causes may be responsible, as well as human sources.

Suggested daily intake infants .6 mg, children 1 mg, adults 2.7 mg. Average intake of fluoride concentrations by infants is .24 mg, for children is .062 mg, and for adults is .042 mg daily.[42]

See "More About Pesticides".

HARMFUL EFFECTS AND SYMPTOMS: Over 60 percent of ingested fluorides is retained. **Chronic exposure** to fluorides (by ingestion, 20 to 80 **mg/day**, and by inhalation 2.4 to 6 **mg/m^3**) have resulted in crippling and disablement within 10 to 20 years.[28] Fluorides are considered to be of high **toxicity** (3).[5]

EXPOSURE LIMITS:

AIR: ACGIH TLV-TWA 2.5 **mg/m^3**.[28]

WATER: Drinking water ADI's for children 1 mg, and for adults 2 mg.[42] WA groundwater criteria 4 **mg/l**.[8]

See "More About Exposure Limits."

FLUOROCARBON 11 (trade name): *see Fluorotrichloromethane.*

FLUOROCARBON 12 (trade name): *see Dichlorodifluoromethane.*

FLUOROTRICHLOROMETHANE CAS 75-69-4; **molecular weight** 137.38:

SYNONYMS: Trichlorofluoromethane, Trichloromonofluoromethane.

TRADE NAMES: Fluorocarbon 11, Freon, Freon-11, Arcton-9, Frigen-11, Genetron, Genetron 11, Isotron, Isotron 11, Racon, Ucon, Ucon Fluorocarbon 11, Ucon Refrigerant 11, Algofrene Type 1, F-11, Electro-CF-11, Eskimon 11, FC-11, Isceon 131, Isotron 11, Ledon 11.

DESCRIPTION: Fluorotrichloromethane, as a liquid, is colorless and odorless. It is insoluble and sinks in water. Fluorotrichloromethane dissipates easily from water through evaporation. If it cannot evaporate, it is likely to **bioaccumulate**. Its **half-life** in the atmosphere is 15 to 30 years.[99] As a gas it migrates to the stratosphere.[6]

USES AND SOURCES: Fluorotrichloromethane is used as a refrigerant gas, an aerosol propellant, a solvent, a fire extinguisher ingredient, a chemical intermediate, and a **blowing agent**. It is used in air conditioning. This compound may be the most widely used propellant.[1,6]

Concentrations of chlorofluorocarbons (CFCs), of which fluorotrichloromethane is one, in the atmosphere are increasing at about 5 percent per year.[46]

HARMFUL EFFECTS AND SYMPTOMS: Routes of harmful **exposure** to fluorotrichloromethane include inhalation, diet and skin contact. Direct contact causes mild skin irritation.[1] Exposure to high concentrations (8 percent concentration) causes **narcosis**, anesthesia, confusion, lung irritation, and tremor. Loss of consciousness may occur at 9 percent concentration.[1,6] Symptoms at 10 percent concentration include incoherence, skin problems, frostbite, irregular heartbeat, and heart attack. Degradation products of fluorotrichloromethane accumulate in the liver.[1] There is no evidence for **mutagenicity** or **carcinogenicity** from direct exposure, and very little data on prolonged exposures.[6] Fluorotrichloromethane is considered to be of high **toxicity** (3).[5]

Fluorotrichloromethane is not harmful to aquatic life.[1] In the stratosphere it may affect the ozone. Ozone, the major component of smog, is undesirable near the earth's surface, but its presence in the stratosphere serves to reduce the amount of ultraviolet light reaching the earth's surface. The ozone layer protects people from skin cancer and other harmful effects, such as reduced agricultural and marine productivity.[47]

Chlorofluorocarbons (CFCs), of which fluorotrichloromethane is one, is estimated to contribute significantly to the possibility of the "greenhouse effect."[228]

See "carbon dioxide."

EXPOSURE LIMITS:

ADI 32.3 **mg/kg.**[1]

AIR: OSHA PEL 1000 **ppm** (approximately 5600 **mg/m^3**).[4]

See "More About Exposure Limits."

FLUTOIDS (trade name): *see Carbon tetrachloride.*

FMC 1240 (trade name): *see Ethion.*

FMC 5462 (trade name): *see Endosulfan.*

FOG 3 (trade name): *see Malathion.*

FOLIDOL (trade name): *see Parathion.*

FORMAL (trade name): *see Formaldehyde and/or Malathion.*

FORMALDEHYDE CAS 50-00-0:

SYNONYMS: Methanal, Oxymethane, Methylin oxide, Methyl aldehyde, Oxymethylene, Formic aldehyde, Formalin.

TRADE NAMES: BFV, Fannoform, Formalith, Formal, Fyde, Ivalon, Karsan, Lysoform, Morbbicid, Paraform, Super Lysoform.

DESCRIPTION: Formaldehyde is a colorless moderately flammable liquid that will dissolve in water. Its pungent hay or straw odor is perceptible at .1 **ppm.** Formaldehyde biodegrades quite rapidly.[1]

USES AND SOURCES: Formaldehyde is used to make plastics, plywood, foam insulation products, textiles, embalming fluids, room deodorants, glass, mirrors, explosives, medicine, resins, laminates, paints, paper, dyes, adhesives, moldings, rubber, and cosmetics. It is used as a disinfectant, as a **fungicide**, as a reducing agent, as a preservative, and as a hardening agent. Formaldehyde is used in organic synthesis, in tanning, in photography, in fertilizer, in detergents, and in fuel.[1] It is found at illegal drug laboratory **hazardous waste** sites, where the drug methylamine has been processed.[2] Formaldehyde is a component of tobacco smoke, at 20 to 250 **ppm** per cigarette.[3]

Exposure to formaldehyde often includes other chemical exposures. Formaldehyde is used in 4 formulations of atrazine. It is a degradation product in water of glyphosate.[145] Formaldehyde is an atmospheric degradation product of vinylidene chloride.[1] Emissions of carbon monoxide occur during the formaldehyde manufacturing process.[64]

In 1987 6.1 billion pounds of formaldehyde (37 percent pure by weight) were produced.[7] Automobile emissions amount to 610 million pounds annually.[145]

Formaldehyde **exposure** is widespread. People with higher levels of exposure include those who work with it. NIOSH estimates that 8,000 workers nationwide are exposed to formaldehyde.

OSHA estimates that 2.6 million workers nationwide are exposed to formaldehyde. The National Occupational Hazard Survey estimates 57,000 full-time workers and 1.7 million part-time workers nationwide are exposed to formaldehyde. Other exposed people include the 27.7 million people living within 12.5 miles of an industrial source. Another population, the 2 million people living in mobile homes containing particle board and plywood may be **exposed** to concentrations of formaldehyde ranging from .01 to 3 **ppm**. The 1.7 million people living in conventional homes insulated with **urea-formaldehyde** foam may be exposed to concentrations from .37 to .55 **ppm**). Ambient air concentrations range from .001 to .16 **ppm**.[1]

See "Atrazine", "Carbon monoxide", "Glyphosate", and "Vinylidene chloride". See "More About Pesticides".

HARMFUL EFFECTS AND SYMPTOMS: Formaldehyde by inhalation irritates the eyes, at .25 **ppm**, irritates the nose and throat, causes tearing, headache, dizziness, coughing, at 4 to 10 **ppm**, tightness in chest, nosebleeds, swollen glands, skin lesions, and bloating.[1] If it is ingested, nausea and vomiting result. Severe symptoms include abdominal pain, diarrhea, vertigo, loss of consciousness, and death by **pulmonary edema**. It is a probable **carcinogen** and a possible **mutagen**. There is inadequate information about **teratogenicity**, and there are adverse effects indicated in the reproductive processes.[1] Formaldehyde is considered to be of high **toxicity** (3).[5]

EXPOSURE LIMITS:

AIR: ACGIH TLV-TWA 1 **ppm** (approximately 1.5 **mg/m^3**).[28]

See "More About Exposure Limits."

FORMALIN: *see Formaldehyde.*

FORMALITH (trade name): *see Formaldehyde.*

FORMIC ALDEHYDE (trade name): *see Formaldehyde.*

FORMYL TRIBROMIDE: *see Bromoform.*

FORMYL TRICHLORIDE: *see Chloroform.*

FOSFATOX E (trade name): *see Ethion.*

FOSFERNO 50 (trade name): *see Parathion.*

FOSFONO 50 (trade name): *see Ethion.*

FOSFOTHION (trade name): *see Malathion.*

FREON (trade name): *see Fluorotrichloromethane.*

FREON 10 (trade name): *see Carbon tetrachloride.*

FREON 11 (trade name): *see Fluorotrichloromethane.*

FREON 12 (trade name): *see Dichlorodifluoromethane.*

FREON 30: *see Methylene chloride.*

FREON F-12 (trade name): *see Dichlorodifluoromethane.*

FREON 20 (trade name): *see Chloroform.*

FRIGEN-11 (trade name): *see Fluorotrichloromethane.*

FRIGEN 12 (trade name): *see Dichlorodifluoromethane.*

FRUMIN (trade name): *see Disulfoton.*

FRUMIN AL (trade name): *see Disulfoton.*

FRUMIN G (trade name): *see Disulfoton.*

FUEL OIL: *see Kerosene.*

FUMIGRAIN (trade name): *see Acrylonitrile.*

FUMO-GAS (trade name): *see Ethylene dibromide.*

FURADAN (trade name): *see Carbofuran.*

FYDE (trade name): *see Formaldehyde.*

FYFANON (trade name): *see Malathion.*

G27692: *see Simazine.*

GASATOP (trade name): *see Simazine.*

GASOLINE CAS 8006-61-9; average **molecular weight** 72.5:

SYNONYMS: Petrol.

DESCRIPTION: Gasoline is a flammable clear, amber fluid that floats on water. Its characteristic odor is perceptible at .01 **ppm**. There is no **bioaccumulation** except for the lead. Gasoline may be **synergistic** with **pesticides**, for which it may be used as a **carrier**.[1]

See "More About Pesticides."

USES AND SOURCES: Gasoline is used as a fuel, a solvent, and a diluent.[1] It is a commonly encountered toxicant at **hazardous waste** cleanup sites in Washington state.[44] Gasoline may be used as a **carrier** for **pesticides**.[1] Chemicals that are constituents or additives of gasoline include benzene (.12 to 3.5 percent by weight), toluene (2.73 to 21.80 percent by weight), xylene (3.22 to 8.31 percent by weight), ethylbenzene (.36 to 2.86 percent by weight), naphthalene (.09 to .49 percent by weight), other polynuclear aromatic hydrocarbons, cadmium (.01 to .07 **g/g**), chlorine (80 to 300 g/g), lead (520 to 1120 g/g), sulfur (.10 to .15 percent by weight), ethylene dibromide (.7 to 177.2 **ppm**), and ethylene dichloride (150 to 300 **ppm**).[30]

See "Benzene", "Cadmium", "Chlorine", "Ethylbenzene", "Ethylene dibromide", "Ethylene dichloride", "Lead", "Naphthalene", "PAHs", "Sulfur", "Toluene", and "Xylene". See "More About Pesticides."

HARMFUL EFFECTS AND SYMPTOMS: Harmful **exposure** to gasoline may occur by inhalation or ingestion. The taste and odor of gasoline are recognizable before **toxic** levels of exposure are reached. Symptoms of harmful exposure include irritated eyes, nose, and throat (at 160 to 270 **ppm** within several hours), dizziness (at 500 to 900 **ppm** within 1 hour), headache, flushing of the face, difficult breathing, staggering gait, slurred speech, mental confusion (at 2000 **ppm** within 30 minutes), central nervous system depression, liver, kidney, pancreas, and spleen damage, loss of consciousness, and death due to respiratory failure.[1] Gasoline is considered to be of high **toxicity** (3).[5]

EXPOSURE LIMITS:

AIR: ACGIH TWA 300 **ppm** (approximately 900 **mg/m**^{3}).[28]

See "More About Exposure Limits".

GEMALGENE (trade name): *see Trichloroethylene.*

GENOPLAST B (trade name): *see N-butyl phthalate.*

GENETRON (trade name): *see Fluorotrichloromethane.*

GENETRON 11 (trade name): *see Fluorotrichloromethane.*

GENETRON 12 (trade name): *see Dichlorodifluoromethane.*

GENIPHENE: *see Toxaphene.*

GENITHION (trade name): *see Parathion.*

GERMALGENE (trade name): *see Trichloroethylene.*

GESAFRAM-50 (trade name): *see Prometon.*

GESAPRIM (trade name): *see Atrazine.*

GESATOP: *see Simazine.*

GLACIAL ACETIC ACID: *see Acetic acid.*

GLEBOFOS (trade name): *see Disulfoton.*

GLUCINIUM: *see Beryllium.*

GLUCINUM: *see Glucinum.*

GLYCOL DIBROMIDE: *see Ethylene dibromide.*

GLYCOL DICHLORIDE: *see Ethylene dichloride.*

GLYPHOSATE CAS 1071-83-6; **molecular weight** 169.07:

TRADE NAMES: Roundup, Rodeo, Accord, Kleen-up, Doomsday.

DESCRIPTION: Glyphosate is a white, crystalline solid. In soils its **half-life** is 3 to 130 days. Its **half-life** in water is 7 to 10 weeks. Its half-life in plants is at least 90 days. It is not very **mobile** in soils.

N-nitrosoglyphosate, a member of the **carcinogenic** chemical family nitrosamines, may be either a trace contaminant of glyphosate, or it may be a breakdown product where glyphosate contacts nitrites in either fertilizer or in the digestive system. In water, one of the chemicals into which glyphosate breaks down is formaldehyde.

Environmental fate studies which have not been completed for glyphosate include movement, **persistence**, and accumulation of glyphosate in water, soil, air, fish, irrigated crops, aquatic systems, and forests.

See "Formaldehyde", and "Nitrosamines."

USES AND SOURCES: Glyphosate is a systemic **herbicide** used to control grasses, broad leafed weeds, and woody brush.[270] It is one of the most commonly used pesticides in western Washington.[31]

In a 1988 search of the U.S. **EPA** STORET Water Quality File, glyphosate has been found in none of 6 samples analyzed from 3 surface water locations and in none of 98 analyzed samples from 97 groundwater locations.[99]

People applying glyphosate with backpack applicators intake an average of .25 to 10 **mg/kg/day.**[271]

See "More About Pesticides".

HARMFUL EFFECTS AND SYMPTOMS: Routes of harmful **exposure** to glyphosate include inhalation, ingestion, and skin contact. Symptoms of harmful exposure include irritated skin and mucous membranes, runny nose, pink eye, swelling of hands and feet, headache, abdominal pain, lack of appetite, vomiting, bleeding in the stomach, diarrhea, **pulmonary edema**, pneumonia, and seizures. Glyphosate is not a **mutagen.**[271] There is a lack of data concerning **neurotoxicity, immunotoxicity, carcinogenicity, chronic** toxicity, and **metabolism**, with adverse effects indicated so far in carcinogenicity and DNA damage.[271,274] Glyphosate is considered to be of high **toxicity** (3).[5]

The **surfactant** in Roundup, POEA, may be more **toxic** than glyphosate itself. It belongs to a class of compounds that have been reported to cause gastrointestinal, spermicidal, and central nervous system symptoms.

EXPOSURE LIMITS:

ADI .1 **mg/kg/day**.[271]

WATER: Recommended drinking water limit .1 **mg/kg/day**.[270]

INGESTION: Food **tolerance** .1 **ppm**.[270]

See "More About Exposure Limits".

GRANOX: *see Hexachlorobenzene.*

GRANOX NM (trade name): *see Hexachlorobenzene.*

GREEN OIL: *see PAHs.*

GUSATHION: *see Guthion.*

GUSATHION-B (trade name): *see Guthion.*

GUTHION CAS 86-50-0:

SYNONYMS: Gusathion; Azinphos methyl; Bayer-17147; DBD; Methylguthion; Phosphorodithioic acid-O-dimethyl **ester**; S-ester-with-3(mercaptomethyl)-1,2,3-benzotriazin-4 (3H)-one; 1,1-Dimethyl-S-(4-oxobenzotriazino-3-methyl)phosphorodithioate.

TRADE NAMES: Bayer-9027, Azinphosmethyl, Gusathion-B.

DESCRIPTION: Guthion is a brown waxy solid or a white powder, processed into various formulations.[1] It will sink in water and dissolve very slowly. The **half-life** of the spray and dust is 2 to 4 days on cotton leaves. Its half-life in water by chemical decomposition is 10.4 hours.[1] Another study reports that its half-life in water is 1 month. Some studies showed that it lasts in soil 21 to 68 days, and in others soil residues of guthion were still detectable after 8 years. It is not very **mobile** in soils. There is not much **leaching**.

USES AND SOURCES: Guthion is a **systemic pesticide** of which 3 million pounds is used annually. Thirty-four percent is used on cotton, 24 percent on orchards, and the rest on tobacco, fruits, vegetables, nuts, forests, graincrops, and ornamentals.[1,263,277]

Farm workers, spray machinery operators, and formulation workers are likely to receive intakes of guthion amounting to 10 **mg**/hour by skin and .56 mg/hour by inhalation. Fruit tree sprayers receive intakes of guthion of 10 to 700 mg/hour by skin and .04 to .54 mg/hour by inhalation.[276]

EPA establishes the re-entry interval into fields after spraying. For guthion this interval on all crops is 24 hours, with specific exceptions of 2 and 7 days. One study reports that 22 individuals became ill after re-entering a peach orchard which had been sprayed 38 to 47 days previously.

See "More About Pesticides".

HARMFUL EFFECTS AND SYMPTOMS: Guthion as a dust irritates the eyes. If it is inhaled or ingested, symptoms may include sweating, weakness, constriction of the pupils, salivation, cramps, lack of appetite, nausea, vomiting, diarrhea, low blood pressure, wheezing, coughing, respiratory difficulties, asthmatic symptoms, twitching, **cyanosis**, paralysis, convulsions, heart problems, and collapse.[258] Guthion accumulates in the liver very rapidly.[1] It is considered to be of high **toxicity** (3).[5]

Data gaps for guthion include information on skin and eye irritation, **acute** inhalation, **metabolism**, teratology, reproduction, and **mutagenicity**.[277]

Guthion is harmful to aquatic life in very low concentrations.[1]

EXPOSURE LIMITS:

ADI (WHO) .0025 **mg/kg**.[276]

AIR: ACGIH TWA .2 **mg/m^3** **(skin)**.[1]

WATER: Recommended drinking water limit .1 **ppm**.[1]

INGESTION: TMRC .6678 **mg**/1.5 kg diet.[277]

See "More About Exposure Limits".

HALON (trade name): *see Dichlorodifluoromethane.*

HALON 104 (trade name): *see Carbon tetrachloride.*

HALON 122 (trade name): *see Dichlorodifluoromethane.*

HCB: *see Hexachlorobenzene.*

HEDOLIT (trade name): *see 4,6-Dinitro-o-cresol.*

HEDOLITE (trade name): *see 4,6-Dinitro-o-cresol.*

HEDONAL: *see 2,4-D.*

HEPTACHLOR: *see Chlordane.*

HEXACHLOROBENZENE CAS 118-74-1; **molecular weight** 284.80:

SYNONYMS: HCB; Granox; Perchlorobenzene; Pentachlorophenyl chloride.

TRADE NAMES: Amatin, Anticaries, Bunt-cure, Bunt-no-more, Co-op Hexa, Granox NM, Julin's Carbon Chloride, No Bunt, No Bunt 40, No Bunt 80, No Bunt Liquid, Sanocide, Snieciotox; Ortho HCB 4 Flowable Seed Protectant: 40% HCB; Ortho Wheat Seed Protectant: HCB: 40%, Captan 40%; Ortho Wheat Seed Protectant Flowable: HCB 18%, Captan 18%; impurity in production of Dacthal, Mirex, Simazine, Atrazine, Propazine, Pentachloronitrobenzene.

DESCRIPTION: Hexachlorobenzene consists of white pale yellow needles that will sink to the bottom in bodies of water. It is very **persistent** in soils, sediments, and aquatic systems. Its **half-life** in soil is 4 years. In river water its half-life ranges from 1 to 50 days. In ground water its half-life ranges from 30 to 300 days. Hexachlorobenzene is **immobile** in soils. There is **bioaccumulation**.[1] Residues of hexachlorobenzene in river water average from 2 to 90 2 8mg/l Soil residues average 1700 **g/kg** or less.[7]

USES AND SOURCES: Hexachlorobenzene is used as a **fungicide**, in dye manufacturing, to make **organic** compounds such as pentachlorophenol, as a solvent, a degreasing agent, and a cutting fluid.[6,263] It was registered until 1985 as a seed treatment pesticide.[1]

Eight and a half million pounds of hexachlorobenzene wastes are produced annually.[7]

Hexachlorobenzene is widespread in the environment.[1] Airborne emissions amount to 46.3 to 63.9 thousand pounds, generated from **pesticide** use and manufacture of chlorinated solvents.[7]

It is estimated that 95 percent of the U.S. population **carries** trace amounts of hexachlorobenzene. Average daily intake in the diet range from .006 to .04 **mg/kg**.[7] Human milk contains hexachlorobenzene. Infants may be **exposed** to relatively high concentrations from that source alone.[1]

Hexachlorobenzene is a degradation product of a number of pesticides, including pentachlorophenol and aldrin.[1]

See "Aldrin" and "Pentachlorophenol." See "More About Pesticides".

HARMFUL EFFECTS AND SYMPTOMS: Routes of harmful **exposure** to hexachlorobenzene include ingestion, inhalation, and skin contact.[6] Symptoms of harmful exposure include drowsiness, irritation to the eyes, respiratory tract, mucous membranes, and skin, loss of coordination and loss of consciousness.[1,6] In laboratory animals, hexachlorobenzene concentrates in fatty tissue, bone marrow, the **lymph** nodes, milk, and the adrenals, with concentration levels 2 to 5.5 times higher for babies than adults.[1] Laboratory animal studies indicate that **chronic exposure** may cause liver, kidney and lung damage.[6] Hexachlorobenzene is a possible **carcinogen** and is **fetotoxic**. It is neither a **mutagen** nor a **teratogen**.[1,6,25] Hexachlorobenzene is considered to be of high **toxicity** (3).[5]

EXPOSURE LIMITS:

ADI .04 to .07 **g/day**.[7]

WATER: Due to the potential **carcinogenic** effect of hexachlorobenzene, its concentration should be zero. If this level is not attainable, levels which raise the human lifetime cancer risk to

one in ten thousand = 7.200 **ppt**;
one in one million = .720 ppt;
one in ten million = .072 ppt.[1]

WA groundwater criteria .05 **μg/l**.[83]

See "More About Exposure Limits."

1,2,3,4,7,7-HEXACHLOROBICYCLO[2.2.1]HEPTEN-5-6-BISOXYMETHYLENESULITE: *see Endosulfan.*

HEXACHLOROBUTADIENE CAS 87-68-3; **molecular weight** 260.76:

SYNONYMS: HCBD; Hexachloro-1,3-butadiene; Perchlorobutadiene; 1,1,2,3,4,4-hexachloro-1,3-butadiene; C-46.

DESCRIPTION: Hexachlorobutadiene is a clear liquid that is insoluble in water.[1,28] Its faint, turpentine-like odor is perceptable at .006 **ppm**. Its **half-life** in soil is 3 years. In river water its half-life is 3 to 30 days, and in ground and lake water is 30 to 300 days. In the air its half-life is 1 week.[1] Hexachlorobutadiene readily sorbs onto soil and the sediment of contaminated water.[6] Not much plant uptake has been observed.[1] Freshwater organisms tend to **bioconcentrate** hexachlorobutadiene more than saltwater organisms.[6]

USES AND SOURCES: Hexachlorobutadiene is used as an insecticide, a **herbicide**, as a solvent for many **organic** substances, as an intermediate in the manufacture of rubber compounds and lubricants, as a fluid for gyroscopes, and as an additive for transformer oils. Hexachlorobutadiene has not been produced in the U.S. since 1970.[1,6] It is a significant by-product in the manufacture of chlorinated hydrocarbons, including perchloroethylene, trichloroethylene, carbon tetrachloride, and chlorine.[1,6]

The highest concentrations of hexachlorobutadiene in the environment are found in the vicinities of chlorinated hydrocarbon industries. In one study traces of hexachlorobutadiene was found in 34 percent of fish samples, at a range of .010 to 1.20 **mg/kg**, and in 5 percent of milk samples, at 1.32 **mg/l**, in a 25 mile radius of a perchlorethylene plant.[1]

See "Carbon tetrachloride," "Chlorine,", "Perchloroethylene," and "Trichloroethylene." See "More About Pesticides".

HARMFUL EFFECTS AND SYMPTOMS: There is little data concerning the subacute, **acute**, and **chronic toxicity** of hexachlorobutadiene for people. Laboratory animals have experienced reduced weight gains and kidney damage.[1,6] This chemical is a possible **carcinogen** and **mutagen**, but not a **teratogen**. It is **fetotoxic**.[1,6,25] Hexachlorobutadiene is considered to be of high **toxicity** (3).[5]

EXPOSURE LIMITS:

AIR: OSHA TWA .02 **ppm** (approximately .24 **mg/m^3**) **(skin)**.[4]

WATER: Due to the potential **carcinogenic** effect of hexachlorobutadiene, its concentration should be zero. If this level is not attainable, levels which raise the human lifetime cancer risk to

one in ten thousand = 4.460 **ppb**;
one in one million = .450 ppb;
one in ten million = .045 ppb.[1]

See "More About Exposure Limits".

HEXACHLORO-1,3-BUTADIENE: *see Hexachlorobutadiene.*

1,1,2,3,4,4-HEXACHLORO-1,3-BUTADIENE: *see Hexachlorobutadiene.*

HEXACHLOROCYLOHEXANE CAS 608-73-1; **molecular weight** 290.85:

SYNONYMS: BHC, Benzene hexachloride, Hexachlor, Hexachloran, HCCH, HCH, TBH.

TRADE NAMES: Benzex, FBHC, Kotol, Submar, Hilbeech, Hexafor, Hexablanc, Hexamul, Hexapurdre, Ambocide, Gyben, Hexdow, Isaton, Trives T.

Hexachlorohexane is a mixture of a number of **isomers**, of which the most important by volume of use is lindane:

LINDANE CAS 58-89-9; **molecular weight** 290.85:

SYNONYMS: Gamma hexachlorocyclohexane, DBH, HCCH, HCH, Gamma benzene-hexachloride, Gamma-1,2,3,4,5,6-hexachlorocyclohexane.

TRADE NAMES: 666, Bensahex, Gammaexane, Chemhex, Aparasin, Streunex, Tri-6, Lorexane, Kwell, Jacutin, Gamoxol, Hexdon, Celanex, Chloresene, Devoran, Dol Granule, Aplidal, Bentox 10, Exagama, Gallogama, Gamaphex, Inexit, Lindagrain, Denkagranox, Lindalo, Lindamul, Lindapoudre, Lindaterra, Novigam.

DESCRIPTION: Hexachlorocyclohexane is a brown to yellowish white powder with a musty odor. It is insoluble in pure form and sinks to the bottom in bodies of water. Hexachlorocyclohexane is formulated as **emulsifiable concentrates**, **wettable powder**, dusts, and smokes. It does not readily **photolyze**, oxidize, or decompose chemically. Data varies concerning its **half-life** in water, from 4 years to 6 months to 7 to 8 days. Its half-life in soil is 266 days.[1,28]

Lindane is a colorless crystal that is insoluble in water formulated as an **emulsifiable concentrate**, a **wettable powder**, dust or crystal.[1,28] Its odor is perceptible at a range of .33 to 1.8 **ppm**. Its **half-life** in soil is 266 days. It is **immobile** in soils. Reports vary concerning its half-life in water. One study states its half-life to be 7 to 8 days. Another study reports that 80 to 100 percent remained in river water samples after 12 weeks. Still another study reports a 50 percent decrease in concentration in 123 days. Lindane sorbs to sediments in water. Both chemicals are **bioaccumulative**, including uptake by plants, and there is **food chain contamination** potential.[1]

USES AND SOURCES: Hexachlorocyclohexane is a broad spectrum insecticide consisting of a mixture of 8 **isomers**, one of which is lindane. Since 1978, hexachlorocyclohexane has not been produced or sold for domestic use in the U.S. At present, the use of lindane, which is also used as a pesticide, is not allowed in continuous vaporizers, on some agricultural crops and dairy cattle and in dairy barns and milkrooms. In 1983, general use of lindane was restricted to certified applicators only, for lice control, on avocados, pecans, ornamental plants, in forestry, and for animal dips.[1]

In a project by the United States Geological Survey, lindane appeared in 1 to 2 percent of samples gathered from a network of 160 to 180 pesticide monitoring network stations analyzing water and sediment samples.[23]

Exposure to hexachlorocyclohexane often also includes exposure to other chemicals. Xylene is often used as a vehicle for the application of this chemical. DDT was often used with hexachlorocyclohexane.[1] Lindane is possibly contaminated by dioxin.[52] Degradation products include dichlorobenzene and trichlorobenzene.[1]

See "DDT", "Dichlorobenzene," "Dioxin", "Trichlorobenzene", and "Xylene." See "More About Pesticides".

HARMFUL EFFECTS AND SYMPTOMS: Routes of harmful **exposure** to both chemicals include skin contact, inhalation, and ingestion, particularly of contaminated food.[1,6] Symptoms of exposure to either chemical include eyes, nose, skin, and throat irritation, skin problems, dizziness, headaches, nausea, respiratory difficulties, **cyanosis**, convulsions, nervous system and blood damage, and heart failure. Symptoms are often delayed up to 3 hours. **Chronic** exposure to lindane has resulted in anemia. Both chemicals concentrate in fatty tissues. Both are probable **carcinogens** and **teratogens** by ingestion, and **mutagens.**[25] Both chemicals are considered to be of high **toxicity** (3).[5]

There are **data gaps** for lindane recorded in 1985 on **chronic effects** and tumor production.[1]

Both chemicals are harmful to aquatic life in very low concentrations.[1]

EXPOSURE LIMITS:

For lindane:

ADI (FAO/WHO) .001 **mg/kg/day.**[28]

AIR: OSHA TWA .5 **mg/m^3**.[4]

WATER: Due to the potential **carcinogenic** effect of lindane, its concentration should be zero. If this level is not attainable, levels which raise the human lifetime cancer risk to

one in ten thousand = 186.00 **ppt**;
one in one million = 18.60 ppt;
one in ten million = 1.86 ppt.

Chronic Aquatic **Toxicity** Limit .080 **ppb** in freshwater.[1] WA groundwater criteria .06 µg/l.[8]

See "More About Exposure Limits."

HEXACHLORODIBENZO-P-DIOXIN: *see Dioxin.*

HEXANE CAS 110-54-3; **molecular weight** 86.17:

SYNONYMS: Hexyl Hydride, N-hexane.

DESCRIPTION: Hexane is a flammable, colorless liquid that is insoluble in and floats on water. It has a faint gasoline-like odor.[28] Technical and commercial grades of hexane are contaminated with up to 6 percent benzene, as well as other chemicals. Hexane evaporates quickly from water, but does not biodegrade well.[1]

See "Benzene".

USES AND SOURCES: Hexane is used as a solvent, in mineralogy, in thermometry, for home and commercial use, and in food additives.[1] It is found at illegal drug laboratory **hazardous waste** sites, where methadone and THC has been processed.[1]

NIOSH estimates that 2.5 million workers nationwide are potentially **exposed** to hexane annually.[1]

HARMFUL EFFECTS AND SYMPTOMS: Routes of harmful **exposure** to hexane include inhalation, ingestion, and skin contact. Symptoms of exposure include irritated eyes and nose, dizziness, headache, nausea, depression, and heartbeat irregularities. It **bioaccumulates** in the liver and fatty tissues.[1] Hexane is considered to be of high **toxicity** (3).[5]

EXPOSURE LIMITS:

AIR: OSHA TWA 50 **ppm** (approximately 180 **mg/m^3**).[4]

WATER: Drinking water limit 1 **ppm.**[1]

See "More About Exposure Limits".

The effect of low concentrations of hexane on aquatic life is unknown.[1]

HEXAPLAS M/B (trade name): *see N-butyl phthalate.*

HEXAVALENT CHROMIUM COMPOUNDS (Cr^{6+}): *see Chromium.*

HEXAVIN (trade name): *see Carbaryl.*

HEXYL HYDRIDE: *see Hexane.*

HHDN: *see Aldrin.*

HILDAN (trade name): *see Endosulfan.*

HOE 2671 (trade name): *see Endosulfan.*

HYDROCHLORIC ACID CAS 7647-01-0; **molecular weight** of hydrogen chloride, the gas which combined with water, forms hydrochloric acid 36.47:

SYNONYMS: Hydrogen chloride, Hydrochloride, Muriatic acid, Spirits of salt.

DESCRIPTION: Hydrogen chloride is a colorless gas and when dissolved in water it becomes a fuming liquid, hydrochloric acid. Its sharp, pungent, irritating odor is perceptible at 10 **ppm.** The main **toxicity** of hydrochloric acid is to lower the **pH** of its environment. It is neutralized slowly in the environment by natural **alkalinity** and carbon dioxide. There is no **bioaccumulation.**[1]

USES AND SOURCES: Hydrochloric acid is used in the paper industry, the metal manufacturing industry, in making cosmetics, food starch, and seal remover, in vehicle maintenance and equipment repair, and in the rubber industries. It is used in petroleum extraction, in auto and textiles manufacturing, in printing and plating industries, in laboratories, to make fertilizers, dyes, and artificial silk, and in chemical production, such as chloride production.[1]

HARMFUL EFFECTS AND SYMPTOMS: Routes of harmful **exposure** to hydrochloric acid include inhalation, ingestion, and skin contact. Symptoms of exposure include inflamed nose and throat (at 35 **ppm**), coughing, choking, burning eyes, skin, and throat, intense thirst, skin problems, vomiting, diarrhea, and heart damage. **Exposures** of 50 to 100 ppm longer than an hour can result in **pulmonary edema**.[1] Hydrochlorid acid is considered to be of high **toxicity** (3).[5]

EXPOSURE LIMITS:

AIR: ACGIH TLV-ceiling limit 5 **ppm**.[1]

See "More About Exposure Limits".

HYDROCHLORIDE: *see Hydrochloric acid.*

HYDROGEN CHLORIDE: *see Hydrochloric acid.*

HYDROGEN FLUORIDE CAS 7664-39-3; **molecular weight** 20.01:

SYNONYMS: Anhydrofluoric acid (the gas).

DESCRIPTION: Hydrogen fluoride is a gas and when dissolved in water becomes hydrofluoric acid, a clear fuming corrosive liquid. Its odor is perceptible at .03 **mg/m**^{3}. There is no **bioaccumulation**.[1]

USES AND SOURCES: Hydrogen fluoride is used in making glass, polish, cosmetics, in fluorination processes, in the paper industry, in metal manufacturing, and in vehicle maintenance and equipment repair. It is used as an insecticide, and as a **catylist**. It is used in separating uranium isotopes, in working silk, and in chemical production. It is used to increase the porosity of ceramics. [1]

See "More About Pesticides".

HARMFUL EFFECTS AND SYMPTOMS: Routes of harmful **exposure** to hydrogen fluoride include inhalation, ingestion, and skin contact. The odor is a good warning. Symptoms of harmful **exposure** include eye, nose, throat, and skin burning and irritation (30 to 60 **ppm**), **pulmonary edema**, nasal congestion, bronchitus, and ulcers of the respiratory tract (at 50 to 250 **ppm**). Burning pain may be delayed up to an hour.[1] Hydrogen fluoride is considered to be of high **toxicity** (3).[1]

Hydrogen fluoride is harmful to aquatic life in very low concentrations. It can be damaging to plants in acidic soil.[1]

EXPOSURE LIMITS:

AIR: OSHA TWA 3 **ppm**.[1]

WATER: Recommended drinking water limit: 1.2 **ppm**.[1]

See "More About Exposure Limits".

HYDROXYBENZENE: *see Phenol.*

1-HYDROXY-2,4-DIMETHYLBENZENE: *see 2,4-Dimethylphenol.*

4-HYDROXY-1,3-DIMETHYLBENZENE: *see 2,4-Dimethylphenol.*

2-HYDROXYNITROBENZENE: *see Nitrophenol.*

4-HYDROXYNITROBENZENE: *see Nitrophenol.*

HYDROXYTOLUENE: *see Cresol.*

HYLEMAX (trade name): *see Ethion.*

HYLEMOX (trade name): *see Ethion.*

HYLENE T (trade name): *see Toluene-2,4-diisocyanate.*

HYLENE TM (trade name): *see Toluene-2,4-diisocyanate.*

HYPONITROUS ACID ANHYDRIDE: *see Nitrogen oxide.*

HYVAR (trade name): *see Bromacil.*

HYVAR X (trade name): *see Bromacil.*

HYVAR X-L (trade name): *see Bromacil.*

IDRYL: *see Polynuclear aromatic hydrocarbons.*

INDENO(1,2,3-CD) PYRENE: *see PAHs.*

INERTEEN (trade name): *see PCBs.*

INSECTICIDE-4049 (trade name): *see Malathion.*

IP: *see Polynuclear aromatic hydrocarbons.*

ISCEON 122 (trade name): *see Dichlorodifluoromethane.*

ISCEON 131 (trade name): *see Fluorotrichloromethane.*

ISCOBROME (trade name): *see Ethylene dibromide.*

ISOPHORONE CAS 78-59-1; **molecular weight** 138.20:

SYNONYMS: 3,5,5-Trimethyl-2-cyclohexen-1-one.

DESCRIPTION: Isophorone is a slightly flammable whitish liquid that floats and mixes slowly with water. It has a camphor-like odor. There is no **food chain contamination.**[1]

USES AND SOURCES: Isophorone is used as a solvent or cosolvent for finishes, lacquers, polyvinyl and nitro cellulose resins, in **pesticides, herbicides**, fats, oils, and gums, and in printing.[6]

See "More About Pesticides".

HARMFUL EFFECTS AND SYMPTOMS: Symptoms of **exposure** to isophorone include irritated eyes, nose, and throat (at 25 **ppm**), tearing, fatigue, malaise, dizziness, skin problems, headache, and loss of consciousness.[6] Isophorone is a central nervous system depressant, a kidney poison, and a possible **carcinogen.**[6,25] It is considered to be of high **toxicity** (3).[5]

Isophorone is toxic to aquatic life, particularly saltwater invertebrates and mammals.[5]

EXPOSURE LIMITS:

AIR: OSHA TWA 4 **ppm** (approximately 23 **mg/m^3**).[4]

See "More About Exposure Limits".

ISOTRON (trade name): *see Fluorotrichloromethane.*

ISOTRON 2 (trade name): *see Dichlorodifluoromethane.*

ITOPAZ (trade name): *see Ethion.*

IVALON (trade name): *see Formaldehyde.*

JET FUEL: *see Kerosene.*

JULIN'S CARBON CHLORIDE (trade name): *see Hexachlorobenzene.*

KANACHLOR (trade name): *see PCBs.*

KANECHLOR (trade name): *see PCBs.*

KARBASPRAY (trade name): *see Carbaryl.*

KARBOFOS (trade name): *see Malathion.*

KARSAN (trade name): *see Formaldehyde.*

KERB: *see Pronamide.*

KEROSENE CAS 8008-20-6:

SYNONYMS: Fuel Oil, Jet fuel, Range Oil, Coal oil.

DESCRIPTION: Kerosene is a yellow-white liquid that floats on water. It is only moderately flammable, and there is no **bioaccumulation**. Its odor is perceptible at .082 **ppm**.[1]

USES AND SOURCES: Kerosene is used as fuel for lamps, stoves, jets, and rockets, as a degreaser, and as a metal cleaner. It is used in leather products manufacturing, in metal manufacturing, in furniture making and refinishing, in chemical production, and in printing. It is used as a dispersal agent in **herbicide** sprays in forest and cropland spraying.[1] Kerosene is found at illegal drug laboratory **hazardous waste** sites, where cocaine has been processed.[2]

See "More About Pesticides".

HARMFUL EFFECTS AND SYMPTOMS: Routes of harmful **exposure** to kerosene include inhalation and ingestion. When inhaled, kerosene may cause headache, stupor, coughing, difficulty in breathing, bloody discharge, and pneumonia. When ingested, it may cause irritation, nausea, vomiting, drowsiness progressing to coma, and death by **pulmonary edema**. Skin contact may cause irritation and sloughing off of dead skin.[1] Kerosene is considered to be of high **toxicity** (3).[5]

The coating action of oils, including kerosene, can destroy water birds, plankton, algae, and fishes. Kerosene is dangerous to aquatic life in high concentrations.[1]

EXPOSURE LIMITS:

AIR: No standards have been set for kerosene, at least in part because of its variable composition.[1]

See "More About Exposure Limits".

KETONE, DIMETHYL: *see Acetic acid.*

KILLMASTER (trade name): *see Chlorpyrifos.*

KOMEEN (trade name): *see Copper naphthenate.*

KOPFUME (trade name): *see Ethylene dibromide.*

KOPLEX (trade name): *see Copper naphthenate.*

KOP-THIODAN (trade name): *see Endosulfan.*

KOPTHION (trade name): *see Malathion.*

KYANOL: *see Aniline.*

K III (trade name): *see 4,6-Dinitro-o-cresol.*

K IV (trade name): *see 4,6-Dinitro-o-cresol.*

KRENITE (trade name): *see 4,6-Dinitro-o-cresol.*

KROVAR II (trade name): *see Bromacil.*

KWIT (trade name): *see Ethion.*

KYPFOS (trade name): *see Malathion.*

LANADIN (trade name): *see Trichloroethylene.*

LASSO: *see Alachlor.*

LEAD CAS 7439-92-1; **atomic weight** 207.2; Chemical Symbol: Pb

SYNONYMS: Plumbum (Latin name)

DESCRIPTION: Lead is a heavy metal that in some forms dissolves in water. It accumulates in the bones. There is **bioaccumulation** and **food chain contamination** potential.[1]

USES AND SOURCES: Lead is used as a cleaning agent in heavy metal soaps, in metal manufacturing, in vehicle maintenance and equipment repair, in tanks and piping, in petroleum refining, and in batteries. Lead is a constituent of leaded gasoline (and may even be in "unleaded" gasoline), from 520 to 1120 **g/g**. It is a component of automobile exhaust and is found on plants and in gardens grown in urban areas and on roadsides.

Lead is found in the discharge of municipal wastewater treatment plants. In an **EPA** assessment, it was estimated that 35 percent of the discharge from large numbers of municipal wastewater treatment plants exceed water quality standards for lead. When low stream flows were analyzed, 35 to 64 percent of the plant discharges exceeded water quality standards.

Annual airborne emissions of lead amount to 49.9 million pounds.[7]

In 1988 3 to 4 million American children continued to be **exposed** to levels of lead in the environment that put them at risk of adverse health consequences, in spite of sharp reductions in various sources of lead production. In 1985 the **EPA** said that 42 million Americans drink water with higher lead content than recommended. 23 percent of 292 stations measuring lead in surface water nationwide report declines in concentrations from 1970 to 1984, and only 2 percent showed increases. The improvement probably is due to reduced lead in gasoline. EPA's Rural Water Survey found lead to exceed drinking water standards in about 10 percent of wells nationwide.

HARMFUL EFFECTS AND SYMPTOMS: Routes of harmful **exposure** to lead include inhalation, ingestion, and skin contact. **Toxic** levels can be absorbed through the skin.[1] Exposure to lead is often measured in concentrations of lead in the blood, in micrograms of lead per deciliter of blood (**g/dl**). Overexposure for children occurs at least at 25 g/dl.[33] The history of research in this field shows a progressive decline in the lowest exposure levels at which adverse health effects can be reliably detected. With further research, these levels could decline even further. Lead is a **toxicity** problem in **chronic** doses more than in **acute** doses.[1] Symptoms of overexposure may include lassitude, insomnia, paleness, lack of appetite, **pica**, low weight, malnutrition, constipation, abdominal pain, colic (when the blood lead level is 50 **g/dl**), vomiting, tremors, paralysis of the wrists, and permanent brain damage.[1,29] Chronic exposures resulting in blood lead levels of 40 to 60 g/dl have been accompanied by symptoms such as slowed reaction time, decreased fertility, abnormal menstrual cycles, impotence, decreased sex drive, sterility, fatigue, headache, irritability, anxiety, hearing difficulty, weakness of wrists and ankles, and loss of short term memory.[29] Studies have linked low level lead exposure, as low as 15 **g/dl** blood, with intelligence reduction in children. Lead is a potential **mutagen** and **teratogen**, and a probable **carcinogen**.[1,25]

EXPOSURE LIMITS:

ADI (FAO/WHO) 3 mg/week.[25]

AIR: OSHA PEL 50 g/m^3.

WATER: Proposed **maximum contaminant level** goal in drinking water 0. Proposed **maximum contaminant level** 5 μg/l.[25] WA groundwater criteria .05 mg/l.[8]

See "More About Exposure Limits".

LEAD CHROMATE: *see Chromium.*

LEDON 11 (trade name): *see Fluorotrichloromethane.*

LEDON 12 (trade name): *see Dichlorodifluoromethane.*

LETHURIN (trade name): *see Trichloroethylene.*

LEXONE (trade name): *see Metribuzin.*

LIPAN (trade name): *see 4,6-Dinitro-o-cresol.*

LORSBAN (trade name): *see Chlorpyrifos.*

LYE: *see Sodium hydroxide.*

LYSOFORM (trade name): *see Formaldehyde.*

M74 (trade name): *see Disulfoton.*

M-DICHLOROBENZENE: *see 1,3-Dichlorobenzene.*

MALACIDE (trade name): *see Malathion.*

MALAFOR (trade name): *see Malathion.*

MALAKILL: *see Malathion.*

MALAGRAN (trade name): *see Malathion.*

MALAMAN 50 (trade name): *see Malathion.*

MALAMAR (trade name): *see Malathion.*

MALAPHOS (trade name): *see Malathion.*

MALASPRAY (trade name): *see Malathion.*

MALATHION CAS 121-75-5; **molecular weight** 330.36:

TRADE NAMES: Phosphothion, Mercapthion, Carbofos, EPN, American-Cyanimide-4049, Insecticide-4049, Malathon, Calmathion, Detmol Ma 96%, Carbophos, Cythion, Cyanamid, MLT, Karbofos, Carbetox, Carbethoxy malathion, Chemathion, Compound 4049, Zithiol, Siptox I, SF 60, Sadophos, Sadofos, Oleophosphothion, Malphos, Malatox, Malatol, Malathion LV Concentrate, Malakill, ENT 17034, Formal, Emmatos Extra, Malaspray, Malagran, Kopthion, Fosfothion, Malaphos, Fyfanon, Kypfos, Malamar, Ethiolacar, Malaman 50, Malacide, Fog 3, Malathion E 50, Malafor, Moscdarda.

DESCRIPTION: Malathion is a flammable amber to dark brown liquid that sinks to the bottom in bodies of water, and dissolves very, very slowly. Its garlic-like odor is perceptible at 10 **mg/m^3**. There is no **bioaccumulation.** Malathion **leaches** through soil and is **persistent** for about a week. In studies of persistence in river water, about 10 percent remains after 2 weeks in river water, and none remains after 4 weeks. Its **half-life** in water by chemical decomposition ranges from 7 hours to a month.[1]

USES AND SOURCES: Malathion is used as an insecticide for fruits, vegetables, ornamentals, and household and livestock use. It is one of the most commonly used **pesticides** in western Washington.[31] There are 1600 separate registrations of this chemical.

Thirty-five million pounds of malathion are produced annually.[38]

See "More About Pesticides".

HARMFUL EFFECTS AND SYMPTOMS: Routes of harmful **exposure** to malathion occurs by inhalation, ingestion, and by skin contact. Symptoms of harmful exposure include eye and skin irritation, inflammation of the nasal mucous membranes, salivation, sweating, pinpoint pupils, headache, blurred vision, slow pulse, and tremors, tightness in chest, muscular pain in the lower limbs, wheezing, laryngeal spasms, lack of appetite, abdominal cramps, nausea, vomiting, diarrhea, and loss of coordination.[1,38] Symptoms may develop over 8 hours.[1] Malathion is a potential **mutagen** and **teratogen.**[38] One source states that malathion is not **carcinogenic.**[1] One degradation product, malaxon, is 100,000 times as **toxic**, as a **cholinesterase inhibitor**, as malathion.

Malathion is harmful to aquatic life in very low concentrations.[1]

EXPOSURE LIMITS:

AIR: OSHA TWA total dust 10 **mg/m^3**. **Respirable fraction** 5 mg/m^3 **(skin).**[4]

WATER: Recommended drinking water limit .1 **ppm.**[1]

See "More About Exposure Limits".

MALATHION E50 (trade name): *see Malathion.*

MALATHION LV CONCENTRATE (trade name): *see Malathion.*

MALATHON (trade name): *see Malathion.*

MALIX (trade name): *see Endosulfan.*

MALATOL (trade name): *see Malathion.*

MALATOX (trade name): *see Malathion.*

MALPHOS (trade name): *see Malathion.*

MARSH GAS: *see Methane.*

M-B-C FUMIGANT (trade name): *see Methyl bromide.*

MCP: *see MCPA.*

MCPA CAS 94-74-6; **molecular weight** 200.63:

SYNONYMS: [(4-Chloro-o-tolyl)oxy] acetic acid; (4-Chloro-2-methylphenoxy) acetic acid; Metaxon; MCP; 2-Methyl-4-chlorophenoxyacetic acid; SCPA.

TRADE NAMES: Agroxone, Agritox, Cornox M, Methoxoice, Chiptox, Rhomene, Rhonox, Agroxohe, Mephanaic.

DESCRIPTION: MCPA is a light brown solid formulated as an **emulsifiable concentrate** or as a dust. It does not dissolve in water unless formulated as an emusifiable concentrate or accompanied by a **wetting agent**. Sources varied in their reports of its **persistence** in soil. One source stated that MCPA is persistent in the soil for about 3 months, and is not **bioaccumulative.**[1] Another source stated that in soil it degrades from 1 to 28 days. In yet another study in the forest ecosystem, MCPA remained in the soil up to 3 **ppm** and in the leaf litter at .7 to 32 **ppm** for 10 months after application at a rate of 2.5 **kg active ingredient** per hectare. MCPA **leaches** readily in most soils.[22]

USES AND SOURCES: MCPA is an **herbicide** used for legumes, corn, grains, and flax.[1]

In a 1988 search of the U.S. **EPA STORET** Water Quality File, MCPA has been found in 4 of 18 samples analyzed from 13 surface water locations, with a range of concentrations of .04 μg/l to .54 μg/l. It was found in none of 118 analyzed samples from 117 groundwater locations. In other studies MCPA has been found in ground water in Montana, with the highest concentration being 5.5 **ppb**, and in 2 of 237 wells in Ontario at a range of 1.1 to 1000 ppb.[22]

See "More About Pesticides".

HARMFUL EFFECTS AND SYMPTOMS: Symptoms of harmful exposure to MCPA in **acute** doses may include pinpoint pupils, muscular weakness, liver damage, kidney damage, diminished or absent reflexes, low blood pressure, spasms, loss of consciousness, and death. The liver damage that MCPA causes, liver peroxisomal proliferation, has been linked to **carcinogenicity**. Studies thus far indicate that MCPA is not **fetotoxic, teratogenic**, or **mutagenic**.[22]

EXPOSURE LIMITS:

ADI NAS (1977) .00125 **mg/kg/day**.[22]

AIR: There are no standards set.[1]

WATER: Recommended drinking water limit .1 **ppm**.[1]

INGESTION: **Residue tolerances** .1 **ppm** in milk and meat.[22]

See "More about Exposure Limits".

M-CRESOL: *see Cresol.*

MEBR: *see Methyl bromide.*

MEDIBEN (trade name): *see Dicamba.*

MEK: *see Methyl ethyl ketone.*

MEPHANAIC (trade name): *see MCPA.*

MERCAPTOPHOS: *see Systox.*

MERCAPTOTHION (trade name): *see Malathion.*

MERCURY CAS 7439-97-6; **atomic weight** 200.59; Chemical symbol: Hg

DESCRIPTION: Mercury is an odorless lustrous liquid metal that will sink in water. There are many compounds and salts of which mercury is an element that have very different environmental and human health effects than that of mercury alone. Mercury accumulates in the liver, spleen, kidneys, and bone. An organic form, methyl mercury, concentrates as well in the brain. Mercury **bioaccumulates** in the tissues of fish, plants, and animals.[1] In the body the **half-life** of inorganic mercury is 45 days and of methyl mercury is 80 days.

USES AND SOURCES: Mercury is used as a cleaning agent in heavy metal soaps, and as a base for pesticides. It is used in chemical production, laboratories, auto repair shops, dentistry, preservation of some latex paints, and the plating and metal printing industries. Mercury is used in thermometers, switches, and batteries, in fluorescent light bulbs, and in pharmaceuticals.[1] It is found at illegal drug laboratory **hazardous waste** sites, where amphetamines and barbituates have been processed.[2]

Mercury is found in the discharge of municipal wastewater treatment plants. In an EPA assessment, it was estimated that 4 to 10 percent of the discharge from large numbers of municipal wastewater treatment plants exceed water quality standards for mercury. When low stream flows were analyzed, 10 to 28 percent of the plant discharges exceeded water quality standards.[35]

EPA's Rural Water Survey found mercury to exceed drinking water standards in nearly 25 percent of wells nationwide, and up to 33 percent of rural wells in the north central region.[35] Mercury contamination is especially prevalent in California, Nevada, Oregon, and Washington. Average atmospheric concentration of mercury is 20 **ng/m^3**. Average dietary intake of mercury from food is 4 g/day.[42]

HARMFUL EFFECTS AND SYMPTOMS: Routes of harmful **exposure** to mercury include inhalation, ingestion, and skin contact. Absorption through the gastrointestinal tract is dependent on the chemical form of mercury. Elemental mercury is indigestible. The inorganic salts have 12 percent absorption rate. Methyl mercury is completely absorbed. By inhalation 85 percent of both elemental and inorganic mercury are absorbed.[42] Effects of **exposure** may be delayed. Symptoms of harmful exposure, **acute** and **chronic**, include irritated eyes and skin, inflammation of the mucous tissues of the mouth, loosened teeth, salivation, coughing, difficulty in breathing, irritability, indecision, headache, fatigue, weakness, insomnia, stomach problems, lack of appetite, low weight, nausea, vomiting, bloody diarrhea, tremors, jerky gait, spasms, personality changes, depression, kidney damage, pneumonia, and death.[1]

Mercury is harmful to aquatic life in very low concentrations.[1]

EXPOSURE LIMITS:

ADI (for methyl mercury): .007 **mg/day**.[25]

AIR: OSHA PEL inorganic .1 **mg/m^3**.[25] alkyl .01 mg/m^3. vapor .05 mg/m^3.[4]

WATER: Proposed maximum contaminant level in drinking water 2 **μg/l**.[25] WA groundwater criteria .002 **mg/l**.[8]

INGESTION: Oral ADI .011 mg/day.[25]

See "More About Exposure Limits".

METAFUME ISOBROME (trade name): *see Methyl bromide.*

METALS: *see Antimony, Beryllium, Cadmium, Chromium, Lead, Mercury, Nickel, and Selenium.*

METAXON: *see MCPA.*

METHACIDE PHENYLMETHANE: *see Toluene.*

METHAN TRICHLORIDE: *see Chloroform.*

METHANE CAS 74-82-8; **molecular weight** 16.04:

SYNONYMS: Marsh gas, Natural gas.

DESCRIPTION: Methane is a colorless and odorless flammable gas.[1]

USES AND SOURCES: Methane is a commonly encountered toxicant in **hazardous waste** sites in Washington state where there has been organic decomposition such as landfills. Other sources of methane include rice cultivation and cattle populations. Methane may be used as a fuel.[1] Atmospheric concentrations of methane have been climbing for about 300 years, with a dramatic increase beginning in the late 1800's. A significant contributor may be increased cultivation of rice and growing populations of cattle.[45]

HARMFUL EFFECTS AND SYMPTOMS: Harmful **exposure** to methane occurs by inhalation. If inhaled, methane can cause dizziness, difficulty in breathing, and loss of consciousness. Direct contact of methane being released under pressure can cause frostbite.[1] Methane is considered to be of high **toxicity** (3).[5]

Methane is not harmful to aquatic life. This gas has become a problem because of its creation and migration beneath solid waste landfills. There is danger of explosions if a pocket of it is **exposed** to heat or flame.[1] Methane is estimated to contribute significantly to the possibility of the "greenhouse effect."

See "Carbon dioxide", "CFCs", and "Nitrogen oxide."

EXPOSURE LIMITS:

See "More About Exposure Limits."

METHANAL (trade name): *see Formaldehyde.*

METHANE DICHLORIDE: *see Methylene chloride.*

METHANE TETRACHLORIDE: *see Carbon tetrachloride.*

METHENYL TRICHLORIDE: *see Chloroform.*

METHOXOICE (trade name): *see MCPA.*

2-METHOXY-4,6-BIS(ISOPROPYLAMINO)-S-TRIAZINE: *see Prometon.*

2-METHOXY-3,6-DICHLOROBENZOIC ACID: *see Dicamba.*

METHOXY PROPAZINE: *see Prometon.*

METHYL ACETONE: *see Methyl ethyl ketone.*

METHYL ALDEHYDE: *see Formaldehyde.*

METHYLBENZENE: *see Toluene.*

METHYL BROMIDE CAS 74-83-9; **molecular weight** 94.95:

SYNONYMS: Bromomethane, Brom-o-gas, Bromosol, Brozone, MEBR, Monobromomethane.

TRADE NAMES: Zytox, Profume, Rotox, Embafume, Dowfume MC-33, Dowfume-MC2, Celfume, Metafume Isobrome, Pestmaster, Terr-o-gas 100, Terabol, M-B-C **Fumigant.**

DESCRIPTION: Methyl bromide is a slightly flammable liquified colorless gas. It clings to the ground and does not dissolve in water. Methyl bromide is usually odorless, but has a sweet, chloroform-like odor at high concentrations. It evaporates rapidly from water, and **photodegrades** when it migrates to the stratosphere. Its **half-life** in water by chemical decomposition is 20 days.[1] The potential for **bioaccumulation** in aquatic life is low.[6] **Environmental fate data gaps** include photodegradation in water, **aerobic** soil and **anaerobic** soil studies, **leaching** and **adsorption**, and field dissipation studies.

USES AND SOURCES: Methyl bromide is used in **ionization** chambers, in greenhouses, homes, grain elevators, mills ships, transportation vehicles, and in stored commodities (both raw agricultural commodities and processed foods). It is used to degrease wool and extract oils. Methyl bromide is used as a refrigerant, as a fire extinguishing agent, and as a soil, seed, feed, and space **fumigant**.[1,6,48] It is one of the most commonly used pesticides in western Washington.[31]

In a study of **exposure** levels to methyl bromide after soil injection, initial values of 30 to 3000 **ppm** were recorded, declining to 4 ppm within 5 days. Milling the soil produced exposures of 15 **ppm** as long as 9 days after application.[28]

See "More About Pesticides".

HARMFUL EFFECTS AND SYMPTOMS: Routes of harmful **exposure** to methyl bromide include inhalation, ingestion, and skin contact. It may penetrate rubber protective gear.[1,] There are no reliable warning properties. When methyl bromide is taken into the body, there is initial rapid elimination, though complete elimination is slow. Direct contact causes irritation, with symptoms of itching, cold sensation, redness, blisters, burns, and damage to **peripheral nerve** tissue. Other skin problems may be delayed.[1] Symptoms of **acute** non-fatal poisoning (100 to 500 **ppm**) are extremely variable, with nearly every type of nervous disturbance being reported, including irritated eyes and skin, headache, dizziness, visual distortions, vertigo, loss of coordination, malaise, hand tremor, convulsions, difficulty in breathing, nausea, and vomiting. Death due to **acute exposures** result from lung damage while death from **chronic** exposures are due to injury of the central nervous system.[6,] Symptoms of fatal poisoning (8,600 to 60,000 **ppm**) may include headache, visual disturbances, smarting of the eyes, irritation of the skin, listlessness and tremor, followed by fever, convulsions, **pulmonary edema**, loss of consciousness, and death. This process is usually rapid.[6] Methyl bromide is a **mutagen.**[1] It is considered to be of high **toxicity** (3).[5]

There are **data gaps** in laboratory studies on reproduction, rabbit teratology, cancer, subchronic inhalation in rat and rabbit, storage stability, **mutagenicity**, chronic feeding studies in the rat and dog, and **metabolism** in vegetables.[48]

EXPOSURE LIMITS:

AIR: OSHA TWA **(skin)** 5 **ppm** (approximately 20 **mg/m^3**).[1]

WATER: Recommended drinking water limit 1.39 **ppm.**[1]

See "More About Exposure Limits."

METHYLCARBAMATE: *see Carbofuran.*

METHYLCARBAMIC ACID O-((2-METHYL-2-(METHYLTHIO)PROPYLIDENE)AMINO DERIVATIVE: *see Aldicarb.*

METHYL CHLORIDE CAS 74-87-3; **molecular weight** 50.49:

SYNONYMS: Chloromethane, Monochloromethane.

DESCRIPTION: Methyl chloride can take two forms. It may be a very flammable colorless gas that clings to the ground or a colorless liquid that floats on water. Its faint, sweet ether odor is perceptible at a range of 10 to 100 **ppm**. Its **half-life** by chemical decomposition is 1.14 years, and its half-life by evaporation from stirred water is 27 minutes.[1] There is no **bioaccumulation.**[6]

USES AND SOURCES: Methyl chloride is used as a food additive, a refrigerant gas, a methylating agent, a dewaxing agent, and as an intermediate in the production of silicone. It is used in gasoline anti-knock compounds, in rubber synthesis, in **herbicides**, in plastics, and in petroleum refineries as an extractant.[1,6] It is a component of tobacco smoke.[3] Acrolein is sometimes used a **warning agent** in methyl chloride.[1]

See "Acrolein." See "More About Pesticides".

HARMFUL EFFECTS AND SYMPTOMS: Harmful **exposure** to methyl chloride may occur by inhalation or ingestion.[1] The odor is not a good warning. Inhalation does not cause irritation.[6] Methyl chloride is rapidly absorbed by the body, but it is slowly eliminated. There is often a delay in the onset of symptoms. Direct contact with the skin may cause frostbite.[1] The **chronic** exposures are of more concern. Symptoms of repeated exposures to methyl chloride at low levels include fatigue, muscular weakness, drowsiness, dimness of vision, loss of appetite, and central nervous system damage. Symptoms of exposure to high concentrations include dizziness, drowsiness, confusion, abdominal pain, nausea, vomiting, and loss of coordination, followed by convulsions, delirium, loss of consciousness, and death. If the **exposure** is not **lethal**, recovery is very slow, with degenerative changes in the central nervous system not uncommon.[6] Other body systems damaged by methyl chloride include the **cardiovascular system**, the liver, the kidney and bone marrow.[1] Methyl chloride is a potential **mutagen**, **teratogen**, and a possible **carcinogen**.[1,25] Methyl chloride is considered to be of high **toxicity**. (3).[5]

Methyl chloride is not harmful to aquatic life.[1]

EXPOSURE LIMITS:

AIR: OSHA TWA 50 **ppm** (approximately 105 **mg/m^3**).[4]

See "More About Exposure Limits".

METHYLCHLOROFORM CAS 71-55-6; **molecular weight** 133.42:

SYNONYMS: 1,1,1-Trichloroethane, TCE, Alpha-trichloroethane, Ethylidene chloride, Chlorotene, Baltana, Genklene.

TRADE NAMES: Chlorothene Nu, Aerothene TT.

DESCRIPTION: Methylchloroform is a colorless slightly flammable liquid that sinks in water and does not dissolve. Its sweet odor is perceptible at a range of 100 to 400 **ppm**. There is no **bioaccumulation**. Methylchloroform will not **persist** in high concentrations in soil or water due to evaporation, but low concentrations (**ppb**) **persist** in water without degradation. Its **half-life** by chemical decomposition in water is 6 to 9 months. Its half-life in the body is less than a day. There is some uptake by plants from the soil. Nine to fifteen percent of all methylchloroform released into the atmosphere reaches the stratosphere and adversely affects the ozone layer.[1]

Studies have not been made concerning its **leaching**, evaporation, or absorption.[1]

Methylchloroform contains stabilizers that range from 7 to 8 percent by volume. Chemicals used in this capacity include dioxane, methyl ethyl ketone, and toluene.[1] Dioxane is a contaminant as well as a stabilizer.[7]

See "Dioxane", "Methyl ethyl ketone", and "toluene."

USES AND SOURCES: Methylchloroform is used as a solvent, as a degreaser for cleaning metals in the metal manufacturing industries, as a dry-cleaning agent, as a propellant, as a vapor degreasing agent, and as a solvent for various insecticides. It is used in making cosmetics, in printing, in textile manufacturing, in vehicle maintenance and equipment repair, in paper production, and in chemical production.[44] Methylchloroform was formerly used for degreening citrus fruits and **fumigating** strawberries after harvest. Registered agricultural uses have been cancelled.[1] As a solvent, methylchloroform achieved widespread use as a substitute for carbon tetrachloride.[49] Methylchloroform is a commonly encountered toxicant at **hazardous waste** cleanup sites in Washington state.[44]

Exposure to methylchloroform often includes exposure to other chemicals. Methylchloroform degrades in the environment into vinyl chloride gas.[51] 1,1,2-Trichloroethane is sometimes an impurity in commercial production of methylchloroform.

See "Vinyl chloride" and "1,1,2-Trichloroethane." See "More About Pesticides".

HARMFUL EFFECTS AND SYMPTOMS: Routes of harmful **exposure** to methylchloroform include inhalation, ingestion, and skin contact. Symptoms of harmful exposure, **chronic** as well as **acute**, include eye irritation, dry, scaly, fissured and inflamed skin, impaired judgement, drowsiness, dizziness, breathing congestion, loss of coordination, central nervous system depression, loss of consciousness, and death to due respiratory failure.[6,44] There is degeneration of the liver after **chronic** exposures to 1000 **ppm** methylchloroform.[1] The

cardiovascular system is particularly sensitive to methylchloroform.[6] There is insufficient data to determine carcinogenicity in humans, but it has proved to be a **carcinogen** in laboratory animals.[6] Methylchloroform is considered to be of high **toxicity** (3).[5] The effect of methylchloroform in low concentrations on aquatic life is unknown.[1]

EXPOSURE LIMITS:

AIR: OSHA PEL 350 **ppm** (approximately 1900 **mg/m^3**).[4]

WATER: Proposed maximum contaminant level in drinking water 200 µg/l.[25] WA groundwater criteria .20 **mg/l.**[8]

See "More About Exposure Limits".

2-METHYL-4-CHLOROPHENOXYACETIC ACID: *see MCPA.*

1-METHYL-2,4-(9CI)BENZENE: *see 2,4-Dinitrotoluene.*

1-METHYL-2,4-DINITROBENZENE: *see 2,4-Dinitrotoluene.*

2-METHYL-1,3-DINTRO-(9CI)BENZENE: *see 2,6-Dinitrotoluene.*

METHYLENE BICHLORIDE: *see Methylene chloride.*

METHYLENE CHLORIDE CAS 75-09-2; **molecular weight** 84.94:

SYNONYMS: Dichloromethane, Methylene bichloride, Methylene dichloride, Methane dichloride, NCI-C50102, Aerothene MM, Freon 30, Narkotil, Solaesthin, Solmethine.

DESCRIPTION: Methylene chloride is a nonflammable colorless liquid that sinks and dissolves slowly with water. Its sweet, pleasant odor is perceptible at 300 **ppm.** Its **half-life** in water due to evaporation is 1 1/2 hours. Its half-life in water due to chemical decomposition is 18 to 22 months. Its half-life in the **troposphere** is probably several months, indicating potential for ozone destruction. There is no **bioaccumulation.**[1]

USES AND SOURCES: Methylene chloride is used as a solvent in the metal manufacturing industries, as a solvent and **inert ingredient** in insecticides, as a solvent in paint removers (23 percent of use), as a processing solvent for pharmaceuticals (20 percent of use), as a refrigerant, as a degreasing and dewaxing solvent (8 percent of use), and in aerial sprays (20 percent of use). It is used in vehicle maintenance, in laboratories, in paper production, in printing, in chemical production, in furniture making and refinishing, in textile manufacturing, in paint shops, and as an insecticide for strawberries, citrus fruits, and a variety of grains.[1,6,7] It is a commonly encountered toxicant at **hazardous waste** cleanup sites in Washington state.[44] Methylene chloride is found at illegal drug laboratory hazardous waste sites, where MDA has been processed.[2] Methylene chloride ranks 16th of the 25 substances most frequently detected at 53 Superfund sites sampled by the EPA. **NIOSH** estimates that 2.5 million workers nationwide are potentially **exposed** to this compound annually.[7]

In 1986, 566 million pounds were produced nationwide. This amount will probably lessen, as industries move toward waterbased aerosol spray systems. They anticipate future regulation.[7]

Methylene chloride is found in drinking water, ground water, finished drinking water, and commercially bottled artesian well water, usually in concentrations of less than 3.6 **ppm.**[7]

See "More About Pesticides".

HARMFUL EFFECTS: Routes of harmful **exposure** to methylene chloride include inhalation, ingestion, and skin contact. The odor is not a good warning. Methylene chloride is a **narcotic** above 500 **ppm.**[1] Symptoms of harmful exposure include eye and upper respiratory tract irritation, skin burns, lassitude, headache, giddiness, stupor, irritability, numbness, tingling in the limbs, liver damage, central nervous system damage, loss of muscular coordination, lack of appetite, nausea, and vomiting.[1,44] In severe cases, symptoms include brain dysfunction with hallucinations, **pulmonary edema,** loss of consciousness, and death from heart failure.[44] Methylene chloride is a probable **carcinogen,** a **neurotoxin,** but not a **teratogen,** and in laboratory mice it displayed **mutagenicity.**[1,6,25,52] Methylene chloride is considered to be of high **toxicity** (3).[5]

The effect of low concentrations of methylene chloride on aquatic life is unknown.[1]

EXPOSURE LIMITS:

AIR: ACGIH TLV-TWA 50 **ppm** (approximately 175 **mg/m^3**).[28]

WATER: Proposed **maximum contaminant level** goal for drinking water 0. Proposed **maximum contaminant level** for drinking water 5 µg/l.[25] WA groundwater criteria 5 µg/l.[8]

See "More About Exposure Limits".

METHYLENE DICHLORIDE: *see Methylene chloride.*

METHYLENE TRIBROMIDE: *see Bromoform.*

METHYL ETHYL KETONE CAS 78-93-3; **molecular weight** 72.10:

SYNONYMS: 2-Butanone, MEK, Ethyl methyl ketone, Butanone, Methyl acetone.

DESCRIPTION: Methyl ethyl ketone is a quite flammable, colorless liquid which will dissolve in water. Its sweet acetone odor is perceptible at 10 **ppm.** Methyl ethyl ketone biodegrades rapidly, with no **bioaccumulation.**[1]

USES AND SOURCES: Methyl ethyl ketone is used in making cosmetics, in vehicle maintenance and equipment repair, in furniture making and refinishing, in chemical production, and as an industrial degreaser. It is used as a process solvent, in paper production, in laboratories, in printing, in making smokeless powder, in synthetic resins, and in the surface coating industry. Methyl ethyl ketone is found in paint waste.[1]

HARMFUL EFFECTS AND SYMPTOMS: Routes of harmful **exposure** to methyl ethyl ketone include inhalation, ingestion, and skin contact. Symptoms of harmful exposure include eye and nose irritation, weakness, dizziness, headache, nausea, vomiting, difficult breathing, and loss of consciousness. Methyl ethyl ketone is a potential **teratogen.**[1]

Methyl ethyl ketone is dangerous to aquatic life in high concentrations.[1]

EXPOSURE LIMITS:

ADI 3.2 **mg/kg/day.**[25]

AIR: OSHA TWA 200 **ppm** (approximately 590 **mg/m^3**).[4]

See "More About Exposure Limits".

METHYLGUTHION: *see Guthion.*

METHYL HYDROXIDE: *see Methanol.*

METHYLINE OXIDE: *see Formaldehyde.*

METHYL ISOBUTYL KETONE CAS 108-10-1; **molecular weight** 100.16:

SYNONYMS: 4-Methyl 2-pentanone, Hexone, MIK, 2-Methyl-4-pentanone, Isopropylacetone, Isobutyl methyl ketone, MIBK.

DESCRIPTION: Methyl isobutyl ketone is a flammable colorless liquid which floats on and then dissolves in water. Its camphor odor is perceptible at .47 **ppm**. It biodegrades at a slow rate. There is no **food chain contamination** potential.[1]

USES AND SOURCES: Methyl isobutyl ketone is used as a solvent.[1]

HARMFUL EFFECTS AND SYMPTOMS: Routes of harmful **exposure** to methyl isobutyl ketone include inhalation, ingestion, and skin contact. Symptoms of harmful exposure include eye and mucous membrane irritation, skin problems, headache, and loss of consciousness.[1] Methyl isobutyl ketone is considered to be of high **toxicity** (3).[5]

Effects of low concentrations of methyl isobutyl ketone on aquatic life is unknown.[1]

EXPOSURE LIMITS:

AIR: OSHA TWA 50 **ppm** (approximately 205 **mg/m^3**).[4]

See "More About Exposure Limits".

METHYLHYDROXYBENZENE: *see Cresol.*

2-METHYL-2-(METHYLTHIO)-PROPANAL O-[(METHYLAMINO)CARBONYL]OXIME: *see Aldicarb.*

2-METHYL-2-(METHYLTHIO)-PROPIONALDEHYDE O-(METHYLCARBAMOYL)OXIME: *see Aldicarb.*

4-METHYL-M-PHENYLENE ESTER(8CI)ISOCYANIC ACID: *see Toluene-2,4-diisocyanate.*

4-METHYL-M-PHENYLENE DIISOCYANATE: *see Toluene-2,4-diisocyanate.*

4-METHYL-M-PHENYLENE ISOCYANATE: *see Toluene-2,4-diisocyanate.*

METHYLPHENOL: *see Cresol.*

METHYL PHTHALATE: *see Dimethyl phthalate.*

METHYL TRIBROMIDE: *see Bromoform.*

METHYL TRICHLORIDE: *see Chloroform.*

MIPAX (trade name): *see Dimethyl phthalate.*

MLT (trade name): *see Malathion.*

MLT (trade name): *see Malathion.*

MONDUR TD-80 (trade name): *see Toluene-2,4-diisocyanate.*

MONDUR TDS (trade name): *see Toluene-2,4-diisocyanate.*

MONOBROMOMETHANE: *see Methyl bromide.*

MONOCHLOROBENZENE: *see Chlorobenzene.*

MONOCHLOROETHYLENE: *see Vinyl chloride.*

MONOCHLOROETHANE: *see Vinyl chloride.*

MONOCHLOROMETHANE: *see Methyl chloride.*

MONOCHROMATES OF SODIUM, POTASSIUM, AMMONIUM, LITHIUM, CESIUM, AND RUBIDIUM: *see Chromium.*

MONOHYDROXYBENZENE: *see Phenol.*

MONONITROPHENOL: *see Nitrophenol.*

MONSANTO PENTA (trade name): *see Pentachlorophenol.*

MONTAR (trade name): *see PCBs.*

MORBICID (trade name): *see Formaldehyde.*

MORTON EP-201 (trade name): *see Dichloropropene.*

MOSCARDA (trade name): *see Malathion.*

MOTH FLAKES: *see Naphthalene.*

MOTH SNUB D (trade name): *see Dieldrin.*

MOTTENHEXE (trade name): *see Hexachloroethane.*

MURIATIC ACID: *see Hydrochloric acid.*

M-XYLENOL: *see 2,4-Dimethylphenol.*

M-4-XYLENOL: *see 2,4-Dimethylphenol.*

MYSORITE: *see Asbestos.*

NAC (trade name): *see Carbaryl.*

NACCONATE (trade name): *see Toluene-2,4-diisocyanate.*

NACCONATE 300: see Methylene bisphenyl isoyanate.

NAPHTHALENE CAS 91-20-3; **molecular weight** 128.16:

SYNONYMS: Naphthalin, Maphthene, Tar camphor, Naphthaline, Moth flakes, Albocarbon, Dezodorator, White tar.

DESCRIPTION: Naphthalene is a moderately flammable white or brown powder that is insoluble in water. Its mothball odor is perceptible at a range of .03 to .25 **ppm**. Its **half-life** in water by evaporation is 3 hours. It is moderately biodegradable, and it **bioconcentrates** in aquatic organisms.[1,6] There is no **food chain contamination** potential.[1]

USES AND SOURCES: Naphthalene is used as an intermediate in the production of dyes and chemicals, moth **pesticides**, and the formulation of solvents, lubricants and motor fuels (in gasoline .09 to .49 percent by weight).[6,30] It is the most abundant single constituent of coal tar and a major component of petroleum.[6]

See "Gasoline" and "Petroleum." See "More About Pesticides".

HARMFUL EFFECTS AND SYMPTOMS: Routes of harmful **exposure** to naphthalene include ingestion, inhalation, and skin contact.[6] Symptoms of harmful exposure include eye irritation, skin problems, profuse sweating, headache, confusion, excitement, malaise, abdominal pain, nausea, vomiting, irritated bladder, bloody urine, jaundice, anemia, liver damage, fever, convulsions, and loss of consciousness.[1,6] Naphthalene is linked to blood disorders and is suspected of having traversed the placental membranes in humans. There is no evidence that it is either **carcinogenic** or **mutagenic**.[6] People especially at risk from naphthalene are those who have an **enzyme** deficiency, G6PD (glucose-6-phosphate dehydrogenase). The problem manifests itself in the symptom of anemia. 100 million people worldwide have this deficiency. The incidence among whites is only around .1 percent, but the proportion rises to 20 percent among blacks, and may be as much as 50 percent for people of Jewish ancestry. Newborns are also quite susceptible to anemia upon **exposure** to naphthalene, even without the G6PD deficiency.[1] Naphthalene is considered to be of high **toxicity** (3).[5]

Naphthalene is harmful to aquatic life in very low concentrations.[1]

EXPOSURE LIMITS:

AIR: OSHA TWA 10 ppm; 50 mg/m^3.[4]

See "More About Exposure Limits."

NAPHTHALIN: *see Naphthalene.*

NAPHTHALINE: *see Naphthalene.*

NAPHTHANTHRACENE: *see PAHs.*

NAPHTHENE: *see Naphthalene.*

1,2-(1,8-NAPHTHYLENE)BENZENE: *see PAHs.*

NARCOGEN (trade name): *see Trichloroethylene.*

NARKOGEN (trade name): *see Trichloroethylene.*

NARKOSOID (trade name): *see Trichloroethylene.*

NARKOTIL: *see Methylene chloride.*

NATURAL GAS: *see Methane.*

N-BUTYL PHTHALATE CAS 84-74-2; **molecular weight** 278.34:

SYNONYMS: Dibutyl **ester** phthalic acid; Di-n-butyl phthalate; Dibutyl phthalate; Dibutyl ester 1,2-benzenedicarboxylic acid.

TRADE NAMES: PX 104, Celluflex DPB, Elaol, Palatinol C, Polycizer DBP, Staflex DBP, Witicizer 300, Hexaplas M/B, Genoplast B, Unimoll DB, DBP.

DESCRIPTION: N-butyl phthalate is a slightly flammable colorless, oily liquid that sinks to the bottom in water and mixes with sediments. It has a mild odor. It is nearly insoluble. Certain bacterial strains will degrade n-butyl phthalate, but only if the concentrations are low. **Anaerobic** conditions slow biodegradation. In **aerobic** conditions, in freshwater hydrosoil, 98 percent was degraded in 5 days. There is no **bioaccumulation**. Crustaceans **bioconcentrate** and then eliminate it within 10 days of **exposure**.[1] Phthalate **esters**, of which di-n-butyl phthalate is one, are present in water sources, air, food, consumer products, and in medical devices, such as tubing and blood bags.[6]

USES AND SOURCES: N-butyl phthalate is used as an insect repellent for the impregnation of clothes, as a plasticizer for specific plastics such as polyvinyl chloride, as a defoaming agent in the production of paper, in cosmetics, and in lubricating oil. It is used as a denaturant for alcohol, a bad-tasting additive to make it unfit for human consumption, in explosives, and in other industrial, and commercial uses.[1,6]

See "More About Pesticides".

HARMFUL EFFECTS AND SYMPTOMS: Routes of harmful **exposure** to n-butyl phthalate include ingestion, inhalation, skin contact, and parenteral administration (blood bags and tubes). N-butyl phthalate irritates the mucous membranes and the central nervous system. Chronic **exposure** may damage the liver. Animal studies indicate that phthalate **esters**, of which n-butyl phthalate is one, have low **acute** toxicities, but can cause serious **chronic effects**.[6] It is a potential **carcinogen** and **teratogen**, but not a **mutagen**.[1] N-butyl phthalate is considered to be of high **toxicity** (3).[5]

N-butyl phthalate is toxic to aquatic organisms.[1]

EXPOSURE LIMITS:

AIR: OSHA TWA 5 mg/m^3.[4]

WATER: EPA proposed drinking water limits: 34 mg/l. Freshwater should not exceed .3 ppb phthalate esters (of which n-butyl phthalate is one).[6]

See "More About Exposure Limits".

NCI-COO511 (trade name): *see Ethylene dichloride.*

NCI-CO1865: *see 2,4-Dinitrotoluene.*

NCI-CO2686: *see Chloroform.*

NCI-CO2904: *see 2,4,6-Trichlorophenol.*

NCI-CO4546 (trade name): *see Trichloroethylene.*

NCI-CO4637 (trade name): *see Fluorotrichloromethane.*

NCI-CO8640 (trade name): *see Aldicarb.*

NCI-C50102: *see Methylene chloride.*

NCI-C55141: *see Propylene dichloride.*

N-[5-(1,1-DIMETHYLETHYL)-1,3,4-THIADIAZOL-2-YL]-N,N-DIMETHYLUREA: *see Tebuthiuron.*

NDPA: *see Nitrosamines.*

NEANTINE (trade name): *see Ethyl phthalate.*

NECATORINA (trade name): *see Carbon tetrachloride.*

NECTORINE (trade name): *see Carbon tetrachloride.*

NEMA (trade name): *see Tetrachloroethylene.*

NEMEX (trade name): *see Propylene dichloride and Dichloropropene.*

NEW FIELDFUME (trade name): *see Propylene dichloride and Dichloropropene.*

N-HEXANE: *see Hexane.*

NIA 1240 (trade name): *see Ethion.*

NIA 5462 (trade name): *see Endosulfan.*

NIA 10242: *see Carbofuran.*

NIAGARA 10242: *see Carbofuran.*

NIAGARA 1240 (trade name): *see Ethion.*

NIAGARA 5462 (trade name): *see Endosulfan.*

NIAGARAL 242: *see Carbofuran.*

NIALATE (trade name): *see Ethion.*

NIALK (trade name): *see Trichloroethylene.*

NICKEL CAS 7440-02-0; **atomic weight** 58.71; Chemical Symbol: Ni

DESCRIPTION: Nickel sinks and is insoluble in water, but most of its salts are soluble. It can **persist** in natural waters indefinitely. Nickel is **bioaccumulative**, and its **half-life** in the human body is 667 days.[1]

USES AND SOURCES: Nickel and its salts are used to make stainless steel and other metal alloys. It is used to make wire, spark plugs, coins, magnets, and storage batteries. It is used in printing, in vehicle maintenance, in equipment repair, and as a **catalyst**.[1,7] The use of nickel, when categorized by industry, is 24 percent in transportation, 15 percent in the chemical industry, 9 percent in electrical equipment, 9 percent in construction, 8 percent in petroleum, 7 percent in household appliances, and 28 percent in other uses. Nickel is a component of tobacco smoke (3 g/cigarette).[3]

In 1987, 110 million pounds of nickel were produced from secondary sources, 302 million pounds imported, and 2 million pounds exported.[7]

Twenty-two million four hundred thousand pounds of nickel is released into the atmosphere annually in emissions from coal and oil burners, diesel fuel burning, and gray-iron foundries.[7]

In an EPA assessment, it was estimated that 4 to 10 percent of the discharge from large numbers of municipal wastewater treatment plants exceed water quality standards for nickel.[7] The general population is **exposed** primarily through nickel-infused food (300 to 600 g daily). Seven hundred twenty thousand people living within 12.5 miles of primary sources are exposed to an average of 15.8 **g/m**^{3} of nickel, and the 160 million people living within 12.5 miles of all sources are exposed to .05 **g/m**^{3}. Concentrations of nickel in ambient air in non-urban areas averages 6 **ng/m**^{3}, and in urban air averages 20 **ng/m**^{3}, with spikes of 150 ng/m^3 occurring in places like New York City.[7]

HARMFUL EFFECTS AND SYMPTOMS: Routes of harmful **exposure** to nickel include inhalation and ingestion. The oral absorption rate of nickel by the gastro-intestinal tract is 5 percent.[42] Symptoms of harmful exposure to nickel by inhalation includes irritation of the nasal cavities, skin irritation and disorders, asthma, and pneumonitus. Ingestion of the soluble salts causes nausea, vomiting, and diarrhea. In laboratory animals nickel damages the **cardiovascular** and muscular system, the brain, liver, and kidney.[1] The 47 million smokers nationwide are potentially at risk for the combination effects of nickel and smoking on the respiratory tract.[3] It is a **carcinogen** by inhalation, particularly involving cancers of the lungs and nasal passages, with latency periods ranging from 4 to 51 years. It is not a carcinogen by ingestion.[25,42] Nickel is considered to be of high **toxicity** (3).[5]

EXPOSURE LIMITS:

AIR: OSHA TWA 1 **mg/m**^{3}.[4]

See "More About Exposure Limits".

NIRAN (trade name): *see Chlordane and/or Parathion.*

NITRADOR (trade name): *see 4,6-Dinitro-o-cresol.*

NITRATE: *see Nitric acid and Nitrogen oxide.*

NITRIC ACID CAS 7697-37-2; **molecular weight** 63.02:

DESCRIPTION: Nitric acid is a nonflammable colorless liquid that sinks and dissolves rapidly in water. It has an acrid odor. There is no **food chain contamination** potential. Nitric acid is slowly neutralized in the environment by natural **alkalinity**.[1]

Nitrates, **ions** of nitric acid, may persist indefinitely in the environment.[1] They can stimulate algae blooms and the growth of nuisance water plants. They accelerate the aging of lakes and reservoirs, and cause problems with oxygen depletion as water plants die and decompose. Algae blooms block light from reaching submerged aquatic vegetation, killing off nursery habitat for finfish and shellfish.

USES AND SOURCES: Nitric acid is used to make fertilizers (75 percent of use). Fifteen percent is used to make explosives, and the remaining amount is used medically, in the paper industry, the metal manufacturing industry, making cosmetics, laboratories, chemical production, equipment repair, auto and textiles manufacturing, and printing.[1] Nitric acid is found at illegal drug laboratory **hazardous waste** sites, where the drug phenyl-2-propanone is processed.[2]

On the average 7 million **tons** of nitrogen annually are released from unregulated **nonpoint sources.** Nonpoint sources of pollution are estimated to be responsible for 82 percent of the nitrogen reaching the nation's surface waters, with 18 percent originating from **point sources.** Cropland erosion is estimated to be responsible for 40 percent of the nitrogen entering the nation's waterways. Pastureland and rangeland erosion combined are responsible for another 13 to 17 percent. The rest originates from other sources.

Numerous studies demonstrate a relationship between nitrate concentrations in groundwater and nitrogen fertilization rates or fertilization history. Nitrate, an **ion** of nitric acid, may be the most common groundwater contaminant in the United States. Although low levels of nitrates are natural, resulting from the decomposition of vegetation and geological deposits, higher levels may indicate that contamination is occurring. In one assessment, 34 states reported known contamination of groundwater by nitrates, and 4 others reported suspected contamination. The United States Geological Survey analyzed the occurrence of nitrate-nitrogen in samples collected over 25 years from nearly 124,000 wells across the country. 20 percent of the wells sampled had nitrate concentrations over 3 **mg/l**, a level that may indicate contributions by human activities (although natural levels in some locations, like the semiarid West, are known to exceed this level). About 6 percent of wells tested exceeded the **EPA**'s drinking water standard. Some of the wells sampled were chosen because of suspected contamination, so the survey was not random, and may overstate the problem of nitrate contamination.[60] EPA's Rural Water Survey found 2.7 percent of rural wells to exceed the drinking water standard for nitrates.[35] In a 1984 survey of 40 groundwater contaminants in 2,654 households representative of rural populations in the United States, nitrate was found in 500 to 600 supplies in excess of the **EPA** drinking water standard.

HARMFUL EFFECTS AND SYMPTOMS: Routes of harmful **exposure** to nitric acid include inhalation, ingestion, and skin contact. The odor is a fairly good warning. Symptoms of harmful exposure to nitric acid by inhalation include irritated eyes, mucous membranes, and skin, delayed **pulmonary edema**, pneumonitus, bronchitus, dental erosion, and heart damage. Symptoms of ingestion of nitric acid include burning of the gastro-intestinal tract, abdominal tenderness, shock, and death.[1] Nitric acid is considered to be of high **toxicity** (3).[5]

Nitrates, **ions** of nitric acid, in groundwater have been identified as a potential cancer threat. They react readily with other chemicals, even in the stomach, to form **carcinogenic** nitrosamine compounds.[1]

Fertilizer runoff from croplands and urban lawns and runoff from feedlots are significant sources of nitrogen in surface waters.[60] Other sources include atmospheric deposition of nitrates and discharges from municipal wastewater treatment plants.[60]

See "nitrogen oxide", "nitrosamines", and "phosphorus."

EXPOSURE LIMITS:

AIR: Nitric acid **OSHA TWA** 2 **ppm** (approximately 5 **mg/m^3**).[4]

WATER: Nitric acid recommended drinking water limit 10 **mg/l.**[59]

See "More About Exposure Limits".

NITRITES: *see Nitric acid and Nitrogen oxide.*

NITROBENZENE CAS 98-95-3; **molecular weight** 123.11:

SYNONYMS: Oil of Mirbane, Essence of Mirbane, Nitrobenzol.

DESCRIPTION: Nitrobenzene is an oily greenish yellow liquid which smells like almonds and sinks in water and slowly dissolves. Its **odor threshold** ranges from .03 to .2 **ppm.** It does not biodegrade well, but there is no **bioaccumulation.**[1]

USES AND SOURCES: Nitrobenzene reduces to aniline, which is used as an ingredient for dyes, rubber, medicinals, metal polishes, perfume, dye intermediates, and as a combustible propellant. The greatest **exposure** occurs in an industrial setting. Pregnant women are especially at risk, as this compound will cross the placental membrane.[6]

HARMFUL EFFECTS AND SYMPTOMS: Routes of harmful **exposure** to nitrobenzene include ingestion, inhalation, and skin contact.[6] There may be a latent period of 1 to 4 hours before signs of harmful exposure to nitrobenzene occur. Symptoms include irritated eyes, skin problems, dizziness, headache, drowsiness, weakness, nausea, vomiting, difficulty in breathing, **cyanosis,** anemia, severe depression, and loss of consciousness.[1,6] Nitrobenzene is highly **toxic** by **chronic** as well as **acute** dosages. Chronic **exposure** may cause spleen and liver damage and jaundice. There is no evidence that nitrobenzene is either **carcinogenic** or **mutagenic.**[1] Nitrobenzene is considered to be of high **toxicity** (3).[5]

Nitrobenzene is harmful to aquatic life in very low concentrations.[1]

EXPOSURE LIMITS:

AIR: OSHA PEL 1 **ppm** (approximately 5 **mg/m^3**) **(skin).**[25]

See "More About Exposure Limits".

NITROGEN OXIDE CAS 10024-97-2; **molecular weight** 44.02:

SYNONYMS: Nitrous oxide; Dinitrogen monoxide, Hyponitrous acid anhydride.

DESCRIPTION: Nitrogen oxide is a nonflammable colorless gas that sinks and does not dissolve well in water. Its sweet to acrid odor clings close to the ground. There is no **food chain contamination.** It is very stable in the atmosphere. A variety of nitrogen oxides interact with volatile **organic** compounds to form ozone, a major component of smog.[62]

Nitrogen oxide is estimated to contribute significantly to the possibility of the "greenhouse effect."[47]

See "carbon dioxide."

Nitrogen, as well as other nutrients like phosphorus, can stimulate algae blooms and the growth of nuisance water plants, accelerate the aging of lakes and reservoirs, and cause problems with oxygen depletion as water plants die and decompose.[53] Algae blooms block light from reaching submerged aquatic vegetation, killing off nursery habitat for finfish and shellfish.[54]

USES AND SOURCES: Nitrogen oxide is used to make whipping cream, for medical purposes, to manufacture nitrites, and as a rocket fuel oxidizer.[1] In 1984, just over half of nitrogen oxides emitted in the U.S. came from fuel burning at stationary sources such as wood stoves, with most of the contribution coming from utilities, while nearly all the rest came from motor vehicles.[46] EPA reports that at 119 air monitoring sites, average nitrogen oxide levels increased from 1975 to 1979, decreased through 1983, and then increased slightly in 1984, with the 1984 level 10 percent below that of 1975. On the average 7 million **tons** of nitrogen annually emerge as pollution from unregulated **nonpoint sources.**[55]

Nitrate, an **ion** of nitrogen oxide, may be the most common groundwater contaminant in the United States.[56] The historical and continued use of nitrogen fertilizers threatens groundwater supplies in much of the United States.[57] In one assessment, 34 states reported known contamination of groundwater by nitrates, and 4 others reported suspected contamination.[58] Numerous studies demonstrate a relationship between nitrate concentrations in groundwater and nitrogen fertilization rates or fertilization history.[57] Although low levels of nitrates are natural, resulting from the decomposition of vegetation and geological deposits, higher levels may indicate that contamination is occurring. The United States Geological Survey analyzed the occurrence of nitrate-nitrogen in samples collected over 25 years from nearly 124,000 wells across the country. Twenty percent of the wells sampled had nitrate concentrations over 3 **mg/l**. This level that may indicate contributions by human activities, although natural levels in some locations, like the semiarid West, are known to exceed this level. About 6 percent of wells tested exceeded the **EPA**'s drinking water standard. Some of the wells sampled were chosen because of suspected contamination, so the survey was not random, and may overstate the problem of nitrate contamination.[59] EPA's Rural Water Survey found 2.7 percent of rural wells to exceed the drinking water standard for nitrates. In a 1984 survey of 40 groundwater contaminants in 2,654 households representative of rural populations in the United States, nitrate was found in 500 to 600 supplies in excess of the **EPA** drinking water standard. **Nonpoint sources** of pollution are estimated to be responsible for 82 percent of the nitrogen reaching the nation's surface waters.[61] It is estimated that cropland erosion is responsible for 40 percent of the nitrogen entering the nation's waterways. Pastureland and rangeland erosion combined are responsible for another 13 to 17 percent. The rest comes from other sources.[62]

HARMFUL EFFECTS AND SYMPTOMS: The odor is a poor warning. Inhalation causes cessation of pain. Inhalation of concentrations over 40 to 60 percent causes loss of consciousness preceded by hysteria. The **chronic hazard** is unknown.[1] Nitrogen oxide is considered to be of moderate **toxicity** (2).[5]

A variety of nitrogen oxides interact with volatile **organic** compounds to form ozone, a major component of smog. Nitrogen oxide emissions, along with sulfur oxide, lead to acid rain. Acid rain is a phenomena which contributes to forest damage and wildlife population decline. Scientists theorize other causes to be **chronic** and **acute exposure** to ozone, exposure to heavy metals and organic substances, and drought.

Nitrates in groundwater have been identified as a potential cancer threat. They react readily with other chemicals, in the environment and the digestive system, to form **carcinogenic** nitrosamine compounds.[1]

Atmospheric deposition of nitrate, a breakdown product of nitrogen oxides, is a significant source, if not the largest in some places, of nitrogen causing problems in surface waters. It is a significant source in the eastern states.[60] Other sources include fertilizer runoff from croplands and urban lawns and runoff from feedlots, and discharges from municipal wastewater treatment plants.[60]

See "Nitric acid", "Nitrosamines", and "Phosphorus."

EXPOSURE LIMITS:

AIR: ACGIH TLV-TWA 50 **ppm** (approximately 91 **mg/m**^{3}).[28] U.S. National Ambient Air Quality Standard 80 **g/m**^{3}.[53]

WATER: WA groundwater criteria 10 **mg/l**.[8]

See "More About Exposure Limits".

NITROPHENOL, in particular the two isomers,

O-NITROPHENOL CAS 88-75-5; **molecular weight** 139.11

SYNONYMS: 2-Nitrophenol, Mononitrophenol, 2-Hydroxynitrobenzene.

TRADE NAMES: Atonik, Ortho-nitrophenol, ONP,

and

P-NITROPHENOL CAS 100-02-7

SYNONYMS: 4-Nitrophenol, Mononitrophenol, 4-Hydroxynitrobenzene.

TRADE NAMES: PNP, Para-nitrophenol.

DESCRIPTION: Both **isomers** of nitrophenol in solid form resemble light yellow needles with a sweet odor that sink in water and mix slowly. They are **persistent**, but there is no **bioaccumulation.**[1]

USES AND SOURCES: Both **isomers** of nitrophenol are used as indicators, as **fungicides**, and as intermediates in **organic** compound production. It is used in leather treatment, and in dye stuffs.[1,6] In addition to being released into the environment directly from production and chemical plants where they are used, nitrophenols are also inadvertently produced by **microbial** or **photodegradation** of certain pesticides.[6]

See "More About Pesticides".

HARMFUL EFFECTS AND SYMPTOMS: Routes of harmful **exposure** to nitrophenol include skin contact, ingestion, and inhalation. Symptoms of harmful exposure to o-nitrophenol include eye and skin irritation, headache, drowsiness, nausea, and **cyanosis.**[1] In laboratory animals kidney and liver damage has been noted. In addition to these symptoms, p-nitrophenol has produced high fever, blood poisoning, and depression of the central nervous system under experimental conditions.[6] Both chemicals are suspected co-**carcinogens** with polynuclear hydrocarbons by skin contact.[1] Both **isomers** of nitrophenol are considered to be of high **toxicity** (3).[5]

O-nitrophenol is harmful to aquatic life in very low concentrations. The effect of p-nitrophenol on aquatic life is unknown.[1]

EXPOSURE LIMITS:

WATER: Recommended drinking water limit .001 **ppm.**[1]

See "More About Exposure Limits."

2-NITROPHENOL: *see Nitrophenol.*

NITROBENZOL: *see Nitrobenzene.*

4-NITROPHENOL: *see Nitrophenol.*

NITROSAMINES, including

N-NITROSODIMETHYLAMINE CAS 62-75-9; **molecular weight** 74.08

SYNONYMS: Dimethylnitrosamine, N,n-dimethylnitrosamine, DMN, DMNA.

and

N-NITROSODI-N-PROPYLAMINE CAS 621-64-7

Other nitrosamines: N-nitroso-n-propyl-1-propanomine, N-nitrosodipropylamine, N-nitroso-dipropylamine, Dipropylnitrosamine, Nitrosodipropylamine, N-N-dipropylnitrosamine, DPNA, NDPA, DPN, Di-N-Propylnitrosamine.

DESCRIPTION: Nitrosamines vary widely in their physical properties. They exist as gases, liquids, and solids.[6] N-nitrosodimethylamine is a yellow liquid that sinks and dissolves slowly in water. It is relatively **persistent** in the environment, and is absorbed the most by soils with **organic** content. N-nitrosodi-n-propylamine is a slightly soluble pale yellow to brown liquid that floats on water. It is very persistent in water, undergoing degradation only by light, which has serious repercussions for ground water contaminated by this chemical. Its **half-life** in the atmosphere is less than 1 hour, and it slowly disappears from soil after an initial lag of about a month. There is moderate **bioaccumulation.**[1] Some nitrosamines are known to **bioconcentrate** in aquatic organisms.[6]

USES AND SOURCES: Nitrosamines are widespread in the environment. They are found in chemical plant wastewaters. They are found in foods such as cheese (20 to 30 **g/kg**), in soybean oil (290 **g/kg**), and alcoholic beverages.[1,6,7] Nitrosamines contaminate certain **pesticides**, among them atrazine (**ppb**). High levels of nitrosamines are found in soils where the use of triazine **herbicides** has been combined with that of nitrogen fertilizers. The high levels have been accompanied by **leaching** and plant uptake of the nitrosamines.[7] Nitrosamines are components of tobacco smoke (3 to 140 **ng**/cigarette).[3,7] The air in smoke filled rooms contain concentrations of nitrosamines of 90 to 240 **ng/m**^{3}. The presence of nitrosamines in tobacco is due mainly to the application of herbicides commonly applied to tobacco. Nitrosamines have been found in cosmetics. Out of 335 cosmetic products analyzed by the **FDA**, 42 percent were contaminated by nitrosamines.[7] A number of nitrosamines are found at illegal drug laboratory **hazardous waste** sites, where cocaine and STP have been processed.[2]

Individual nitrosamines have been identified as to their uses and sources. N-nitrosodimethylamine is used for chemical manufacture, as an industrial solvent, as a pesticide, as a gasoline, rocket fuel, and lubricant additive, and in the manufacture of rubber and batteries. N-nitrosodi-n-propylamine is used as a research chemical. There are few commercial uses for this chemical. N-nitrosodiethanolamine, another nitrosamine, has been found in quantities of up to 130,000 **ppb** in cosmetics, hand and body lotions, shampoos, cutting fluids, specific pesticides, antifreeze, and tobacco. The 10,000 to 100,000 people who get medical implants may be **exposed** to n-nitrosopiperidine. People with high levels of exposure to n-nitrosodimethylamine are the 750,000 to 780,000 who work in cutting fluid factories and anyone in a machine shops who uses the fluid.[7]

See "Atrazine," and "Nitric acid". See "More About Pesticides".

HARMFUL EFFECTS AND SYMPTOMS: Routes of harmful **exposure** to nitrosmaines include ingestion, inhalation, and skin contact.[6] Symptoms of harmful exposure to n-nitrosodimethylamine include skin irritation, headache, dizziness, weakness, abdominal cramps, nausea, vomiting, diarrhea, fever, enlarged liver, jaundice, gastro-intestinal bleeding, excess **accumulation** of fluid in the abdominal cavity, and reduced function of the liver, kidneys, and lungs.[1] N-nitrosodimethylamine and n-nitrosodi-n-propylamine are considered to be of high **toxicity** (3).[5]

Nearly 70 percent of all nitrosamines have been found to be **carcinogenic** in laboratory animals.[6]

EXPOSURE LIMITS:

AIR: No **exposure** is recommended.[1]

WATER: Due to the potential **carcinogenic** effect of n-nitrosodi-n-propylamine, its concentration should be zero. If this level is not attainable, levels which raise the human lifetime cancer risk to

one in ten thousand = 8.00 **ng/l**;
one in one million = .80 ng/l;
one in ten million = .08 ng/l.[1]

WA groundwater criteria N-nitrosodiethanolamine .03 g/l. N-nitrosodiethylamine .0005 µg/l. N-nitrodiphenylamine 17 µg/l. N-nitroso-di-n-propylamine .01 µg/l. N-nitrosopyrrolidine .04 µg/l. N-nitroso-di-n-butylamine .02 µg/l. N-nitroso-N-methylethylamine .004 µg/l.[8]

INGESTION: FDA limit in pacifiers and baby bottle nipples 10 ppb.[7]

See "More About Exposure Limits".

NITROSODIPROPYLAMINE: *see Nitrosamines.*

NITROUS DIPROPYLAMIDE: *see Nitrosamines.*

NITROUS OXIDE: *see Nitrogen oxide.*

N,N-DIMETHYLNITROSAMINE: *see Nitrosamines.*

N-N-DIPROPYLNITROSAMINE: *see Nitrosamines.*

N-NITROSODIPROPYLAMINE: *see Nitrosamines.*

N-NITROSO-DIPROPYLAMINE: *see Nitrosamines.*

N-NITROSO-N-PROPYL-1-PROPANOMINE: *see Nitrosamines.*

NO BUNT (trade name): *see Hexachlorobenzene.*

NO BUNT 40 (trade name): *see Hexachlorobenzene.*

NO BUNT 80 (trade name): *see Hexachlorobenzene.*

NO BUNT LIQUID (trade name): *see Hexachlorobenzene.*

NOFLAMOL (trade name): *see PCBs.*

N.O.S. DICHLOROPROPENE: *see Dichloropropene.*

N.O.S. DICHLOROPROPYLENE: *see Dichloropropene.*

NTM (trade name): *see Dimethyl phthalate.*

O-CRESOL: *see Cresol.*

OCTACHLOROCAMPHENE: *see Toxaphene.*

OCTALENE: *see Aldrin.*

OCTALOX (trade name): *see Dieldrin.*

OCTYL PHTHALATE: *see Dioctyl phthalate.*

ODB: *see 1,2-Dichlorobenzene.*

ODCB: *see 1,2-Dichlorobenzene.*

O-DICHLOROBENZENE: *see 1,2-Dichlorobenzene*

O-DICHLOROBENZOL: *see 1,2-Dichlorobenzene.*

O-ESTER P-NITROPHENOL with O,O-DIETHYL PHOSPHOROTHIOATE: *see Parathion.*

OIL: *see Petroleum.*

OIL OF MIRBANE: *see Nitrobenzene.*

OIL OF VITRIOL: *see Sulfuric acid.*

OLEOPHOSPHOTHION (trade name): *see Malathion.*

OLEUM (FUMING SULFURIC ACID): *see Sulfuric acid.*

OMAL: *see 2,4,6-Trichlorophenol.*

OMS 570 (trade name): *see Endosulfan.*

OMS 864 (trade name): *see Carbofuran.*

ONP (trade name): *see Nitrophenol.*

O,O-DIETHYL-O-(4-NITROPHENYL)PHOSPHOROTHIOATE: *see Parathion.*

O,O-DIETHYL-(4-NITROPHENYL)THIOPHOSPHATE: *see Parathion.*

O,O-DIETHYL-O-ETHYLMERCAPTOETHYLTHIOPHOSPHATE: *see Systox.*

O,O-DIETHYL-O-(2-(ETHYLTHIO)ETHYL)PHOSPHOROTHIONATE: *see Systox.*

O,O-DIETHYL O-(P-NITROPHENYL) ESTER OF PHOSPHOROTHIOIC ACID: *see Parathion.*

O,O-DIETHYL-O,P-NITROPHENYL PHOSPHOROTHIOATE: *see Parathion.*

O,O-DIETHYL-O-(P-NITROPHENYL)THIONOPHOSPHATE: *see Parathion.*

O,O-DIETHYL S-[2-(ETHYLIO)ETHYL]DITHIOPHOSPHATE: *see Disulfoton.*

O,O-DIETHYL S-[2-(ETHYLIO)ETHYL] ESTER: *see Disulfoton.*

O,O-DIETHYL S-[2-(ETHYLIO)ETHYL]PHOPHORODITHIOATE: *see Disulfoton.*

O,O-DIETHYL-S-ETHYL-MERCAPTOETHYL-THIOPHOSPHATE: *see Systox.*

O,O-DIETHYL-S-(2-(ETHYLTHIO)ETHYL)PHOSPHOROTHIOLATE: *see Systox.*

O,O-DITHIOPHOSPHATE: *see Disulfoton.*

O,O,O,O-TETRAETHYL S,S-METHYLNE BIS(PHOSPHOROTHIOLOTHIOLOATE): *see Ethion.*

O,O,O,O-TETRAETHYL S,S-METHYLENE DIPHOSPHORODITHIOATE: *see Ethion.*

O,O,O,O-TETRAETHYL S,S-METHYLENE DI(PHOSPHORODITHIOATE): *see Ethion.*

O,O,O,O-TETRAETHYL S,S-METHYLNE BIS(PHOSPHOROTHIOLOTHIOLOATE): *see Ethion.*

O,O,O,O-TETRAETHYL S,S-METHYLENE DIPHOSPHORODITHIOATE: *see Ethion.*

O,O,O,O-TETRAETHYL S,S-METHYLENE DI(PHOSPHORODITHIOATE): *see Ethion.*

O,P-DINITROTOLUENE: *see 2,4-Dinitrotoluene.*

2,3-O-PHENYLENEPYRENE: *see PAHs.*

ORTHODICHLOROBENZENE: *see 1,2-Dichlorobenzene.*

ORTHODICHLOROBENZOL: *see 1,2-Dichlorobenzene.*

ORTHO-NITROPHENOL (trade name): *see Nitrophenol.*

OXACYCLOPROPANE: *see Ethylene oxide.*

OXANE: *see Ethylene oxide.*

OXIDOETHANE: *see Ethylene oxide.*

OXIRAN: *see Ethylene oxide.*

OXIRANE: *see Ethylene oxide.*

OXYBENZENE: *see Phenol.*

OXYMETHANE: *see Formaldehyde.*

OXYMETHYLENE: *see Formaldehyde.*

OZONE CAS 10028-15-6; **molecular weight** 48:

DESCRIPTION: Ozone is a colorless gas with a very pungent odor.[1] It is produced by chemical reactions between nitrogen oxides and volatile organic compounds. This reaction occurs in the presence of oxygen and sunlight.[47]

See "Nitrogen Oxides" and "Volatile Organic Compounds."

USES AND SOURCES: Ozone forms naturally as a result of solar radiation and electrical storms. It forms around electrical sources. It is used as an oxidizing agent in the **organic chemical** industry, as a food disinfectant in cold storage rooms, and as a water disinfectant. It is used for bleaching textiles, waxes, flours, mineral oils, paper pulp, starch, and sugar, for processing perfumes, vanillin, and camphor, for treating industrial wastes, and for rapid drying of varnishes. Ozone is used for printing inks and deodorizing feathers.[1]

HARMFUL EFFECTS AND SYMPTOMS: Recent scientific findings suggest the current ozone standard may not be sufficiently protective. EPA's Clean Air Scientific Advisory Committee has concluded that the existing one-hour standard has little or no margin of safety, and that lasting health effects might result from long-term **exposure**. Symptoms of harmful exposure to ozone include irritated eyes and mucous membranes, dryness of upper respiratory passages, choking, coughing, severe fatigue, and **pulmonary edema. Chronic** exposure by laboratory animals has produced bronchitus. Symptoms of **systemic poisoning** include headache, malaise, shortness of breath, drowsiness, reduced ability to concentrate, slowing of heart and respiration rate, and visual changes.[1] Ozone is considered to be of high **toxicity** (3).[5]

Ozone is an undesirable gas near the earth. It is a major component of smog. It is formed by the interaction of nitrogen oxides (listed elsewhere) with volatile **organic compounds.**[65] **Chronic** and **acute exposure** to ozone is a phenomena which contributes to forest damage and wildlife population decline. Scientists theorize other causes to be acid rain, exposure to heavy metals and **organic** substances, and drought.[66] Ozone can significantly decrease the yield of several important agricultural crops and may cause other environmental damage.

Ozone is a desirable gas in the stratosphere. The ozone in the stratosphere reduces the amount of ultraviolet light reaching the earth's surface, protecting people from skin cancer and other effects such as reduced agricultural and marine productivity.[47]

EXPOSURE LIMITS:

AIR: OSHA TWA .1 **ppm** (approximately .2 **mg/m^3**). National ambient air quality standard .12 **ppm.**[1]

See "More About Exposure Limits".

PAHs:

SYNONYMS: Polynuclear aromatic hydrocarbons, PNAs, some of which are:

ACENAPHTHENE CAS 83-32-9,

SYNONYMS: 1,2-Dihydroacenaphthylene, 1,8-Ethylenenaphthalene, PERI, Acenaphthylene.

ANTHRACENE CAS 120-12-7,

SYNONYMS: Paranaphthalene, Green oil, Tetra Olive NZG, Anthracen, Anthracin.

BENZO(A)ANTHRACENE

SYNONYMS: 1,2-Benzanthracene, 2,3-Benzphenanthrene, Tetraphene, Benzanthrene, Naphthanthracene, Benzo(b)phenanthrene, 2,3-benzophenanthrene, 1,2-benz(a)anthracene, 1,2-benzanthrene, 1,2-benzanthracene, benzanthracene, BA, B(A)A.

BENZO(A)PYRENE CAS 50-32-8,

SYNONYMS: 3,4-Benzpyrene, 3,4-Benzopyrene, BAP, 1,2-Benzpyrene, Benzo(def)chrysene, 3,4-Benzo(a)pyrene, Benz(alpha)pyrene, B(A)P, BP, 3,4-BP.

BENZO(B)FLUORANTHENE

SYNONYMS: 2,3-Benzofluoranthene, Benz(e)acephenanthrylene, 3,4-Benzofluoranthene, B(B)F, Benzo(k)fluoranthene **CAS** 207-08-9,

CHRYSENE CAS 218-01-9,

SYNONYMS: 1,2-Benzphenanthrene; Benz(a)phenanthrene; 1,2,5,6-dibenzonaphthalene,

INDENO(1,2,3-CD)PYRENE CAS 193-39-5,

SYNONYMS: 2,3-O-phenylenepyrene; IP.

FLUORANTHENE CAS 206-44-0,

SYNONYMS: Benzo(k,j)fluorene; Idryl; 1,2-(1,8-naphthalene)benzene; 1,2-Benzacenaphthene.

1,2,5,6-DIBENZANTHRACENE CAS 53-70-3,

SYNONYMS: Dibenz(a,h)anthracene; DB(A,H)A,; DBA; Dibenzo(a,h)anthracene; 1,2,7,8-Dibenzanthracene

PHENANTHRENE CAS 85-01-8,

and

PYRENE CAS 129-00-0

DESCRIPTION: PAHs, in solid form, are needles, leaflets, and crystals that are colorless to yellow, often with a yellow-green fluorescence. Many PAHs are insoluble and will sink in water. Airborne particles of PAHs **persist** at fairly high concentrations when wind blown for long distances. In strong sunlight, though, the chemical **half-life** may be limited to hours or days. Many PAHs, when deposited in sediment, are quite persistent and may accumulate in high concentrations. Crustaceans readily accumulate PAHs, but they **metabolize** and excrete them within a few days. PAHs degrade little in water, they sorb to sediments. **Photodegradation** may be an important process. Benzo(a)pyrene, among other PAHs, **bioaccumulates,** particularly in bottom dwelling fish with high fat content. Acenaphthene is resistent to photodegradation in soil. Its **half-life** in water is half an hour. Fluoranthene breaks down, in sunlight, into chemicals **toxic** to plants. There is a lack of information on environmental behavior and fate of many PAHs.[1]

USES AND SOURCES: PAHs are found in the the atmosphere, soil, water, food, and atmospheric and road dust due to their large number of sources. Most people are **exposed** to at least very low levels of PAHs. They are formed as a result of incomplete combustion of **organic** compounds (like coal and petroleum) with insufficient oxygen. The less efficient the combustion process, the higher the PAH emission factor is likely to be.[6] PAHs are produced in many hydrocarbon combustion processes. They are constituents of gasoline and components of gasoline and diesel engine exhaust.[6,30] Transportation generated PAHs, particularly fluoroanthene, constitute around 50 percent of urban resident **exposures** (urban ambient air .2 to 29.5 **mg/m**^{3}).[1] Stationary sources include heat and power generation, industrial activity (such as coke ovens), oil spills, and coal refuse heaps.[6] Other sources include plant biosynthesis, petroleum products, asbestos, wood stove smoke, and the manufacture and distribution of coal tar, coal tar pitch, and petroleum asphalts. PAHs are contained in cigarette smoke (.26 **g**/cigarette; benzo(a)anthracene 20 to 70 **mg**/cigarette; dibenz(a,h)anthracene 4 mg/cigarette).[1,6,7] They are encountered toxicants at **hazardous waste** cleanup sites in Washington state.[44] Acenaphthene, one PAH, is used in **organic** compound production, as an intermediate in dye stuffs, and in the manufacture of plastics and **pesticides.**[6]

One million eight hundred thousand pounds of benzo(a)pyrene are emitted annually through combustion.[7]

North American daily **exposure** to fluoranthene amounts to .017 **g** by water, 1.6 to 16 g by food, and .040 to .080 g by air.[1]

See "Asbestos", "Gasoline", and "Petroleum."

HARMFUL EFFECTS AND SYMPTOMS: Routes of harmful **exposure** to PAHs include inhalation, ingestion, and skin contact. With fluoranthene, ingestion of contaminated food is the greatest source. There is a wide variety in the **toxicity** of PAHs. Fluoroanthene is not a **mutagen**, but may be a potent co-carcinogen. 1,2,5,6-Dibenzanthracene is a possible **carcinogen** (C) by inhalation and skin exposure, and a possible mutagen. Symptoms of harmful **exposure** include tremors, fever, gastro-intestinal distress, **immune system suppression**, and convulsions. Symptoms of harmful exposure to acenaphthene include skin and eye irritation.[6] Chrysene and benzo(b)fluoranthene are possible **carcinogens** (C) by inhalation and skin contact.[1] Benzo(a)pyrene is a possible carcinogen (C) by skin and inhalation, and in laboratory animals is **fetotoxic**, **teratogenic**, and causes sterility and immune system depression.[1,6] Anthracene is not carcinogenic, in and of itself, but industrial material in which it is found may be carcinogenic due to impurities. There is generally a lack of information on health effects for PAHs.[1] Anthracene, benzo(a)pyrene, indeno(1,2,3-cd)pyrene, fluoranthene, phenanthrene, pyrene, and chrysene are considered to be of high **toxicity** (3).[5]

Acenaphthene is highly toxic to aquatic organisms and fish in quantities of .5 to 2 **ppm.**[6]

EXPOSURE LIMITS:

AIR: The **OSHA PEL(TWA)** for coal tar volatiles (benzene, anthracene, BAP, phenanthrene, acridine chrysine, and pyrene) is .2 **mg/m^3**. Indeno(1,2,3-cd)pyrene OSHA PEL .5 mg/m^3.[25]

WATER: Proposed maximum contaminant level 0.[25] For acenaphthene, the drinking water limit is .02 **ppm.**[1] WA groundwater criteria PAH .01 **µg/l.** benzo(a)pyrene .008 µg/l.[8]

See "More About Exposure Limits."

PALATINOL C (trade name): *see N-butyl phthalate.*

PALATINOL M (trade name): *see Dimethyl phthalate.*

PANARAM D-31 (trade name): *see Dieldrin.*

PARACIDE (trade name): *see 1,4-Dichlorobenzene.*

PARADICHLOROBENZENE: *see 1,4-Dichlorobenzene.*

PARADICHLOROBENZOL: *see 1,4-Dichlorobenzene.*

PARADOW (trade name): *see 1,4-Dichlorobenzene.*

PARAFORM (trade name): *see Formaldehyde.*

PARAMOTH (trade name): *see 1,4-Dichlorobenzene.*

PARANAPHTHALENE: *see PAHs.*

PARA-NITROPHENOL (trade name): *see Nitrophenol.*

PARAZENE: *see 1,4-Dichlorobenzene.*

PARATHION CAS 56-38-2; molecular weight 291.27:

SYNONYMS: O,O-diethyl-o,p-nitrophenyl phosphorothioate; Diethyl-p-nitrophenyl monothiophosphate; Diethyl p-nitrophenyl thiophosphate; O,O-diethyl-o-(4-nitrophenyl) phosphorothioate; Diethyl 4-nitrophenyl thionophosphate; O,O-diethyl-o-(p-nitrophenyl) thionophosphate; O,O-diethyl-o-(4-nitrophenyl)thiophosphate; Diethylparathion; O,O-diethyl o-(p-nitrophenyl)**ester** of phosphorothioic acid; O-ester P-nitrophenol with O,O-diethyl phosphorothioate; Ethyl parathion.

TRADE NAMES: Corothion, Drexel parathion 8E, Fosferno 50, Soprathion, Alkron, DNTP, DPP, Niran Penphos, Phoskil, Thiophos, Vapophor, Genithion, Bladan, Folidol, Thiopnos, ENT 15,108.

DESCRIPTION: Parathion is a slightly flammable yellow liquid that sinks in water and dissolves very slowly. Its garlic odor is perceptible at .04 **ppm**. The technical grade is colored from amber to dark brown. Parathion is formulated as a dust, **wettable powder, emulsifiable concentrate,** and aerosol. Its **half-life** in water ranges from 18 to 35 days. In one soil study, an application of 20 **ppm** concentration decreased to a range of 2 to .2 ppm in 30 days. In another study, concentrations of more than 3 **ppm** remained after 8 months. Parathion is slightly **mobile** in soil. There is **bioaccumulation** if there are repeated **exposures** over a short period of time. If there are not, then it is unlikely that parathion contaminates the food chain.[1]

USES AND SOURCES: Parathion is a **pesticide** that is used on fruits, vegetables, grasses, and nuts.

See "More About Pesticides".

HARMFUL EFFECTS AND SYMPTOMS: Harmful **exposure** to parathion may occur by inhalation, ingestion, and skin contact. Parathion is a **cumulative poison,** particularly in repeated exposures over a short period of time. It does not accumulate in the body fat.[1] Symptoms of harmful exposure include sweating, salivation, inflammation of the nasal mucous membranes, skin problems, headache, weakness, lassitude, miosis, wheezing, laryngal spasms, abdominal cramping, loss of appetite, nausea, vomiting, diarrhea, loss of coordination, difficulty in walking, irregular heartbeat, low blood pressure, **cyanosis,** paralysis, convulsions, **pulmonary edema,** incontinence, loss of consciousness, and death. Parathion is a possible **carcinogen, mutagen,** and **teratogen.**[1,69] Parathion is considered to be of high **toxicity** (3).[5]

It is harmful to aquatic life, birds, and mammals in very low concentrations.[1]

EXPOSURE LIMITS:

ADI .005 **mg/kg/day.** TMRC 192 percent of **ADI.**[69]

AIR: OSHA TWA .1 **mg/m^3 (skin).**[4]

WATER: Recommended drinking water limit .1 **ppm.**[1]

See "More About Exposure Limits".

PARTICULATES

DESCRIPTION: Particulates are solid particles or liquid droplets small enough to remain suspended in air. They can be emitted directly from a source or formed from gases like sulfur dioxide.

Ambient levels of particulates are assessed by monitors that measure those ranging up to 45 microns in diameter.[64] The monitors do not distinguish between larger and smaller particles, although more serious health risks are posed by particles 2.5 microns in diameter or less. In 1984, **EPA** proposed revising the air quality standard to apply only to particles 10 microns or less in diameter.

See "Sulfur dioxide."

USES AND SOURCES: Electrical utilities and other industrial sources were responsible for about 47 percent of particulate emission in 1984. Wood stoves emit particulates.[64]

The EPA reports that average total suspended particulate (TSP) levels, measured at 1,344 sites, decreased 20 percent between 1975 and 1984, and emissions declined an average of 33 percent. Changes in ambient levels tend to differ from changes in emission estimates because ambient levels are influenced by natural dust, construction activity, and other factors as well as emissions. Decreases in emission levels are due to reduced industrial activity, installation of control equipment, reduced coal burning, and installation of control equipment by coal burning utilities.[64] The highest concentrations of particulates in 1984 generally were found in the industrial Midwest and in arid areas of the West.[70] Worldwide, progress in reducing emissions from industrial sources has been offset somewhat by particulates generated from increased motor vehicle traffic and use of diesel-powered automobiles.[66]

HARMFUL EFFECTS AND SYMPTOMS: Particulates may irritate the respiratory system and contribute to **acute** respiratory illness. Prolonged inhalation of some types of airborne particulates may increase both the incidence and the severity of **chronic** respiratory disease.[70] Particles of 2.5 microns or less are deposited in the parts of the lung that are most vulnerable to injury and can carry with them other pollutants, such as toxic metals and viruses.

See "Metals."

EXPOSURE LIMITS:

AIR: OSHA TWA total dust 15 **mg/m**^{3}. **Respirable fraction** 5 mg/m^3.[4]

See "More About Exposure Limits."

PCBs CAS 1336-36-3; **molecular weight** of Arochlor 1242: 258; of Arochlor 1254: 326.

SYNONYMS: Polychlorinated biphenyls: Arochlor 1242 (CAS 53469-21-9), Arochlor 1254 (CAS 11091-69-1), 1221 (CAS 11104-28-2), 1232 (CAS 11141-16-5), 1248 (CAS 12672-29-6), 1260 (CAS 11096-82-5), 1016 (CAS 12674-11-2).

TRADE NAMES: Aroclor, Dykanol, Noflamol, Chlorentol, Inerteen, Pyranol, Therminol, Chlorophen, Chlorextol, Clophen, Colphen, Fenclor, Kanachlor, Kanechlor, Montar, Pyralene, Santotherm, Santotherm FR, Sovol, Therminol FR.

DESCRIPTION: PCBs are complex mixtures of **isomers** of chlorobiphenyls with different chlorine contents. In any commercial mixture there may be 40 to 70 different compounds present. PCBs appear in several forms, including oily light yellow liquids, waxy solids or resins, or white powders. All are practically odorless, flammable, sink to the bottom in bodies of water, and dissolve only slightly. In soil PCBs with less than 5 chlorines have a **half-life** of 30 days. PCBs with more than 5 chlorines have a half-life of over a year. In water their half-lives are 10 to 12 hours. They evaporate slowly. Chemical decomposition is unlikely. If they settle on the bottom and mix with the sediment, they can **persist** indefinitely.[1] PCBs are **bioaccumulative**, and they contaminate the food chain.[1,6,74]

USES AND SOURCES: PCBs have become widespread throughout the environment since the beginning of their commercial use in 1929.[6,44] Over 1 billion pounds of PCBs were produced before their production was halted in 1976. It is estimated that 20 to 30 years will elapse before all PCBs in use will be disposed of or destroyed. A major use of PCBs was in insulation for electrical cables and wires, and in the production of electrical condensers. They were also used in epoxy paints, carbonless copy paper, adhesives, caulking compounds, plasticizers, additives for extreme pressure lubricants, wax-extenders, and coatings in foundry use.[1,6,44] They are also a by-product of certain combustion processes. Around 312 million pounds are still in use as insulation, heat-transfer, or hydraulic fluids.[1,6,75] PCBs are commonly encountered toxicants at **hazardous waste** cleanup sites in Washington state.[44]

In 1978 the **EPA** stated that about 150 million pounds of PCBs had entered the environment.[75]

PCB concentrations of 4 to 440,000 µg/l has been found in runoff, sediments, soil, creek water, **leachate**, underground oil-water layer, and pond effluent. PCBs are found in 6 percent of finished ground water supplies, at concentrations of .1 µg/l.[7]

Average daily intake of PCBs amounts to .93 g/day.[7] Measurable levels of PCBs have been found in more than 50 percent of subjects tested with maximum blood levels generally less than 20 **ppb**. Fat tissue samples have ranged from 1 to 2 **ppm**, and human milk from 40 to 100 ppb.[74] In another study, 91 percent of individuals sampled had detectable levels of PCBs in fatty tissue.[6]

HARMFUL EFFECTS AND SYMPTOMS: Routes of harmful **exposure** to PCBs include diet, inhalation, and skin contact. PCBs are stored in the fatty tissues, liver, kidneys, lungs, adrenal glands, brain, heart, and skin.[73] **Acute** and **chronic** symptoms include irritation of the eyes, ears, nose, and throat, tearing, swelling in the eyes, acne (by air contaminated with 1 **mg/m^3** PCBs), coloring of the skin, itching, joint pain, headache, fatigue, hearing and vision problems, **pulmonary edema**, jaundice, loss of appetite, abdominal pains, weight loss, vomiting, nausea, numbness of limbs, menstrual changes, spasms, bronchitus, and liver damage.[1,3] PCBs are **fetotoxic**.[76] They may initiate or aggravate skin, liver, lung, gastro-intestinal and central nervous diseases.[6] In laboratory animals they have caused reproductive and gastric damage, liver disorders, tumors, birth defects, and cancer.[75] They are **immune system suppressants**, **teratogens** and probable **carcinogens** and **mutagens**.[6,25,42,74] PCBs are considered to be of high **toxicity** (3).[5]

PCBs can be harmful to aquatic life and birds in very low concentrations. In birds, PCBs cause thinning of the eggshells.[1]

EXPOSURE LIMITS:

AIR: OSHA TWA 1 **mg/m^3** for PCBs containing 42 percent chlorine, like Arochlor 1242. .5 mg/m^3 for PCBs containing 54 percent chlorine, like Arochlor 1254.[4]

WATER: Due to the potential **carcinogenic** effect of PCBs, their concentration should be zero. If this level is not attainable, levels which raise the human lifetime cancer risk to

one in ten thousand	=	.7900 **ppt**;
one in one million	=	.0790 ppt;
one in ten million	=	.0079 ppt.

Chronic aquatic **toxicity** limit .0014 **ppb**.[1] WA groundwater criteria .01 µg/l.[44]

INGESTION: 10 **ppm** in food packaging. 1.5 ppm in dairy products. 3 ppm in poultry. .3 ppm in eggs. 2 ppm in fish. .2 ppm in baby food.[7]

See "More About Exposure Limits".

PCE: *see Tetrachloroethylene.*

P-CRESOL: *see Cresol.*

PDB: *see 1,4-Dichlorobenzene.*

PDCB: *see 1,4-Dichlorobenzene.*

P-DICHLOROBENZENE: *see 1,4-Dichlorobenzene.*

P-DICHLOROBENZOL: *see 1,4-Dichlorobenzene.*

P-DIOXANE: *see Dioxane.*

P-DIOXIN: *see Dioxin.*

PENCHLOROL: *see Pentachlorophenol.*

PENPHENE: *see Toxaphene.*

PENPHOS (trade name): *see Parathion.*

PENTA: *see Pentachlorophenol.*

PENTACHLORIN: *see DDT.*

PENTACHLOROPHENOL CAS 87-86-5; **molecular weight** 266.35:

SYNONYMS: PCP, Penta, Penchlorol.

TRADE NAMES: Santophen-20, Dowicide-G, Dowicide-7, Dowicide EC-7, Monsanto Penta, Santobrite.

DESCRIPTION: Pentachlorophenol in solid form is white to light brown in the form of solid beads or flakes. In water it appears as dark colored plumes. In solid form it sinks to the bottom in bodies of water, where it dissolves very slowly. Its odor is perceptible at .857 **ppm.**[1] Pentachlorophenol **bioconcentrates** in the body tissues of animals, and it is **bioaccumulative.**[1,6] This compound is often contaminated with hexachlorobenzene and members of the dioxin family.

See "Hexachlorobenzene."

USES AND SOURCES: Pentachlorophenol is everywhere in the environment, due to its many sources. It has been used as a bactericide, **fungicide**, and slimicide used for wood and wood product preservation, and as an **herbicide**, insecticide, and molluscicide.[6] Pentachlorophenol is a commonly encountered toxicant at **hazardous waste** cleanup sites in Washington state.[44] It is one of the major **pesticides** used in the Puget Sound Basin. Pentachlorophenol is registered as a **toxicologically** significant **inert ingredient** in pesticides.[52] Utility companies have an estimated 20 to 30 million wooden poles supporting overhead distribution and transmission lines. They install 1.5 million new poles yearly. Sixty-five percent of these new poles are being treated with pentachlorophenol.[78] In 1986 the **EPA** denied over-the-counter sales of pentachlorophenol and restricted its use to licensed applicators. In 1987, the EPA prohibited all non-wood uses of pentachlorophenol, except for minor applications as a slimicide in paper mills and oil wells.

Annually 700,000 pounds of pentachlorophenol are used.

Treated lumber **leaches** up to 158,000 **ppb** pentachlorophenol, and generates runoff with up to 6,600 ppb total pentachlorophenol. Elevated levels of pentachlorophenol and related dioxins have been found in poultry and pork (54 percent of samples in excess of 100 **ppb**), beef, milk, eggs, and fish, by **exposure** of animals to pentachlorophenol treated sawdust and shelters.

See "Dioxin." See "More About Pesticides".

HARMFUL EFFECTS AND SYMPTOMS: Routes of harmful **exposure** to pentachlorophenol include ingestion, inhalation, and skin contact.[1] The skin will absorb 62 percent of a dose if the pentachlorophenol is in oil, and 16 percent if the exposure is to pentachlorophenol salts.[6] Symptoms of harmful **exposure** include irritation of the eyes, nose, throat, and skin, headaches, sweating, dehydration, skin problems, dizziness, weakness, sneezing and coughing, difficulty in breathing, chest pains, loss of appetite, weight loss, nausea, vomiting, diarrhea, increase, then decrease of respiration, blood pressure and urinary output, abnormally fast heartbeat, fever, and convulsions followed by collapse.[6] Deaths have occurred due to high fever.[6] In studies pentachlorophenol has been linked to cancers of the **lymphatic system**, soft-tissue cancer, cancers of the nasal cavity, sinuses, nasopharynx, and liver, birth defects, weakening of the immune system, blood, liver, skin disorders, and reduced sperm counts. It is a matter of debate whether the effects are due to pentachlorophenol, or to impurities present in commercial forms. Pentachlorophenol is a **mutagen**. Pentachlorophenol is considered to be of high **toxicity** (3).[5]

Pentachlorophenol is harmful to aquatic life in very low concentrations (30 **ppb**).[87]

EXPOSURE LIMITS:

ADI .002 mg.

AIR: OSHA TWA .5 mg/m^3 (skin).[4]

WATER: Recommended drinking water limit .01 **ppm**.[1]

See "More About Exposure Limits".

PENTACHLOROPHENYL CHLORIDE: *see Hexachlorobenzene.*

PENTECH (trade name): *see DDT.*

PER: *see Tetrachloroethylene.*

PERAWIN (trade name): *see Tetrachloroethylene.*

PERC: *see Tetrachloroethylene.*

PERCHLOR: *see Tetrachloroethylene.*

PERCHLORETHYLENE: *see Tetrachloroethylene.*

PERCHLOROBENZENE: *see Hexachlorobenzene.*

PERCHLOROBUTADIENE: *see Hexachlorobutadiene.*

PERCHLOROETHYLENE: *see Tetrachloroethylene.*

PERCHLOROMETHANE: *see Carbon tetrachloride.*

PERCLENE (trade name): *see Tetrachloroethylene.*

PERCOSOLV (trade name): *see Tetrachloroethylene.*

PERI: *see PAHs.*

PERK: *see Tetrachloroethylene.*

PERKLONE (trade name): *see Tetrachloroethylene.*

PERM-A-CHLOR (trade name): *see Trichloroethylene.*

PERM-TRIAL (trade name): *see Trichloroethylene.*

PERSEC (trade name): *see Tetrachloroethylene.*

PERSISTOSPRAY: *see DDT.*

PESTMASTER (trade name): *see Methyl bromide and/or Ethylene dibromide.*

PESTMASTER EDB-85 (trade name): *see Ethylene dibromide.*

PETROL: *see Gasoline.*

PETROLEUM CAS 8002-05-9

SYNONYMS: Crude oil, of which the major fractions are: benzine (not benzene), lubricating oils, paraffin wax, asphalt, diesel fuel, and kerosene.

USES AND SOURCES: Petroleum is used as a fuel, and for a vast array of manufacturing processes and as an intermediate and an ingredient for many, many products. It is a major component in Washington **hazardous waste** dumps.[44] Production of crude oil and condensate (natural gas liquid) in the United States ran in 1985 at about 8.5 to 9.0 million **barrels** a day (mbd) after falling from the 1970 level of 9.6 mbd. Imports totalled 5.0 mbd in 1985, down from a peak of 8.8 mbd in 1977. U.S. production of natural gas in 1985 totalled 16.4 trillion cubic feet (tcf), down from a peak in 1973 of 21.7 tcf. Net imports totalled .9 tcf in 1985. Carbon monoxide emissions are produced in petroleum refining.[64]

See "Carbon monoxide" and "Kerosene."

HARMFUL EFFECTS: Petroleum is considered to be of high **toxicity** (3).[5]

Petroleum production is the source of a number of environmental problems, in the form of routine releases of drilling muds and the cleaning of tanks or oil spills and blowouts. Offshore drilling, in particular, poses significant risks. Some research indicates that the species composition of marine communities can change dramatically. Onshore drilling also poses environmental risks, particularly the possibility that a breach in a pipeline could develop and affect land ecosystems.[92]

EXPOSURE LIMITS:

See "More About Exposure Limits".

PETZINOL (trade name): *see Trichloroethylene.*

PHENACHLOR: *see 2,4,6-Trichlorophenol.*

PHENACIDE: *see Toxaphene.*

PHENATOX (trade name): *see Toxaphene.*

PHENANTHRENE: *see PAHs.*

PHENE: *see Benzene.*

PHENIC ACID: *see Phenol.*

PHENOCHLOR (trade name): *see PCBs.*

PHENOL CAS 108-95-2; **molecular weight** 94.11:

SYNONYMS: Carbolic acid, Phenylic acid, Hydroxybenzene, Phenyl hydroxide, Oxybenzene, Phenic acid, Phenyl hydrate, Monohydroxybenzene.

DESCRIPTION: Phenol is moderately flammable and colorless to light pink, whether its form is in solution or as crystals. It dissolves in water. Phenol has a sweet tarry odor perceptible at .047 **ppm.** In water phenol is **persistent** for 1 to 19 days. Eight to eighteen percent of phenol is cresol.[1]

See "Cresol."

USES AND SOURCES: Phenol is used in the production and manufacture of explosives, fertilizer, coke, illuminating gas, lampblack, paints, paint removers, asbestos goods, wood preservatives, synthetic resins, and textiles. It is used to make drugs, and pharmaceutical preparations, including mouth, throat, and skin medications. It is also used to make perfumes, bakelite, and other plastics as well as other **polymer** intermediates. Phenol is used as a disinfectant. It is used in the petroleum, leather, paper, soap, toy, tanning, dye, and agricultural industries.[1,6] It is a commonly encountered toxicant in **hazardous waste** cleanup sites in Washington state.[44] Phenol is a component of tobacco smoke.[3]

HARMFUL EFFECTS AND SYMPTOMS: Routes of harmful **exposure** to phenol include ingestion of food and water, inhalation, and skin contact. The odor of phenol is a good warning.[1] Symptoms of harmful exposure include skin and eye burns (which may occur after a lapse of time), headache, dizziness, weakness, dimness of vision, ringing in the ears, irregular and rapid breathing, weak pulse, low blood pressure, mental disturbances, lung, spleen, pancreas, kidney, and liver damage, collapse, and death.[6] If ingested orally, in addition to the previous symptoms, there will be paleness and burning of the lips, mouth, throat, esophagus, and stomach, difficulty in swallowing, frothing of the nose and mouth, skin rash, sweating, lack of appetite, nausea, vomiting, diarrhea, greenish or smoky colored urine, **cyanosis**, paralysis, **pulmonary edema**, shock, loss of consciousness, and death.[1,6] Phenol is considered to be of high **toxicity** (3).[5]

Phenol is harmful to aquatic life in very low concentrations.[1]

EXPOSURE LIMITS:

AIR: OSHA TWA 5 **ppm** (approximately 19 **mg/m**^{3}).[4]

See "More About Exposure Limits."

PHENYL CHLORIDE: *see Chlorobenzene.*

PHENYLAMINE: *see Aniline.*

PHENYLETHANE: *see Ethylbenzene.*

PHENYLETHYLENE: *see Styrene.*

PHENYL HYDRATE: *see Phenol.*

PHENYL HYDRIDE: *see Benzene.*

PHENYL HYDROXIDE: *see Phenol.*

PHENYLIC ACID: *see Phenol.*

PHENYL METHANE: *see Toluene.*

PHILEX (trade name): *see Trichloroethylene.*

PHORATE CAS 298-02-2; **molecular weight** 260.40:

TRADE NAMES: Thimet, Timet.

DESCRIPTION: Phorate is a colorless to pale straw to light brown liquid. It sinks and dissolves slowly in water, and is formulated as a **pesticide**. ⑰ Its **half-life** in soil ranges from 20 to 100 days, and it is **mobile**. In a river water study 9 percent of phorate degraded after 5 days, and 65 percent degraded within 100 days. In lake water 87 percent degraded within a year. There is low **bioconcentration** potential.[1] More data is required concerning chemical degradation and **photodegradation** in water, photodegradation in soil, **aerobic** soil **metabolism**, **anaerobic** soil metabolism, soil dissipation, and accumulation in fish.[94]

USES AND SOURCES: Phorate is an **organophosphate pesticide** of concern in the Puget Sound Basin region.[31] It is used on beans, corn, cotton, hops, peanuts, potatoes, sorghum, soybeans, sugar beets, sugarcane, barley, and wheat. Phorate is used to control various leaf-feeding insects, mites, and soil insects.[94]

See "More About Pesticides".

HARMFUL EFFECTS AND SYMPTOMS: Routes of harmful **exposure** to phorate include inhalation, ingestion, and skin contact. Symptoms of harmful exposure include headache, dizziness, sweating, salivation, respiratory depression, muscular weakness, lack of coordination, pinpoint pupils, blurred vision, tremors, mental confusion, chest tightness, stomach cramps, and diarrhea.[1] Data is lacking concerning the effect of cooking and processing on phorate residues. Phorate does not appear to be **carcinogenic** (though more data is required), **teratogenic**, or **mutagenic**.[94] Phorate is considered to be of high **toxicity** (3).[5]

Phorate is highly toxic to aquatic life and land wildlife, and moderately toxic to bees.[1] Data is lacking concerning its **metabolism**, and its effects on bird reproduction, fish, and freshwater and **estuarine** environments.[94]

EXPOSURE LIMITS:

ADI .0001 **mg/kg/day.**[1] ARC .000491.[4]

AIR: OSHA TWA .05 **mg/m^3** (**skin**).[4]

WATER: NOAEL in drinking water .0007 **mg/l.**[1]

See "More About Exposure Limits."

PHOSKIL (trade name): *see Parathion.*

PHOSPHORODITHIOIC ACID: *see Disulfoton.*

PHOSPHORODITHIOIC ACID-O-DIMETHYL ESTER: *see Guthion.*

PHOSPHORUS CAS 7723-14-0; **molecular weight** 123.895

DESCRIPTION: Phosphorus is an odorless reddish brown powder that sinks in water. There is potential for **bioaccumulation.**[1]

USES AND SOURCES: Phosphorus is used to manufacture matches, and to make **organic** compounds. It is used in fireworks, phosphoric compounds, insecticides, and fertilizers.[55] Phosphorus is found at illegal drug laboratory **hazardous waste** sites, where the drug methamphetamine has been processed.[2] Annually 2 million tons of phosphorus contribute to unregulated **nonpoint source** pollution through fertilizer runoff from croplands and urban lawns, runoff from feedlots, and discharges from municipal wastewater treatment plants.[55,60] **Nonpoint sources** of pollution are estimated to be responsible for 84 percent of the phosphorus reaching the nation's surface waters. Fifty to seventy percent of phosphates (**ions** of phosphorus) resulting as pollution originated as detergents. Human wastes have accounted for the rest.

Nationwide, from 1970 to 1984, nearly as many monitoring stations reported decreases as increases in phosphorus. Phosphorus concentrations are increasing in the south, probably due to increased agricultural activity. In the Great Lakes region and Upper Mississippi regions, concentrations are declining. One explanation may be the controls on phosphorus content initiated in the late 1970s.[96]

HARMFUL EFFECTS AND SYMPTOMS: Phosphorus is considered to be of high **toxicity** (3).[5]

Phosphorus has harmful effects environmentally. Phosphorus, as well as other nutrients like nitrogen, can stimulate algae blooms and the growth of nuisance water plants. It accelerates the aging of lakes and reservoirs, and cause problems with oxygen depletion as water plants die and decompose.[53] Algae blooms block light from reaching submerged aquatic vegetation, killing off nursery habitat for finfish and shellfish.[54]

EXPOSURE LIMITS:

AIR: OSHA TWA .1 **mg/m^3**.[4]

See "More About Exposure Limits."

PHOSPHOTHION (trade name): *see Malathion.*

PHOSPHOTOX E (trade name): *see Ethion.*

PHOSVIN (trade name): *see Zinc phosphide.*

PIC-CLOR 60 (trade name): *see Dichloropropene.*

PLUMBUM: *see Lead.*

P-METHYLHYDROXYBENZENE: *see Cresol.*

P-METHYLPHENOL: *see Cresol.*

PNAs: *see PAHs.*

PNP (trade name): *see Nitrophenol.*

POLYCHLORINATED BIPHENYLS: *see PCBs.*

POLYCHROMATES: *see Chromium.*

POLYCIZER 162 (trade name): *see Dioctyl phthalate.*

POLYCIZER DBP (trade name): *see N-butyl phthalate.*

POLYNUCLEAR AROMATIC HYDROCARBONS: *see PAHs.*

POLYSTREAM: *see Benzene.*

PRAMITOL (trade name): *see Prometon.*

PREMERGE (trade name): *see Dinoseb.*

PREMERGE 3 (trade name): *see Dinoseb.*

PRIMATOL (trade name): *see Simazine and/or Atrazine.*

PRIMATOL A (trade name): *see Atrazine.*

PRIMATOL 25E (trade name): *see Prometon.*

PRIMATOL-S: *see Simazine.*

PRINCEP (trade name): *see Simazine.*

PRINCEP CET: *see Simazine.*

PROFUME (trade name): *see Methyl bromide.*

PROKARBOL (trade name): *see 4,6-Dinitro-o-cresol.*

PROMETRYN CAS 1610-18-0; **molecular weight** 241.37

SYNONYMS: 2-Methoxy-4,6-bis(isopropylamino)-s-triazine; Methoxy propazine.

TRADE NAMES: Prometone, Pramitol, Prometon, Primatol 25E.

DESCRIPTION: Prometryn is a light amber liquid formulated as an **emulsifiable** concentrate and a **wettable powder.** Its usual **carrier** is water. It is very **mobile** in sandy soil. Prometryn is **persistent** in water at least 40 days. In sunlit water it is persistent 2 weeks. In field dissipation studies, prometryn has a **half life** of 459 to 1,123 days. More **environmental fate** data is required concerning prometryn's degradation, **mobility**, accumulation, and **metabolism.**[98]

USES AND SOURCES: Prometryn is a **herbicide** used for weed control on cereal, vegetable crops (3 percent of use on 95 percent of the celery crop), ornamental plants, forest trees, and cotton (97 percent of use on 9 to 12 percent of crop). On celery 31,000 to 37,000 pounds of prometryn is used annually and on cotton 1.5 million pounds are used. It is used to control annual broadleaf and grass weeds.[98] Prometryn is one of the most commonly used **pesticides** in western Washington.[31]

In a 1988 search of the U.S. **EPA** STORET Water Quality File, prometryn has been found in 386 of 1419 samples analyzed from 250 surface water locations, in concentrations of .6 μg/l at the **85th percentile** of sample levels, with a maximum concentration of 8.5 μg/l. It has been found in 36 of 746 analyzed samples from 250 groundwater locations, in concentrations of 50 μg/l at the 85th percentile of sample levels, with a maximum concentration of 250 μg/l. Prometryn residues from agricultural practices have been detected in California ground water at .21 to 80 **ppb.**[99]

See "More About Pesticides".

HARMFUL EFFECTS AND SYMPTOMS: Prometryn may be **toxic** by inhalation, ingestion and skin contact. Symptoms of harmful **exposure** include skin, eye, and upper respiratory tract irritation, headache, blurred vision, dizziness, drowsiness, and nausea. There are **data gaps** concerning prometon's **teratogenecity**, **mutagenicity**, ability to cause cancer, **acute toxicity**, subchronic and **chronic** toxicity, and reproductive toxicity.[98]

Prometryn is moderately **toxic** to fish, slightly toxic to freshwater invertebrates, and not **acutely hazardous** to birds.[98]

EXPOSURE LIMITS:

PADI: .004 **mg/kg/day.**

WATER: DWEL .2 **mg/L.**[99]

See "More About Exposure Limits".

PROMETONE: see Prometon.

PRONAMIDE CAS 23950-58-5; **molecular weight** 256.13

TRADE NAMES: Propyzamide, Kerb.

DESCRIPTION: The **half life** of pronamide in soil is 2 to 9 months.[1] Another source stated that the half life of pronamide in **aerobic** soils is 10 to 120 days. It is moderately **mobile** in soils ranging in texture from loamy sand to clay.[99] There is very little **leaching**. Pronamide is not **toxic** to common soil organisms.[1] There are **data gaps** in pronamide's **environmental fate.**

USES AND SOURCES: Pronamide is a systemic **herbicide** for use on lettuce, alfalfa, southern turf, woody ornamentals, nursery stock and Christmas trees commonly used in the Northwest.[1,31] In a 1988 search of the U.S. **EPA** STORET Water Quality File, pronamide has been found in 20 of 391 samples analyzed from 391 ground water locations, averaging 1 μg/l.[99]

See "More About Pesticides".

HARMFUL EFFECTS AND SYMPTOMS: No information on the health effects of pronamide was found. Pronamide is not a **mutagen**, but it may be a **carcinogen.**[1] There are **data gaps** in its ability to cause cancer, additional **chronic** effects, **teratogenicity**, reproductive and mutagenic effects, general **metabolism**, and skin penetration.[102]

EXPOSURE LIMITS:

PADI: .0750 **mg/kg/day.**[99]

WATER: DWEL 2.6 **mg/L.**[99]

INGESTION: **Residue tolerances** .02 **ppm** to 10 **ppm.**[99]

See "More About Exposure Limits."

PROPANE, KETONE: *see Acetone.*

2-PROPANONE: *see Acetone.*

PROPANAL: *see Acrolein.*

PROPELLANT 12 (trade name): *see Dichlorodifluoromethane.*

2-PROPENAL: *see Acrolein.*

PROPENITRILE: *see Acrylonitrile.*

PROPYLENE CHLORIDE: *see Propylene dichloride.*

PROPYLENE DICHLORIDE CAS 78-87-5; **molecular weight** 112.99:

SYNONYMS: Dichloropropane; 1,2-Dichloropropane; DCP; Alpha,beta-dichloropropane; Alpha,beta-propylene dichloride; Propylene chloride; ENT 15,406; NCI-C55141; it also occurs in mixtures of 1,3-Dichloropropane; Isothiocyanotomethane; Trichloronitromethane; and Ethylene dibromide.

TRADE NAMES: Propylene dichloride is mixed in compounds with these tradenames: D-D soil **fumigant**, Dowfume NC, Vidden D, EP-201, Nemex, Vorlex, D-D Pilfume, Terr-o-cide, Terr-o-gas, Dorlone, New Fieldfume.

DESCRIPTION: Propylene dichloride is a flammable colorless liquid which sinks in bodies of water and slowly dissolves. Its chloroform-like odor is perceptible at .25 **ppm**. Evaporation is the most rapid transport process from water. **Biodegradation** is slow in comparison to evaporation.[1] 99% will disperse from soil within 10 days. The half-life of propylene dichloride in groundwater is between 6 months to 2 years. Its half-life in air is longer than 23 days.[103]

HARMFUL EFFECTS AND SYMPTOMS: Routes of harmful **exposure** to propylene dichloride include diet, inhalation, and skin contact.[1,6] Symptoms of harmful exposure include skin, eye, and mucous membrane irritation, headache, dizziness, nausea, vomiting, loss of consciousness, and death.[1,6,103] Persons with pre-existing skin disorders will be more susceptible to the development of dermatitis with **exposure** to propylene dichloride. Symptoms of people with impaired liver, kidney, or respiratory functions may be aggravated by exposure to propylene dichloride.[103]

No studies were located concerning **immune system, developmental**, carcinogenic, or **genotoxic** effects in humans following inhalation. Only carcinogenic studies were located concerning skin **exposure. Data gaps** exist for **intermediate** and **chronic systemic toxicity**, carcinogenicity, immune system, developmental, and **reproductive toxicity**, genotoxicity, and death by skin exposure.[103]

Chronic toxicity for freshwater aquatic life may occur as low as 5.7 ppm, and for saltwater life 3.04 ppm.[103]

USES AND SOURCES: Propylene dichloride has been used as a solvent and as a soil **fumigant.** It has has been found in at least 26 of 1,177 sites listed on the 1989 National Priorities List.[103]

Propylene dichloride in city air averages 22 ppt, and is found in air near hazardous waste sites at low levels. 1.4% of groundwater supplies contain it at around 1 ppb. The highest amount found was 21 **ppb.**[103]

EXPOSURE LIMITS:

AIR:	MRLs	50 ppb (short-term exposure)
	MRLs	7 ppb (long-term exposure)
		75 ppm OSHA TWA.
FOOD:	MRLs	3.6 ppm (short-term exposure)
	MRLs	2.5 ppm (long-term exposure)[103] WA groundwater criteria .6 µg/l.[8]

See "More About Exposure Limits."

PROPYZAMIDE: *see Pronamide.*

P-TOLUOL: *see Cresol.*

PX 104 (trade name): *see N-butyl phthalate.*

PYRENE: *see PAHs.*

PYROACETIC ETHER: *see Acetone.*

PYRALENE (trade name): *see PCBs.*

PYRANOL (trade name): *see PCBs.*

PYROBENZOL: *see Benzene.*

QUINTOX (trade name): *see Dieldrin.*

R20 (trade name): *see Chloroform.*

RACON (trade name): *see Fluorotrichloromethane.*

RADON:

USES AND SOURCES: Radon is a radioactive gas that seeps from soil and rocks containing minute quantities of uranium. Its concentrations build up in trapped spaces and temperature inversions. A typical concentration in the air of radon at 1 meter above ground is .2 pCi/l (3500 atoms/l). Air over the oceans may carry .0005 to .005 pCi/l. Indoor air concentrations may be .5 pCi/l. Air in a cavern may range from 10 to 300 pCi/l. Air in an unventilated uranium mine ranges from 1000 to 100,000 pCi/l. A typical concentration in surface water may be 10 pCi/l and in groundwater ranging from 100 to 1000 pCi/l. Deep wells, mineral springs may contain concentrations of radon amounting to 100,000 pCi/l.

HARMFUL EFFECTS AND SYMPTOMS: Radon is a probable human **carcinogen** by inhalation. Radon, and its degradation products which are also readioactive, attaches itself to particulates in the air, and are inhaled into the lungs. It is estimated to cause 5000 to 20,000 cases of lung cancer annually nationwide.

RANGE OIL: *see Kerosene.*

RAVYON (trade name): *see Carbaryl.*

RED SHIELD (trade name): *see Dieldrin.*

RED SELENIUM: *see Selenium.*

REFRIGERANT 12 (trade name): *see Dichlorodifluoromethane.*

RHOMENE (trade name): *see MCPA.*

RHONOX (trade name): *see MCPA.*

RODOCID (trade name): *see Ethion.*

RODOCIDE (trade name): *see Ethion.*

ROTOX (trade name): *see Methyl Bromide.*

RP 8167 (trade name): *see Ethion.*

RUBINATE TDI 80/20 (trade name): *see Toluene-2,4-diisocyanate.*

SADOFOS (trade name): *see Malathion.*

SADOPHOS (trade name): *see Malathion.*

SANDOLIN A (trade name): *see 4,6-Dinitro-o-cresol.*

SANOCIDE (trade name): *see Hexachlorobenzene.*

SANTOBRITE (trade name): *see Pentachlorophenol.*

SANTOCHLOR (trade name): *see 1,4-Dichlorobenzene.*

SANTOPHEN-20 (trade name): *see Pentachlorophenol.*

SANTOTHERM (trade name): *see PCBs.*

SANTOTHERM FR (trade name): *see PCBs.*

SCPA: *see MCPA.*

SD 4314 (trade name): *see Endosulfan.*

S-DIBROMOETHANE: *see Ethylene dibromide.*

(S)DICHLOROPROPENE: *see Dichloropropene.*

SELENIUM CAS 7782-49-2; **atomic weight** 78.96; Chemical Symbol: Se

SYNONYMS: Red selenium.

DESCRIPTION: Selenium is quite flammable. The metal sinks in water, and the salts dissolve in water. Selenium **persists** in natural waters. It is **mobile** in water and bottom sediments. It is retained in the body in the liver and kidneys, and has a **half-life** of 11 days. There is **food chain contamination**, as cereals and grains concentrate selenium from the soil.[1] Selenium reduces the **toxicity** of mercury, cadmium, lead, silver, and to some extent, copper.

See "Mercury", "Cadmium", and "Lead".

USES AND SOURCES: Selenium is a naturally occurring substance that is widely but unevenly distributed in the earth's crust.[106] It is used as a cleaning agent in heavy metal soaps, alloyed with stainless steel, copper, and cast steel, in photography, in making glass electrodes and rubber, as a pigment, in antidandruff shampoos, and in chemical production.

It is found in sludges and sediments from electrolytic copper refining and in flue dust in sulfuric acid manufacture.[1] Selenium has been found in at least 54 of 1,177 **hazardous waste** sites on the National Priorities List.[106]

EPA's Rural Water Survey found selenium to exceed **EPA** drinking water standards in about 15 percent of wells sampled nationwide, with the highest frequency in the north central (26 percent) and western (41 percent) regions.[61] Adult intake averages .071 to .152 **mg/day.**[106]

See "More About Pesticides".

HARMFUL EFFECTS AND SYMPTOMS: Routes of harmful **exposure** to selenium include inhalation, ingestion, or by skin contact. Symptoms of harmful exposure include irritated eyes, nose, and throat, garlic breath and sweat, skin problems, nervousness, pallor, stomach problems, depression, and liver damage. The majority of human and animal studies show selenium oxychloride, selenium dioxide, sodium selenate, selenium sulfide, and selenic acid to show effects similar to that of arsenic.[1] Symptoms of **chronic exposure** (1.64 **ppm** orally over months to years) may include brittle hair, deformed nails, and in extreme cases, loss of feeling and control in the arms and legs.[106] The majority of recent studies of humans and animals reveal no association between selenium intake and incidence of cancer, or that selenium intake helps deter cancer.[106] Selenium sulfide, which is found in anti-dandruff shampoos, has been found to be **carcinogenic** in mice by oral exposure.[106]

Exposure to high levels of selenium is **teratogenic** in birds.[106] Selenium is highly **toxic** to aquatic life in very low concentrations.[1]

See "Arsenic."

EXPOSURE LIMITS:

AIR: OSHA TWA .2 **mg/m^3**.[28]

WATER: EPA recommended drinking water limit .01 **ppm**. WA groundwater criteria .01 **mg/l.**[8]

See "More About Exposure Limits."

SELINON (trade name): *see 4,6-Dinitro-o-cresol.*

SENCOR (trade name): *see Metribuzin.*

SENCORAL (trade name): *see Metribuzin.*

SENCOREX (trade name): *see Metribuzin.*

SEPTENE (trade name): *see Carbaryl.*

SERPENTINE: *see Asbestos.*

S-ESTER-WITH-3(MERCAPTOMETHYL)-1,2,3-BENZOTRIAZIN-4(3H)-ONE: *see Guthion.*

SEVIN (trade name): *see Carbaryl.*

SF 60 (trade name): *see Malathion.*

SILICIC ACID: *see Asbestos.*

SIMADEX (trade name): *see Simazine.*

SIMANEX: *see Simazine.*

SIMAZINE CAS 122-34-9; **molecular weight** 201.67

SYNONYMS: DCT; Primatol-S; Princep Cet; (G27692): Simanex; 2-Chloro-4,6-bis (ethylamino)-s-triazine; 2,4-Bis(ethylamino)-6-chloro-s-triazine; Simazin.

TRADE NAMES: Gesatop, Primatol, Aquazine, Princep, Gasatop, Simadex.

DESCRIPTION: Simazine is a nonflammable, nearly odorless, white, crystalline solid. It may be formulated as a **wettable powder** or a **granule** that sinks in water. In moist loam soil simazine applied at a rate of 1 to 4 pounds per acre **persists** for 3 to 6 months with little or no **leaching** in summer conditions.[1] In wet situations it may persist up to 3 years. Its **half life** in water ranges from 50 to 700 days. It is **mobile** in sandy soil and less mobile in loamy clay soil.[99] Simazine undergoes some chemical degradation in soil, one product of which may be nitrosamines.[1] **Environmental fate** data that is inadequate includes **photodegradation** studies on soil and in water, **aerobic** soil **metabolism**, **anaerobic** and aerobic aquatic metabolism, **leaching**, **adsorption** and desorption, terrestial, aquatic, forestry, long term field dissipation studies, and accumulation studies on rotational and irrigated crops.

See "Nitrosamines".

USES AND SOURCES: Simazine is a **systemic herbicide** used for forestry weed control and as an algaecide. It is used on corn (36 percent), on citrus (25 percent), on aquatic sites (19 percent) and on noncrop industrial sites (20 percent).[108] Simazine is one of the most commonly used **pesticides** in western Washington.[31]

In a 1988 search of the U.S. **EPA** STORET Water Quality File, simazine has been found in 922 of 5,873 samples analyzed from 620 surface water locations, in concentrations of 2.18 µg/l at the **85th percentile** of sample levels, and at a maximum concentration of 1,300 µg/l. It has been found in 202 of 2,654 analyzed samples from 2,128 groundwater locations, in concentrations of 1.60 µg/l at the 85th percentile of sample levels, with a maximum concentration of 800 µg/l.[99]

Hexachlorobenzene is an impurity in the production of this chemical.[1]

See "Hexachlorobenzene." See "More About Pesticides".

HARMFUL EFFECTS AND SYMPTOMS: In man, **exposure** to simazine has caused skin problems characterized by reddening, swelling, itching, and a burning sensation lasting for 4 to 5 days. Simazine is a possible **carcinogen** and **mutagen**. It is **fetotoxic**, but not **teratogenic**.[99] Simazine is considered to be of high **toxicity** (3).[5]

EXPOSURE LIMITS:

INGESTION: **Residue tolerances** .02 **ppm** to 15 **ppm**.[99]

WATER: DWEL .175 **mg/l** (200 µg/l).[99]

See "More About Exposure Limits."

SINTERED CHROMIUM TRIOXIDE: *see Chromium.*

SIPTOX I (trade name): *see Malathion.*

666 (trade name): *see Lindane.*

SNIECIOTOX (trade name): *see Hexachlorobenzene.*

SODA LYE: *see Sodium hydroxide.*

SODIUM HYDROXIDE CAS 1310-73-2; **molecular weight** 40.01; Chemical Symbol: NaOH

SYNONYMS: Caustic soda, Soda lye, Lye, Sodium hydrate.

DESCRIPTION: Sodium hydroxide is an odorless nonflammable white solid that dissolves in water. It is sold as pellets, flakes, lumps,or sticks. Solutions in water are known as soda lye. Sodium hydroxide is slowly neutralized in the environment by natural **alkalinity**. There is no **bioaccumulation.**[1] It is very corrosive to most metals, painted surfaces, etc.

USES AND SOURCES: Sodium hydroxide is used in the paper industry, metal manufacturing, cosmetics, vehicle maintenance and equipment repair, laboratories, chemical production, leather and wood products industries, printing, coal distillation; making cellulose, rubber, rayon, soap, cleaning compounds, petroleum, and mineral and vegetable oils. Sodium hydroxide may be found in the wastes from all of these activities.[1] It is found at illegal drug laboratory **hazardous waste** sites, where amphetamines, barbituates, cocaine, MDA, mescaline, methadone, STP, and THC have been processed.[2]

HARMFUL EFFECTS AND SYMPTOMS: Routes of harmful **exposure** to sodium hydroxide include inhalation, ingestion, and skin contact. Sodium hydroxide is a caustic solution that is very corrosive to the tissues in which it comes into contact, by whatever route but the eyes are the most vulnerable to splashing liquid. There is no **chronic** poisoning. Symptoms of harmful exposure include irritated nose, burned eyes, skin, and mucous membranes, burning pain, temporary loss of hair, and pneumonitus.[1] Sodium hydroxide is considered to be of high **toxicity** (3).[5]

Sodium hydroxide is dangerous to aquatic life in high concentrations.[1]

EXPOSURE LIMITS:

AIR: OSHA PEL 2 **mg/m^3**.[4]

WATER: Chronic aquatic **toxicity** limit 24 **ppm.**[11]

See "More About Exposure Limits."

SODIUM HYDRATE: *see Sodium hydroxide.*

SODIUM SELENATE: *see Selenium.*

SOILBROM-85 (trade name): *see Ethylene dibromide.*

SOILFUME (trade name): *see Ethylene dibromide.*

SOLAESTHIN: *see Methylene chloride.*

SOLMETHINE: *see Methylene chloride.*

SOLVANOM (trade name): *see Dimethyl phthalate.*

SOLVARONE (trade name): *see Dimethyl phthalate.*

SOLVIREX (trade name): *see Disulfoton.*

SOPRATHION (trade name): *see Ethion and/or Parathion.*

SOVOL (trade name): *see PCBs.*

SPIRITS OF SALT: *see Hydrochloric acid.*

S,S-DIMETHANEDITHIOATE O,O-DIETHYL PHOSPHORODITHIOATE: *see Ethion.*

STAFLEX DBP (trade name): *see N-butyl phthalate.*

STIBIUM: *see Antimony.*

STRONTIUM CHROMATE: *see Chromium.*

STYRENE CAS 100-42-5; **molecular weight** 104.14:

SYNONYMS: Styrol, Styrolene, Cinnemene, Dinnamol, Phenylethylene, Vinylbenzene.

DESCRIPTION: Styrene is a flammable colorless to light yellow oily liquid that floats on water and slowly dissolves. It has a sweet odor at lower concentrations that becomes disagreeable at high concentrations. The odor is perceptible in a range of .02 to .73 **ppm**. **Exposure** to light and air causes styrene to decompose. It biodegrades slowly, and there is no **bioaccumulation.**[1]

USES AND SOURCES: Styrene is used to make plastics, rubber, resins, and insulators.[1]

HARMFUL EFFECTS AND SYMPTOMS: Routes of harmful **exposure** to styrene include inhalation, ingestion, and skin contact. The odor is a good warning. Symptoms of harmful exposure include irritated eyes and nose, skin problems, drowsiness, cramps, loss of consciousness, and death due to respiratory paralysis.[1] Styrene is considered to be of high **toxicity** (3).[5]

Styrene is harmful to aquatic life in very low concentrations.[1]

EXPOSURE LIMITS:

AIR: OSHA TWA 50 ppm (approximately 215 mg/m^3).[1]

See "More About Exposure Limits."

STYROL: *see Styrene.*

STYROLENE: *see Styrene.*

SULFOCARBONIC ANHYDRIDE: *see Carbon disulfide.*

SULFUR 7704-34-9; **atomic weight** 32.064 .003:

DESCRIPTION: Sulfur resembles brown to yellow solids that will sink in water or form a yellow dispersion, formulated as a dust or flowable liquid. It is nearly odorless. There is no **bioaccumulation.** Sulfur will slowly oxidize to sulfur dioxide.[1]

See "Sulfur dioxide."

USES AND SOURCES: Sulfur is used in many compounds and products, as a constituent of gasoline, from .10 to .15 percent by weight, and as a **pesticide**, with over 200 registrations.[9,30]

As a **pesticide**, 135 to 190 million pounds of sulfur are used annually.[9] It is one of the most commonly used pesticides in western Washington.[31] Two hundred forty-one poisoning incidents occurred between 1976 and 1980, one third of which involved workers reentering fields too soon.[9]

See "Gasoline." See "More About Pesticides".

HARMFUL EFFECTS AND SYMPTOMS: **Chronic** human **exposure** in mines and refineries have resulted in serious respiratory disturbances. Most agricultural incidents involve skin and eye irritation.[9] Sulfur is considered to be of high **toxicity** (3).[5]

It is dangerous to aquatic life in high concentrations.[1]

EXPOSURE LIMITS:

WATER: WA groundwater criteria 250 **mg/l**.[8]

See "More About Exposure Limits."

SULFUR DIOXIDE CAS 7446-09-5; **molecular weight** 64.07:

DESCRIPTION: Sulfur dioxide is a colorless gas. Its characteristic pungent odor is perceptible at .47 **ppm**. There is no **bioaccumulation**. It will slowly oxidize from sulfurous to sulfuric acid and natural **alkalinity** will neutralize it slowly at the same time.[1]

See "Sulfuric acid."

USES AND SOURCES: Sulfur dioxide is used in preservatives, breweries, bleach, glue, and pulp.[1]

In 1980 nationwide emissions of sulfur oxides (including sulfur dioxide) totaled 23.2 million tons.[64]

Two-thirds of all sulfur dioxide emissions nationwide are generated by electric utilities, with most coming from a relatively small number of coal-fired power plants. Fifty-three plants in 14 states account for one-half of all power plant emissions, and the 200 highest emitters produce 85 percent of all power plant emissions of sulfur dioxide. These 200 plants account for 57 percent of all sulfur dioxide emissions nationwide.[64]

Between 1975 and 1984, the annual mean sulfur dioxide concentration declined 36 percent nationwide. Emissions of all sulfur dioxides declined 16 percent.[64] Decreases have come from installation of pollution control devices, energy conservation, and reduction in the average sulfur content of fuels used.

HARMFUL EFFECTS AND SYMPTOMS: The odor is a good warning. **Exposure** to sulfur dioxide may cause **pulmonary edema** and result in respiratory paralysis.[1] Sulfur dioxide is considered to be of high **toxicity** (3).[5]

Sulfur dioxide is harmful to aquatic life in very low concentrations.[1] Sulfur oxide emissions, along with nitrogen oxides, lead to acid rain, a phenomena which contributes to forest damage and wildlife population decline. Scientists theorize other causes to be **chronic** and **acute exposure** to ozone, exposure to heavy metals and **organic** compounds, and drought.[66]

See "Nitrogen Oxides" and "Ozone".

EXPOSURE LIMITS:

AIR: OSHA TWA 2 **ppm** (approximately 5 **mg/m^3**).[1]

See "More About Exposure Limits."

SULFURIC ACID CAS 7664-93-9; **molecular weight** 98.08:

SYNONYMS: Dithionic acid, Brown oil, Oil of vitriol, Vitriol, Oleum (fuming sulfuric acid), Vitriol brown oil, Dripping acid, Bov., Battery acid, Chamber acid, Fertilizer acid.

DESCRIPTION: Sulfuric acid is a nonflammable colorless liquid that sinks and dissolves in water. Its penetrating odor (in some grades) is perceptible in a range of .6 to 1 **ppm**. Depending on the process, spent sulfuric acid may be a black oily liquid. Sulfuric acid is **synergistic** with an acidic environment, and is moderated by an **alkaline** environment. There is no **bioaccumulation.**[1]

USES AND SOURCES: Sulfuric acid is used in the paper industry, metal manufacturing, making cosmetics, vehicle maintenance and equipment repair, laboratories, and in textiles and auto manufacturing. It is also used in chemical production, plating and printing industries, petroleum refining, and to make fertilizers, pigments, rayon, and explosives.[1]

HARMFUL EFFECTS AND SYMPTOMS: Routes of harmful **exposure** to sulfuric acid include inhalation, ingestion, and skin contact. When sulfuric acid is pure, the odor is not a good warning, but in oleum and the technical grades, it is a good warning. Sulfuric acid is very corrosive to tissues it encounters, by whatever route. Eyes are especially vulnerable.

When inhaled, concentrations of .125 to .5 **ppm** are mildly irritating, concentrations of 1.5 to 2.5 **ppm** are definitely unpleasant, and 10 to 20 **ppm** are unbearable. Symptoms of harmful **exposure** to sulfuric acid include eyes, nose, and throat irritation and burning, skin burns and problems, inflammation of the mucous tissues of the mouth, erosion of the teeth, pink eye, **pulmonary edema**, bronchial emphysema, tracheobronchitus, nausea, and vomiting.[1] Sulfuric acid is considered to be of high **toxicity** (3).[5]

Sulfuric acid is harmful to aquatic life in very low concentrations.1

EXPOSURE LIMITS:

AIR: OSHA TWA 1 **mg/m^3**.[1]

WATER: Recommended drinking water limits 250 **ppm.**[1]

See "More About Exposure Limits."

SULFURYL FLUORIDE CAS 2699-79-8; **molecular weight** 102.07:

DESCRIPTION: Sulfuryl fluoride is a nonflammable colorless odorless gas formulated as a liquified gas under pressure.' Data is lacking concerning residue on household articles and surfaces.[110]

USES AND SOURCES: Sulfuryl fluoride is one of the most commonly used **pesticides** in western Washington.[31] It is applied in domestic dwellings and contents, wood and wood structures, commercial, institutional, and industrial areas, surface ships in ports, and in vehicles.[110]

See "More About Pesticides".

HARMFUL EFFECTS AND SYMPTOMS: Routes of harmful **exposure** to sulfuryl fluoride include inhalation.[111] Symptoms of harmful exposure include itching, respiratory irritation, cramps, nausea, vomiting, and **pulmonary edema.**[5,110] Repeated **exposures** to high concentrations may result in kidney and lung damage.[110] Sulfuryl fluoride is considered to be of high **toxicity** (3).[5]

EXPOSURE LIMITS:

AIR: OSHA TWA 5 **ppm** (approximately 20 **mg/m^3**).[4]

See "More About Exposure Limits."

SUPER LYSOFORM (trade name): *see Formaldehyde.*

SYM-DIBROMOETHANE: *see Ethylene dibromide.*

SYM-1,2-DICHLOROETHYLENE: *see 1,2-Dichloroethylene.*

SYM-DICHLOROETHYL ETHER: *see Dichloroethyl ether.*

SYM-TRICHLOROPHENOL: *see 2,4,6-Trichlorophenol.*

SYSTEMOX: *see Systox.*

SYSTOX CAS 8065-48-3; **molecular weight** 258.34:

SYNONYMS: Demeton; Demox; E 1059; Mercaptophos; Bayer-8169; Systemox; Demeton-O; Demeton-S; O,O-diethyl-o-(2-(ethylthio)ethyl)phosphorothionate; O,O-diethyl-o-ethylmercaptoethylthiophosphate; O,O-diethyl-s-(2-ethylthio)ethyl)phosphorothiolate; O,O-diethyl-s-ethylmercaptoethyl-thiophosphate.

DESCRIPTION: Systox is a light brown to colorless oil or liquid that can be formulated as an **emulsifiable concentrate.** It has an unpleasant odor. In solution it is concentrated 25 to 66 percent in xylene, a chemical that is listed separately. Systox will sink and dissolve in water at a very, very slow rate. It has a **half-life** by chemical decomposition in water of 18 hours, and is **persistent** in soil for 23 days. There is no **bioaccumulation.**[1]

USES AND SOURCES: Systox is a **systemic** insecticide.[1]

See "More About Pesticides".

HARMFUL EFFECTS AND SYMPTOMS: Routes of harmful **exposure** to systox include ingestion, inhalation, and skin absorption. Symptoms of harmful exposure include blurred vision, pinpoint pupils, aching eyes, headache, vertigo, dizziness, salivation, sweating, stomach cramps, nausea, vomiting, diarrhea, loss of muscular coordination, difficulty in breathing, wheezing, **cyanosis**, **pulmonary edema**, spasms of the upper respiratory tract, convulsions, loss of consciousness, and death. Systox is a potential **teratogen.**[1]

The effect of low concentrations of systox on aquatic life is unknown.[1]

EXPOSURE LIMITS:

AIR: OSHA TWA (**skin**) .1 **mg/m^3**.[4]

WATER: Recommended drinking water limit .1 **ppm.**[1]

See "More About Exposure Limits."

2,4,6-T: *see 2,4,6-Trichlorophenol.*

TAR CAMPHOR: *see Naphthalene.*

TCDBD: *see Dioxin.*

TCDD: *see Dioxin.*

TCE: *see Trichloroethylene.*

TCS: *see Trichloroethylene.*

TDI: *see Toluene-2,4-diisocyanate.*

TDI-80 (trade name): *see Toluene-2,4-diisocyanate.*

2,4-TDI: *see Toluene-2,4-diisocyanate.*

TEBULON: *see Tebuthiuron.*

TEBUTHIURON CAS 34014-18-1; **molecular weight** 228:

SYNONYMS: N-[5-(1,1-dimethylethyl)-1,3,4-thiadiazol-2-yl]-N,N-dimethylurea.

TRADE NAMES: Tebulon, Spike, Grassland.

DESCRIPTION: Tebuthiuron is a colorless to white crystalline solid. It **leaches** easily through soil. Its **half life** in soil ranges from 12 to 15 months. It has been found in ground water in Texas. In one study in sterile water tebuthiuron did not degrade significantly in more than 2 months. It is stable to biological and chemical degradation under environmental conditions. In one study effects of tebuthiuron residues were still being observed after 4 years.

In research, data is lacking concerning its **photodegradation** in water and soil, its **metabolism** in **anaerobic** and **aerobic** soil, **leaching** and **adsorption/desorption**, dissipation in soil and aquatic environments, accumulation in fish, and **persistence** in soil.[112]

USES AND SOURCES: Tebuthiuron is a **herbicide** used for weed control in grasslands and sugarcane. It is used on railroad rights-of-way, industrial sites, ditchbanks, under concrete and asphalt pavements, tank farms, highway medians, and airport runways.[112] It is one of the most commonly used **pesticides** in western Washington.[31]

See "More About Pesticides".

HARMFUL EFFECTS AND SYMPTOMS: Very little information is available on tebuthiuron. In research, data is lacking concerning its **acute** effects, **chronic effects**, and its **carcinogenic, teratogenic, mutagenic, and genotoxic** potential effects.[112] Tebuthiuron is considered to be of high **toxicity** (3).[5]

Data is lacking on its effects on wildlife and aquatic organisms.[112]

EXPOSURE LIMITS:

PADI .017 **mg/kg** bwt/day.[112]

WATER: DWEL 2.45 **mg/l** (2,000 μg/l).[99]

See "More About Exposure Limits."

TELON C-17 (trade name): *see Dichloropropene.*

TELONE C (trade name): *see Dichloropropene.*

TEMIK (trade name): *see Aldicarb.*

TERABOL (trade name): *see Methyl bromide.*

TERCEL (trade name): *see Carbaryl.*

TERR-O-CIDE (trade name): *see Propylene dichloride.*

TERR-O-CIDE 30-D (trade name): *see Dichloropropene.*

TERR-O-GAS (trade name): *see Propylene dichloride.*

TERR-O-GAS 57/431 (trade name): *see Dichloropropene.*

TERR-O-GAS 100: *see Methyl bromide.*

TERSAN (trade name): *see Benomyl.*

TETLEN (trade name): *see Tetrachloroethylene.*

TETRACAP (trade name): *see Tetrachloroethylene.*

TETRACHLORETHYLENE: *see Tetrachloroethylene.*

TETRACHLOROCARBON:] *see Carbon tetrachloride.*

2,3,7,8-TETRACHLORO-(9CI)DIBENZO[B,E][1,4]DIOXIN: *see Dioxin.*

2,3,7,8-TETRACHLORODIBENZO-1,4-DIOXIN: *see Dioxin.*

2,3,7,8-TETRACHLORODIBENZO-P-DIOXIN: *see Dioxin.*

TETRACHLOROETHANE CAS 79-34-5; molecular weight 167.9:

SYNOYMS: S-tetrachloroethane, Cellon, Bonoform, 1,1-Dichloro-2,2-dichloroethane, Acetylene tetrachloride, 1,1,2,2-Tetrachloroethane.

DESCRIPTION: Tetrachloroethane is a colorless, heavy, very corrosive liquid. Its sweetish, chloroform-like odor is perceptible at 1.5 **ppm.**[1] Its **half-life** in water by chemical degradation ranges from a few months to several years. In the stratosphere it decomposes due to light.[1] Its half-life in the air is about 2 months.[114] It evaporates within hours from rapidly stirred water.[1] Tetrachloroethane is expected to **leach** readily from soil surfaces into groundwater.[114] Its **half-life** in the body is less than 2 days. **Bioaccumulation** is unlikely.[1]

USES AND SOURCES: Tetrachloroethane is used as a solvent, an insecticide, a **herbicide**, an extraction solvent for fats and oils, a dry cleaning agent, in cement, and in lacquers, paint removers, and varnishes, in chemical manufacture, and in artificial silk, leather, and pearls. It is used in estimating water content in tobacco and many drugs, and for chromium chloride impregnation of furs.[1,44] Present usage is more limited, as less **toxic** solvents are available.[28] It is commonly encountered at **hazardous waste** cleanup sites in Washington state.[44] It has been found at 59 of 1177 hazardous waste sites on the National Priorities List (NPL).[114]

Information about its current use and production volume is protected by the manufacturer, and is unavailable.[114] In 1974, 34 million pounds was produced.[114]

A 1977-79 survey in New Jersey found 6 percent of groundwater samples (maximum concentration 2.7 **ppb**) and 11 percent of surface water samples (maximum concentration 3 ppb) contaminated with tetrachloroethane. A nationwide survey of drinking water from groundwater sources found a few contaminated sources. It has not been reported in food or soil.[114] Average concentrations of tetrachloroethane in city air range from 5 **ppt** to 57 **ppb**, and indoor air concentrations average 1.8 ppb.[114]

Chloroform, dichloroethylene, trichloroethylene, and vinyl chloride are degradation products of tetrachloroethane.[1,114]

See "Chloroform", "Dichloroethylene", "Trichloroethylene", and "Vinyl chloride". See "More About Pesticides".

HARMFUL EFFECTS AND SYMPTOMS: Tetrachloroethane may be the most **toxic** of all the chlorinated hydrocarbons.[6,44] Routes of harmful **exposure** include inhalation, ingestion, and skin contact.[6] The odor is a good warning against life threatening situations.[114] Ninety-four percent of tetrachloroethane that is inhaled is retained.[1] People with diseases of the central nervous system, liver, or kidneys are at higher risk and should not handle this material. Symptoms of harmful exposure to tetrachloroethane include irritated mucous membranes of the eyes and upper respiratory tract, pink eye, headache, excessive sweating and salivation, a prickling sensation, scaly and fissured skin, numbness of limbs, restlessness, dizziness (116 **ppm** for 10 minutes), exhaustion, drowsiness, lack of appetite, stomach pain, nausea, vomiting, mental confusion, stupor, delerium, tremors, irregular heartbeat, an enlarged liver (1.5 to 36 **ppm** for a few months), jaundice, liver damage, accumulation of fluid in the brain, blood disorders, inability to urinate, central nervous system depression, paralysis, convulsions, and loss of consciousness.[1,44] The liver, heart, nervous system, and kidneys are organs vulnerable to this chemical.[6,114] Tetrachloroethane is a **mutagen** and a possible **carcinogen**.[1,6,44] Tetrachloroethane is considered to be of high **toxicity** (3).[5]

In research, no human studies exist concerning its **chronic systemic toxicity**, **genotoxicity**, its **immune system**, **developmental**, or **reproductive toxicity** by any route. No human studies exist concerning its ability to cause cancer by oral and skin **exposure**. No animal studies exist concerning its chronic systemic toxicity, developmental toxicity, genotoxicity, or ability to cause cancer by any route, its **neurologic** toxicity by oral and skin exposure, or its **intermediate systemic toxicity**, **immune system**, and **reproductive toxicity** by skin exposure.[114]

EXPOSURE LIMITS:

AIR: OSHA TWA 1 **ppm** (approximately 7 **mg/m^3**).[4]

WATER: Recommended drinking water limit .0018 **ppm**.[1]

See "More About Exposure Limits."

1,1,2,2-TETRACHLOROETHANE: *see Tetrachloroethane.*

TETRACHLOROETHYLENE CAS 127-18-4; **molecular weight** 165.84

SYNONYMS: Tetrachloroethene, PCE, Carbon bichloride, Carbon dichloride, Ethylene tetrachloride, Per, Perc, Perchlor, Perchloroethylene, Perchlorethylene, Perk, Tetrachlorethylene, 1,1,2,2-Tetrachloroethylene.

TRADE NAMES: Ankilostin, Antisal 1, DEE-Solv, Didakene, Dow-per, Ent 1860, Fedal-Un, Nema, Perclene, Percosolv, Perklone, Persec, Tetlen, Tetracap, Tetraleno, Tetravec, Tetraguer, Tetropil, Perawin, Tetralex, Dowclene EC.

DESCRIPTION: Tetrachloroethylene is a nonflammable colorless liquid that sinks in water.[1] Its sweetish chloroform odor is perceptible at a range of 5 to 50 **ppm**. Its **half-life** in water by evaporation is 24 minutes. By chemical decomposition and **photolysis** its half-life in water is 9 months. When inhaled, its elimination from the body occurs in 65 hours. Elimination through urine takes 144 hours. It is stored in the body fat.[1]

USES AND SOURCES: Fifty-one percent of the use of tetrachloroethylene occurs in the laundry and dry cleaning industries, 26 percent in the production of chlorofluorocarbons, 15 percent as a degreaser, and 8 percent other uses. Other uses occur in the electronics industry, printing, textile manufacturing, paper industry, paint shops, and auto body shops. It is used as a **fumigant**, as a chemical intermediate, and medically to destroy intestinal worms.[6] It is commonly encountered at **hazardous waste** cleanup sites in Washington state.[44] NIOSH reports that 500,000 workers are **exposed** annually to tetrachloroethylene nationwide.

In 1983, 230,000 metric tons were produced, a decline from 350,000 metric tons in 1981. One source states that its use as a solvent has declined due to replacement by less **toxic** compounds. Another source states that the decline is occurring in demand, through product recycling rather than through decreased product use.[7]

Tetrachloroethylene is widespread in the environment. Eighty-five percent of used tetrachloroethylene enters the atmosphere. In 1974 this quantity amounted to 550 million pounds. Measurements of ambient rural air of 30 **ppt** have been recorded. Measurements of ambient urban air have amounted to 4.5 **ppb**.[7]

See "More About Pesticides".

HARMFUL EFFECTS AND SYMPTOMS: Routes of harmful **exposure** to tetrachloroethylene include diet, inhalation, and skin contact.[6] The odor is not a good warning for **chronic** exposures.[115] Symptoms of harmful exposure include skin burning and reddening, and eye, nose, throat, and gastro-intestinal tract irritation (at 75 **ppm**). The following symptoms may start at around 100 **ppm**: headache, dizziness, sleepiness, fatigue, weakness, tiredness, sensory changes, exhilaration, feeling high, speech difficulty, confusion, flushed face and neck, abdominal pain, nausea, vomiting, constipation, diarrhea, bloody stools, incontinence, lack of coordination, liver and kidney injury, slowing of mental ability, central nervous system depression, and death.[1,6,115] Death may occur by damage/failure of the central nervous system.[6] Long term effects may include fatigue, decreased muscle coordination, difficulty in concentration, loss of short-term memory, and personality changes including increased anxiety, nervousness, and irritability.[115] There is not enough information to determine mutagenicity of **teratogenicity**, but in research up to date, tetrachloroethylene is a potential **mutagen**, but not a **teratogen**.[6,23,116] Tetrachloroethylene is a potential **carcinogen** and a possible **fetotoxin**.[6,116] Tetrachloroethylene is considered to be of high **toxicity** (3).[5]

Effects of low concentrations of tetrachloroethylene on wildlife is unknown.[1]

EXPOSURE LIMITS:

AIR: OSHA TWA 25 **ppm** (approximately 170 **mg/m**^{3}).[4] ACGIH TWA 50 **ppm**.[1]

WATER: Due to the potential **carcinogenic** effect of tetrachloroethylene, its concentration should be zero. If this level is not attainable, levels which raise the human lifetime cancer risk to:

one in ten thousand = 8.00 ppb;
one in one million = .80 ppb;
one in ten million = .08 ppb.[1]

WA groundwater criteria: 0.8 µg/l (ppb).[8]

See "More About Exposure Limits".

1,1,2,2-TETRACHLOROETHYLENE: *see Tetrachloroethylene.*

TETRACHLOROMETHANE: *see Carbon tetrachloride.*

TETRAETHYL S,S-METHYLENE BIS PHOSPHOROTHIOLOTHIONATE: *see Ethion.*

TETRAFINOL (trade name): *see Carbon tetrachloride.*

TETRAFORM (trade name): *see Carbon tetrachloride.*

TETRALENO (trade name): *see Tetrachloroethylene.*

TETRALEX (trade name): *see Tetrachloroethylene.*

TETRA OLIVE NZG: *see PAHs.*

TETRAPHENE: *see PAHs.*

TETRASOL: *see Carbon tetrachloride.*

TETRAVEC (trade name): *see Tetrachloroethylene.*

TETROGUER (trade name): *see Tetrachloroethylene.*

TETROPIL (trade name): *see Tetrachloroethylene.*

THERMINOL (trade name): *see PCBs.*

THERMINOL FR (trade name): *see PCBs.*

THIFOR (trade name): *see Endosulfan.*

THIMUL (trade name): *see Endosulfan.*

THIODAN (trade name): *see Endosulfan.*

THIODEMETON (trade name): *see Disulfoton.*

THIOFOR (trade name): *see Endosulfan.*

THIOMUL (trade name): *see Endosulfan.*

THIOPHOS (trade name): *see Parathion.*

THIOPNOS (trade name): *see Parathion.*

THIOREX (trade name): *see Endosulfan.*

THIOSULFAN (trade name): *see Endosulfan.*

THRETHYLEN (trade name): *see Trichloroethylene.*

THRETHYLENE (trade name): *see Trichloroethylene.*

TIONEL (trade name): *see Endosulfan.*

TIOVEL (trade name): *see Endosulfan.*

TOLUENE CAS 108-88-3; **molecular weight** 92.13:

SYNONYMS: VOC, Toluol, Methylbenzene, Methacide phenylmethane.

DESCRIPTION: Toluene is a flammable colorless liquid that floats on and dissolves very slowly in water. Its pleasant odor is perceptible at .25 **ppm.**[1] Its **half-life** in soil and water (including shallow groundwater) ranges from 1 to 7 days. Toluene will adsorb to soils rich in **organic** matter, but will be readily **leached** from soils with low organic content.[118] Limited data indicates there is moderate **food chain contamination.**[118] Most toluene taken into the body leaves within 12 hours.[118] Additional studies on the rate of evaporation, degradation, and transport of toluene in ground and surface water would be useful, since it is often found in water near **hazardous waste** sites.[118]

USES AND SOURCES: Toluene is used in the manufacture of benzene, pharmaceuticals, and to produce other chemicals. It is used as a solvent for paints and coatings, and as a component of automobile and aviation fuels (in gasoline, 2.73 to 21.80 percent by weight). It is used in leather products manufacturing, metal manufacturing, cosmetics, printing, vehicle maintenance and equipment repair, laboratories, pesticides, furniture making and refinishing, textile manufacturing, and to make dyes and explosives.[1,6,30] Consumer products containing toluene include gasoline, nail polish, cosmetics, rubber cement, paint brush cleaners, stain removers, fabric dyes, inks, and adhesives.[118] Toluene is found in cigarette smoke (1 pack/1000 **μg/m^3**).[118] It is an **inert ingredient** that the **EPA** has classified as potentially **toxic** in pesticides. Toluene is a commonly encountered toxicant at **hazardous waste** cleanup sites in Washington state.[44] It is found at illegal drug laboratory hazardous waste sites, where TCP, methadone, and PCP have been processed.[2]

Domestic capacity in 1988 of isolated toluene is 1,774 million gallons. This figure does not include toluene mixed in gasoline, which constitutes 89 percent of the toluene used in the U.S.[118]

Nearly all toluene released into the environment enters the atmosphere. The largest source of toluene release is production, transport, and use of gasoline.[118] Automobile exhaust is a significant contributor of toluene to the atmosphere.[118] In the air in nonindustrialized areas and indoors toluene concentrations are usually less than 1 **ppm.**[118] A typical daily dose for an adult might be 320 **μg/m^3**. Average outdoor levels in suburban and urban areas range from 5 to 25 **μg/m^3**, and average indoor levels amount to 32 **μg/m^3**.[118] Toluene is also found in the water. A 1988 **EPA** survey of **hazardous waste** sites found toluene at 29 percent of the sites surveyed, at average concentrations of 21 **ppb** in groundwater, 7.5 ppb in surface water, and 77 ppb in soil. In federal and state surveys toluene was found in about 1 percent of groundwater drinking sources, at concentrations lower than 2 **ppb**. Toluene was found more frequently in surface water supplies than in groundwater supplies. Surface water surveys were not as complete as the groundwater surveys. Average daily intake in drinking water from surface waters is .3 to .5 **μg/m^3**. Further studies on toluene levels in food and soil, and studies identifying the sources of toluene in indoor air are needed.[118]

The populations most likely to have high levels of **exposure** are workers in the printing industry, workers using toluene as a solvent, people exposed to gasoline vapors, people using toluene-containing consumer products, smokers, people exposed to second hand smoke, and people using drinking water sources located near **hazardous waste** sites where toluene has contaminated the groundwater.[118]

Xylene, which is listed separately, is an impurity in toluene, in concentrations up to 5 percent.[1] One of toluene's degradation products in the air is cresol.[118]

See "Cresol" and "Xylene". See "More About Pesticides".

HARMFUL EFFECTS AND SYMPTOMS: Routes of harmful **exposure** to toluene include inhalation and ingestion.[6] Symptoms of harmful exposure include irritation of the eyes, and respiratory tract, dry, cracked skin, coughing, giddiness, and drowsiness, dizziness, fatigue (at 100 **ppm**, short term exposure), headache (at 300 **ppm**, short term exposure), confusion (at

600 **ppm**, short term exposure), impaired speech, muscular weakness, tremors, loss of coordination (which may result from an 8-hour **exposure** to 200 **ppm**), memory loss, cramping, nausea, vomiting, central nervous system depression, collapse, loss of consciousness, respiratory arrest, and death.[1,6] Symptoms short of death disappear when exposure stops. Immune system suppression and kidney and liver damage have been reported in people exposed to toluene, but these people were exposed to other solvents at the same time. Long-term exposure to high concentrations of toluene by intentional abuse has been linked with permanent brain damage, including problems with speech, vision, and hearing, loss of muscle control, loss of memory and balance, and reduced scores on psychological tests.[6] Tests show no evidence that toluene is **carcinogenic.**[6] People who are unusually susceptible to adverse effects when **exposed** to toluene include those with asthma, people with other respiratory difficulties, people with **cardiovascular** or liver diseases, the elderly, chronic smokers, and chronic alcohol drinkers.[118] **Teratogenicity** was reported in laboratory animals by inhalation exposure, but not by the oral route.[118] Toluene is considered to be of high **toxicity** (3).[5]

There is no information concerning the human health effects of toluene in **reproductive toxicity** by inhalation, and no information at all concerning **exposures** by oral and skin routes. In animal studies there is no information about **acute systemic** toxicity by oral exposure, and no information about levels of exposure resulting in death, intermediate and **chronic** toxicity, **immune system**, **neurological**, **developmental**, and reproductive toxicity, **genotoxicity**, and **carcinogenicity** by skin and oral exposures.[118] Studies directly measuring exposure levels in humans are needed to improve estimates of appropriate exposure limits. A registry of people known to have been **exposed** to toluene would help in investigations of possible chronic health effects of toluene, and of the dose-response relationship for short term and long-term effects.[118]

Toluene is dangerous for aquatic life in high concentrations.[1]

EXPOSURE LIMITS:

AIR: OSHA TWA 100 **ppm** (approximately 375 **mg/m^3**).[4]

WATER: Recommended drinking water limit 2 **ppm.**[1]

See "More About Exposure Limits".

TOLUENE-2,4-DIISOCYANATE CAS 584-84-9; **molecular weight** 174.16:

SYNONYMS: 2,4-Diisocyanato-1-methyl-(9CI)benzene; 4-Methyl-m-phenylene ester(8CI)isocyanic acid; 2,4-Diisocyanatotoluene; Toluylene 2,4-diisocyanate; Tolylene 2,4-diisocyanate; TDI; 2,4-Diisocyanato-1-methylbenzene; 2,4-Tolylene diisocyanate; 2,4-TDI; 4-Methyl-m-phenylene diisocyanate; 4-Methyl-m-phenylene isocyanate.

TRADE NAMES: Desmodur T80, Hylene T, Mondur TDS, TDS-80, Rubinate TDI 80/20, Mondur TD-80, Voranate T-80, Nacconate, TDI, Hylene TM.

DESCRIPTION: Toluene-2,4-diisocyanate is a slightly flammable dark to pale yellow to clear liquid that sinks in water. Its pungent odor is perceptible at a range of .1 to .4 **ppm**. In cold water, it can change in part to a solid insoluble polyurea, which is biologically **inert**. In one soil spill, the polyurea could be detected after 6 years. The atmospheric **half-life** of toluene-2,4-diisocyanate is 3 days, but if it reacts with ozone, its half-life is 3981 days. In water its half-life by chemical decomposition ranges from half a second to 3 days. There is no **food chain contamination.**[1]

USES AND SOURCES: Toluene-2,4-diisocyanate is used to make polyurethane foams (90 percent of its use), **elastomers**, and coatings.[1] In 1986 616 million pounds were produced. In 1985 29 million pounds were imported and 9 million pounds were exported.[7]

HARMFUL EFFECTS AND SYMPTOMS: Routes of harmful **exposure** include inhalation and skin contact. The odor is not a good warning sign. People who have become sensitized from prior exposures should not handle this chemical, because they may develop serious health problems, even at very low concentrations. These people may have an asthma-like reaction. Sensitization occurs in 2 to 5 percent of people exposed even at occupational exposure levels. This chemical aggravates blood, liver, and respiratory diseases. Symptoms of harmful exposure include irritated nose and throat (at 50 to 500 **ppb**), pink eye, acne-like rash, choking, coughing spasms, chest pain, asthma, chronic bronchitus, emphysema, **pulmonary edema**, tuberculosis, abdominal pain, nausea, and vomiting. Chronic symptoms include shortness of breath, liver diseases, and psychological changes. Toluene-2,4-diisocyanate is not a **carcinogen**, but is a possible **mutagen.**[1] Toluene 2,4-diisocyanate is considered to be of high **toxicity** (3).[5]

Toluene-2,4-diisocyanate is highly toxic to aquatic life.[1]

EXPOSURE LIMITS AND DETECTION LEVELS:

AIR: OSHA TWA .005 **ppm** (approximately .04 mg/m^3).[4]

See "More About Exposure Limits".

TOLUOL: *see Toluene.*

TOLUYLENE 2,4-DIISOCYANTE: *see Toluene-2,4-diisocyanate.*

TOLYLENE 2,4-DIISOCYANATE: *see Toluene-2,4-diisocyanate.*

2,4-TOLYLENE DIISOCYANATE: *see Toluene-2,4-diisocyanate.*

TOXADUST: *see Toxaphene.*

TOXAKIL: *see Toxaphene.*

TOXAPHENE CAS 8001-35-2:

SYNONYMS: Octachlorocamphene, Compound-3956, Alltox, Geniphene, Toxakil, Toxadust, Phenacide, Penphene, Chlorinated camphene.

TRADE NAMES: Phenatox.

DESCRIPTION: Toxaphene is a slightly flammable amber waxy solid or solution that may be formulated as a dust, **emulsifiable concentrate**, a **granule**, or as **wettable powder** with a mild turpentine odor. Its **odor threshold** is .0052 **ppm**. The solid sinks in water, while the solution (usually 10 percent xylene, also in this manual) floats. The wettable powder form dissolves in water. Toxaphene is more **toxic** in environments that are highly **alkaline** and/or ones with a high temperature. It is very persistent in the environment. Some lakes treated for fish kill have remained toxic for 3 or 4 years. Its main form of dissipation from water is by evaporation.[1] It is absorbed by soil, where it has a **half-life** of 10 to 14 years.[1] Toxaphene is detoxified by microorganisms. There is much **bioaccumulation** and **food chain contamination**. It concentrates in fatty tissues.[1]

USES AND SOURCES: Toxaphene is an insecticide for which the **EPA** initiated restrictions in 1982, to taper off its use in 1988. Most of its uses were canceled when it was found that large amounts of the chemical vaporized upon application and were transported in the upper atmosphere from the southern United States to the Great Lakes, where fish populations were contaminated. It has been a very heavily used **pesticide**, primarily on cotton crops, and secondarily on livestock, grains, vegetables, soybeans, and forage.[6] Fifteen to twenty thousand people were **exposed** during formulation, and 40,000 during application.[7] Daily intake in 1974 averaged .7842 **g/day.**[76] Levels in .4 to 8 percent of ambient air samples from 1970 to 1973 ranged from 6.3 to 5000 ng/m^3. The average American inhaled 2 to 3 g/day, and much higher concentrations in the southeast, where toxaphene was heavily used.[120]

See "More About Pesticides".

HARMFUL EFFECTS AND SYMPTOMS: Routes of harmful **exposure** to toxaphene include inhalation, ingestion, and skin contact.[6] Symptoms of harmful exposure include dry red skin, excessive salivation, confusion, agitation, tremors, shivering, leg and back muscle spasms, respiration problems, nausea, vomiting, depression, fever, convulsions, and loss of consciousness, and respiratory failure.[1,6] Toxaphene is a probable liver and **thyroid carcinogen**, a **mutagen**, and a possible **teratogen**.[6,25,120] Toxaphene is considered to be of high **toxicity** (3).[5]

Toxaphene is harmful to aquatic life in very low concentrations.[1]

EXPOSURE LIMITS:

ADI 1.25 g/kg.[25]

AIR: OSHA PEL .5 mg/m^3.[25]

WATER: Proposed maximum contaminant level goal in drinking water 0. Proposed maximum contaminant level in drinking water 5 mg/l.[25] WA groundwater criteria .08 μg/l.[8]

See "More About Exposure Limits".

TRANS-1,2-DICHLOROETHENE: *see 1,2-Dichloroethylene.*

1,2-TRANS-DICHLOROETHENE: *see 1,2-Dichloroethylene.*

TRANS-1,2-DICHLOROETHYLENE: *see 1,2-Dichloroethylene.*

TRANS-1,3-DICHLOROPROPENE: *see Dichloropropene.*

TRANS-1,3-DICHLORO-1-PROPENE: *see Dichloropropene.*

1,3-TRANS-DICHLROPROPYLENE: *see Dichloropropene.*

TREMOLITE: *see Asbestos.*

TRETHYLEN (trade name): *see Trichloroethylene.*

TRETHYLENE (trade name): *see Trichloroethylene.*

TRI: *see Trichloroethylene.*

TRIAD (trade name): *see Trichloroethylene.*

TRIAL (trade name): *see Trichloroethylene.*

TRIALKYL TIN COMPOUNDS, which include

TRIBUTYLTIN ACETATE CAS 56-36-0,

BIS(TRIBUTYLTIN) OXIDE CAS 56-35-9

TRIBUTYLTIN BENZOATE CAS 4342-36-3,

TRIBUTYLTIN FLUORIDE CAS 1983-10-4,

TRIBUTYLTIN HYDROXIDE CAS 1067-97-6,

TRIETHYLTIN CHLORIDE CAS 994-31-0,

and

TRIMETHYLTIN HYDROXIDE CAS 56-24-6.

DESCRIPTION: The environmental chemistry and **fate** of trialkyltin compounds in aquatic environments are complex and not completely understood. Their **half-life** in **aerobic** soils may be 116 days, in **anaerobic** soils 815 days, 6 to 12 days in sea water, and up to 238 days in fresh water. They concentrate in bottom sediment.

USES AND SOURCES: Trialkyltin compounds are used to preserve wood, paper, textiles, leather, and paints, to coat sea pens in the salmon aquaculture industry, as disinfectants in cooling towers, and in marine paints. The **EPA** estimates 730 to 860 thousand pounds are used annually. Two hundred and eight thousand recreational vessels are painted with them.[122]

See "More About Pesticides".

HARMFUL EFFECTS AND SYMPTOMS: Tributyltin acetate, **tributyltin** benzoate, tributyltin fluoride, triethyltin chloride, trimethyltin hydroxide, and bis(tributyltin) oxide is considered to be of high **toxicity** (3). Tributyltin hydroxide is considered to be of moderate **toxicity** (2).[5]

Trialkyltin compounds are extremely **toxic** to mussels, clams, oysters, and fish.[123] They are **lethal** to aquatic life at levels of a few hundred **ppt**, concentrations which are matched or exceeded in many U.S. harbors today.[122]

EXPOSURE LIMITS:

See "More About Exposure Limits".

TRIANGLE (trade name): *see Copper naphthenate.*

TRIASOL (trade name): *see Trichloroethylene.*

TRIBROMOMETHANE: *see Bromoform.*

TRIBUTYLTIN ACETATE: *see Trialkyltin compounds.*

TRIBUTYLTIN BENZOATE: *see Trialkyltin compounds.*

TRIBUTYLTIN FLUORIDE: *see Trialkyltin compounds.*

TRIBUTYLLTIN HYDROXIDE: *see Trialkyltin compounds.*

TRICARNAM (trade name): *see Carbaryl.*

TRICHLORAN (trade name): *see Trichloroethylene.*

TRICHLOREN (trade name): *see Trichloroethylene.*

TRICHLORETHENE: *see Trichloroethylene.*

1,2,4-TRICHLOROBENZENE CAS 120-82-1; **molecular weight** 181.46:

SYNONYMS: Unsym-trichlorobenzene, Asym-trichlorobenzene.

DESCRIPTION: 1,2,4-Trichlorobenzene is one of three similar **isomers** in the form of a colorless liquid or colorless crystalline solid with a pleasant aroma that is insoluble in water. Its **odor threshold** ranges from .88 to 2.4 **ppm**. Its evaporation **half-life** ranges from 45 minutes in turbulent water to several days in still water. Chemical decomposition and oxidation are probably not important **fate** processes. There is little **bioaccumulation**, and **food chain contamination** is unlikely.[1]

USES AND SOURCES: 1,2,4-Trichlorobenzene is used as a dye **carrier, herbicide** intermediate, heat transfer medium, dielectric fluid in transformers, degreaser, lubricant, and insecticide against termites. Sources of **exposure** are surface runoff and municipal and industrial discharges.[6]

See "More About Pesticides".

HARMFUL EFFECTS AND SYMPTOMS: Routes of harmful **exposure** to 1,2,4-trichlorobenzene include inhalation and ingestion.[6] 1,2,4-Trichlorobenzene causes irritation to the eyes, respiratory tract, and mucous membranes at 3 to 5 **ppm.**[1,6] Prolonged or repeated contact with the skin will cause burns. **Acute** exposures cause drowsiness, loss of coordination, and loss of consciousness. In animal studies, **chronic** exposures have caused liver, kidney, and lung damage. The **carcinogenicity** of 1,2,4-trichlorobenzene is unknown.[6] 1,2,4-Trichlorobenzene is considered to be of high **toxicity** (3).[5]

EXPOSURE LIMITS:

AIR: ACGIH Ceiling 5 **ppm** (approximately 40 **mg/m^3**).[28]

See "More About Exposure Limits".

2,4,6-TRICHLORO-(8CI9CI)PHENOL: see 2,4,6-Trichlorophenol.

1,1,1-TRICHLOROETHANE: see Methylchloroform.

1,1,2-TRICHLOROETHANE CAS 79-00-5; **molecular weight** 133.42:

SYNONYMS: Vinyl trichloride; Ethane trichloride; Beta-trichloroethane; 1,2,2-Trichloroethane.

TRADENAMES: Beta-T.

DESCRIPTION: 1,1,2-Trichloroethane is a nonflammable colorless liquid. Its **half-life** in surface waters is 2 days.[1] Its half-life in air is about 49 days. In groundwater and below the soil surface some studies show that 1,1,2-trichloroethane does not breakdown within 16 weeks and others say it will last for 37 years. Releases of 1,1,2-trichloroethane to soil is expected to partially **leach** and partially evaporate. In groundwater it degrades to vinyl chloride, another chemical in this manual. There is no **bioaccumulation.**[124]

Environmental studies that are still needed include the **aerobic** and **anaerobic** degradation of 1,1,2-trichloroethane and a determination of the **half life** in groundwater and sediment-water systems.[124]

USES AND SOURCES: 1,1,2-Trichloroethane is used as a solvent, an intermediate in the production of vinylidene chloride, and a component of adhesives.[1] Information on production and use, estimates of general population and occupational **exposure,** monitoring data, and information about what products in which it is used is not directly available.[124] Data from the EPA Air Toxics Emission Inventory reveals that emissions of 1,1,2-trichloroethane are associated with plastic materials and resins, industrial **organic** chemicals, petroleum refining, gaskets-packing and sealing devices, plating and polishing, residential lighting fixtures, radio and TV communication equipment, electronic components, motor vehicles parts and accessories, engineering and scientific instruments, and photographic equipment and supplies.[124] From surveys of industrial waste water it is found that the timber products, plastics, synthetics, and laundry industries discharge 1,1,2-trichloroethane. 1,1,2-Trichloroethane has been found at 45 of 1177 **hazardous waste** sites on the National Priorities List.[124]

In 1979 412 million pounds were produced.[124]

The release pattern for 1,1,2-trichloroethane is estimated to be 70 to 90 percent to air, 10 to 30 percent to land, and a few percent to water.[124] Releases to the air in 1979 was calculated to be 10,000 to 20,000 million tons annually.[124]

Trichloroethane is present in one quarter to one half of city air samples, from 10 to 50 **ppt.** **Exposure** through contaminated drinking water from groundwater supplies is rare. It has not been reported in soil or food.[124] In one study of indoor air, 11 of 16 samples taken in 8 homes contained 1,1,2-trichloroethane, with a mean concentration of 14.1 **μg/m**^{3} (2.5 **ppb**).[124] From a survey of **EPA's** STORET data base from 1980 to 1988, 10 percent of 3255 samples of surface water were found to contain 1,1,2-trichloroethane at 10 ppb or higher.[124]

It is sometimes an impurity in commercial production of methylchloroform and trichloroethylene.[124]

See "Methylchloroform" and "Trichloroethylene."

HARMFUL EFFECTS AND SYMPTOMS: Routes of harmful **exposure** to 1,1,2-trichloroethane include inhalation and skin contact. Symptoms of harmful exposure include irritation of the nose and eyes. In animal studies **chronic** exposure has caused sleepiness, kidney, liver, and gastro-intestinal distress, immune system suppression, damage to the lungs, shortened lifespan (very high doses).[1,124] It is a possible **carcinogen**, but does not seem to be a **teratogen**.[124] 1,1,2-Trichloroethane is considered to be of high **toxicity** (3).[5]

There is almost no information on human health effects of 1,1,2-trichloroethane, except for a skin **exposure** study. Data is missing in animal studies in **genotoxicity** by oral exposure. Data is missing concerning intermediate and **chronic systemic** toxicity, **immune system**, **developmental** and **reproductive toxicity**, genotoxicity, and **carcinogenicity** by inhalation and skin exposure.[124]

EXPOSURE LIMITS:

AIR: OSHA TWA 10 **ppm** (approximately 45 **mg/m**^{3}).[4]

WATER: Due to the potential **carcinogenic** effect of 1,1,2-trichloroethane, its concentration should be zero. If this level is not attainable, levels which raise the human lifetime cancer risk to

one in ten thousand = 6.00 **ppb**;
one in one million = .60 ppb;
one in ten million = .06 **ppt.**

EPA limit for waters such as lakes and streams .6 μg/l (.6 **ppb**).[124] There is insufficient data to establish criteria for a saltwater **toxicity** limit.[1]

See "More About Exposure Limits".

1,2,2-TRICHLOROETHANE: *see 1,1,2-Trichloroethane.*

TRICHLOROETHENE: *see Trichloroethylene.*

TRICHLOROETHYLENE CAS 79-01-6; molecular weight 131.40:

SYNONYMS: TCE; Trichloroethene; Ethinyltrichloride; Acetylene trichloride; 1-Chloro-2,2-dichloroethylene; 1,1-Dichloro-2-chloroethylene; Ethylene trichloride; 1,1,2-Trichloroethylene; 1,2,2-Trichloroethylene; TCS; TRI; Trichlorethene.

TRADE NAMES: Tri-clene, Trielene, Trilene, Trichloran, Trichloren, Algylen, Trimar, Triline, Trethylen, Trethylene, Westrosol, Chlorylen, Gemalgene, Germalgene, Benzinol, Blacosolv, Blancosolv, Cecolene, Circosolv, Crawhaspol, Dow-tri, Dukerom, Fleck-flip, Flock-flip, Lanadin, Lethurin, Nialk, Perm-a-chlor, Perm-trial, Triasol, Trielin, Triklone, Triol, Vestrol, Vitran, Anamenth, Chlorilen, Chlorylea, Chorylen, Densinfluat, Fluate, Narcogen, Narkogen, Narkosoid, Petzinol, Philex, Threthylen, Threthylene, Triad, Trial, Triclene, Trilen, Tri-plus, Tri-plus M, NCI-C04546.

DESCRIPTION: Trichloroethylene is a slightly flammable colorless liquid that sinks in bodies of water and dissolves very, very slowly. Its sweet chloroform odor is perceptible at 21.4 **ppm**. Sources reported variously on its **half-life** in water and air. One source stated that its half life in water by evaporation ranges from 17 to 90 minutes, its half-life in water due to chemical decomposition is around 11 months, and its **tropospheric** half-life ranges from 1 to 4 days.[1] Another source said its half life in water by evaporation ranges from 1 to 4 days, its half life in water by chemical decomposition is 30 months, and its atmospheric (air) **half life** is around 2 weeks. It is highly **mobile** in soil and liable to **leach** through the ground. **Bioaccumulation** is possible but has not been recorded.[8]

USES AND SOURCES: Trichloroethylene is used as a solvent, degreaser (80 to 95 percent of total use), refrigerant, heat-exchange fluid, dry-cleaning agent, and as a chemical intermediate in the production of **pesticides**. It is used in metal manufacturing, body shops, pharmaceuticals, veterinary medicine, and printing. It is used in the manufacture of paper, waxes, gums, tars, resins, paints, varnishes, and other chemicals, in textile manufacturing, and as an anesthetic.[1,26,125] It is commonly encountered at **hazardous waste** cleanup sites in Washington state.[44] Sources of trichloroethylene in the environment include evaporation from vapor degreasing operations, and emissions and **leaching** to groundwater from waste disposal landfills.[126]

Two hundred million pounds of trichloroethylene is used annually in the U.S.[114] Eighty to ninety-five percent of used trichloroethylene evaporates into the atmosphere. Emission estimates of trichloroethylene in 1979 was 130,000 metric tons.[125]

Trichloroethylene has been found in 36 percent of ground water drinking water sources for 25 cities and in half of surface and subsurface water samples from U.S. urban/industrial areas from 23 states from 1 **ppb** to 403 ppb.[125] It has been found in at least 460 of 1,179 **hazardous waste** sites on the National Priorities List.[114] Trichloroethylene, mostly in parts per billion levels, has been found in many natural and processed foods as a result of contamination of water used in the processing, the use of cleaning solvents for equipment used in food processing, through uptake from the environment, and through contact with packaging materials. Rainwater and snow has been reported to contain trichloroethylene, in parts per trillion levels. Fish and shellfish have been reported to contain trichloroethylene, from below **detection limits** up to 479 **g/kg**.[114] Indoor air levels of trichloroethylene can occur in homes that are supplied with contaminated water.[114] The average ambient urban air concentration of trichloroethylene is 1 **ppb**, with peaks of 32 ppb recorded.[125] Background levels in air range from 30 to 460 **ppt**.[114] The mean concentration in air recorded near emission sources is 1,200 ppt.[114]

Hexachlorobutadiene and 1,1,2-trichloroethane are impurities in the manufacture of trichloroethylene.[1,126] In the environment trichloroethylene may be transformed into vinyl chloride or 1,2-dichloroethylene, substances that are 2.5 and 5 times more potent than trichloroethylene itself. Trichloroethylene is a degradation product of 1,1,2-trichloroethane in water.[114]

NIOSH estimates that 3.5 million workers in the U.S. are occupationally **exposed** to trichloroethylene.[126]

See "Hexachlorobutadiene", "1,1,2-Trichloroethane", "Vinyl chloride", and "1,2-Dichloroethylene".

HARMFUL EFFECTS AND SYMPTOMS: Routes of harmful **exposure** to trichloroethylene include inhalation, ingestion, and skin contact.[6] Inhalation of high concentrations may cause anesthesia, central nervous system depression, convulsions, and loss of consciousness. Symptoms of **chronic** exposure include irritation of the eyes, nose, and throat (at 27 **ppm**), sleepiness (at 27 **ppm**), acne-like rash, headache (at 81 **ppm** in 4 hours), confusion, dizziness, vertigo, fatigue, blurred vision, intoxication similar to that of alcohol, tremors, nausea, vomiting, diarrhea, liver, kidney, and bone marrow damage, effects on the blood, rapid and irregular heartbeat, and death due to heart irregularities and flutterings (at 10,000 **ppm**, single dose).[1,6,126] In general, less severe central nervous system effects that result from one or several **exposures** to trichloroethylene disappear when exposure ends.[126] Ingestion may cause kidney activity suppression.[1] Trichloroethylene is a probable **carcinogen** and a possible **mutagen.** Animal studies indicate it is may be **fetotoxic** and a **teratogen.**[6,25,125,126] Drinking alcohol can make people more susceptible to liver and kidney injury from trichloroethylene.[126] Trichloroethylene is considered to be of high **toxicity** (3).[5]

In human studies there is insufficient information about all health effects of trichloroethylene. There is no information on its **developmental toxicity** by inhalation, or its **intermediate** and **chronic systemic toxicity** and **reproductive toxicity** by inhalation and oral **exposure,** and no information about skin exposure.[126]

In animal studies there is insufficient data in exposures resulting in death, **acute,** intermediate, and chronic systemic toxicity, **developmental** and **reproductive toxicity** by inhalation and oral exposures, and ability to cause cancer by skin exposure. There is no information on other health effects of trichloroethylene by skin **exposure.**[126]

EXPOSURE LIMITS:

AIR: OSHA TWA 50 **ppm** (/ 270 **mg/m^3**).[4]

WATER: EPA drinking water standard 5 **ppb.**[126] There is insufficient data to develop criteria for a **chronic** aquatic **toxicity** limit. **Acute** tests show that trichloroethylene is still toxic in freshwater at 45 **ppm,** and in saltwater at 2 **ppm.**[1] WA groundwater criteria 3 μg/l.[8]

See "More About Exposure Limits."

1,1,2-TRICHLOROETHYLENE: *see Trichloroethylene.*

1,2,2-TRICHLOROETHYLENE: *see Trichloroethylene.*

TRICHLOROFLUOROMETHANE: *see Fluorocarbon 11.*

TRICHLOROFORM: *see Chloroform.*

TRICHLOROMETHANE: *see Chloroform.*

1,3,5-TRICHLOROPHENOL: *see 2,4,6-Trichlorophenol.*

2,4,6-TRICHLOROPHENOL CAS 88-06-2; **molecular weight** 197.46:

SYNONYMS: TCP; Sym-trichlorophenol; NCI-C02904; 2,4,6-Trichloro-(8CI9CI)phenol; 1,3,5-Trichlorophenol; 2,4,6-T; Dowicide 2S; Omal; Phenachlor.

DESCRIPTION: 2,4,6-Trichlorophenol in solid form is crystalline and slightly soluble in water. Its color is colorless to yellow. In a body of water it would sink. It has a phenol-like odor perceptible at .021 **ppm.** 2,4,6-Trichlorophenol is formulated as liquid or as yellow flakes. There is no **bioaccumulation.** It is **persistent** in soil for 5 days. It is absorbed by **organic** soils, but not by sediment. **Biodegradation** may be insignificant in fast-moving waters. In tests 70 percent degradation occurred in seawater from 26 to 65 days. Chemical decomposition, oxidation, and evaporation are unlikely fate processes.[1]

USES AND SOURCES: 2,4,6-Trichlorophenol is used as a germicide, bactericide, an insecticide ingredient, in glue and wood preservatives and as an anti-mildew treatment for textiles. Evidence shows that various chlorophenols, of which this is one, are formed during **microbiological degradation** of certain **herbicides** (like lindane), and during the chlorination of drinking water and waste water.[6] 2,4,6-Trichlorophenol is sometimes contaminated by dioxin.[1]

See "Dioxin" and "Lindane". See "More About Pesticides".

HARMFUL EFFECTS AND SYMPTOMS: Routes of harmful **exposure** to 2,4,6-trichlorophenol include ingestion, inhalation and skin contact. Symptoms of harmful exposure include irritation of the skin, eyes, nose and pharynx. Symptoms of **chronic** exposure include weakness, psychological changes, **persistent** acne, and liver dysfunction. In laboratory animals exposure to 2,4,6-trichlorophenol has caused restlessness, weakness, difficulty in breathing, rapid breathing, gastro-intestinal disturbances, tremors, convulsions, loss of consciousness, and death.[6] It is a probable **carcinogen (B)** and a possible **mutagen, fetotoxin,** and **teratogen.** Its teratogenic possibilities may be due to dioxin contamination.[1] 2,4,6-Trichlorophenol is considered to be of high **toxicity** (3).[5]

EXPOSURE LIMITS:

WATER: Due to the potential **carcinogenic** effect of 2,4,6-trichlorophenol, its concentration should be zero. If this level is not attainable, levels which raise the human lifetime cancer risk to

one in ten thousand = .01200 **ppm**;
one in one million = .00120 ppm;
one in ten million = .00012 ppm.

Chronic Aquatic Toxicity Limit .53 to .97 **ppm.**[1] WA groundwater criteria 4 µg/l.[8]

See "More About Exposure Limits".

TRICLENE (trade name): *see Trichloroethylene.*

TRI-CLENE (trade name): *see Trichloroethylene.*

TRICLOPYR CAS 93-72-1; **molecular weight** 256.46:

TRADE NAME: Garlon 3a.

DESCRIPTION: Triclopyr is a colorless powder or brown liquid which sinks and dissolves very slowly in water. It is formulated as an **emulsifiable concentrate.**[1] It **leaches** easily through soil. Soil residues of up to 10 percent of the original amount **persist** 1 to 2 years or more. In water with light triclopyr dissipates in 10 hours, and in water without light it dissipates in 9 months.

USES AND SOURCES: Triclopyr is a **systemic pesticide** used on rights-of-way to control broadleaf weeds.[1] It is one of the most commonly used pesticides in western Washington.[31]

See "More About Pesticides".

HARMFUL EFFECTS AND SYMPTOMS: Triclopyr causes skin irritation. In laboratory animals it causes liver and kidney damage.[1] Triclopyr is considered to be of high **toxicity** (3).[5]

EXPOSURE LIMITS:

AIR: ACGIH TLV (TWA) 10 **mg/m**^{3}.[1]

WATER: Recommended drinking water limit .01 **ppm.**[1]

See "More About Exposure Limits".

TRIELENE (trade name): *see Trichloroethylene.*

TRIELIN (trade name): *see Trichloroethylene.*

TRIETHYLTIN CHLORIDE: *see Trialkyltin compounds.*

TRIFLURALIN CAS 1582-09-8; **molecular weight** 335.29:

TRADE NAMES: Treflan.

DESCRIPTION: Trifluralin is a yellow orange crystalline solid, formulated as an emulsive concentrate.[1,22] It is probably not a strong potential ground water contaminant due to its strong **adsorption** to soil and its negligible **leaching.** Its **half-life** in soil ranges from 42 to 84 days.[22]

USES AND SOURCES: Trifluralin is a **pesticide** used to control annual grasses and broad-leafed weeds. It is applied to soybean, cotton and vegetables, fruit and nut trees, shrubs, roses and other flowers, on golf courses, rights-of-way and domestic outdoor and industrial sites. In a 1988 search of the U.S. EPA STORET Water Quality File, trifluralin has been found in 172 of 2,047 samples analyzed from 249 surface water locations, at concentrations of .54 µg/l at the **85th percentile** of samples taken, and in 1 of 507 analyzed samples from 386 groundwater locations. In another study trifluralin was detected in 12 percent of soil samples, in concentrations ranging from .01 to .48 **ppm**, taken from 80 sites in 15 states in areas considered to be regular pesticide-use areas.[22]

See "More About Pesticides".

HARMFUL EFFECTS AND SYMPTOMS: Symptoms of harmful **exposure** to trifluralin may include eye and skin irritation, respiratory difficulty, abdominal cramps, nausea, diarrhea, headache, lethargy, cardiac arrest, and death. In laboratory studies thus far trifluralin does not appear to be **mutagenic.** It is a possible **carcinogen.**[22] Trifluralin is considered to be of high **toxicity** (3).[5]

Trifluralin is harmful to aquatic life in very low concentrations.[1]

EXPOSURE LIMITS:

ADI NAS (1977) .1 **mg/kg** bw/day.[22]

WATER: DWEL .105 **mg/L** (100 µg/l).[22]

INGESTION: **Residue tolerances** .05 to 2 **ppm.**[22]

See "More About Exposure Limits".

TRIFOCIDE (trade name): *see 4,6-Dinitro-o-cresol.*

TRIKLONE (trade name): *see Trichloroethylene.*

TRILEN (trade name): *see Trichloroethylene.*

TRILENE (trade name): *see Trichloroethylene.*

TRILINE (trade name): *see Trichloroethylene.*

TRIMAR (trade name): *see Trichloroethylene.*

TRIMETHYLTIN HYDROXIDE: *see Trialkyltin compounds.*

TRIOL (trade name): *see Trichloroethylene.*

TRI-PLUS (trade name): *see Trichloroethylene.*

TRI-PLUS M (trade name): *see Trichloroethylene.*

TRIZINC DIPHOSPHIDE: *see Zinc phosphide.*

TROVIDUR: *see Vinyl chloride.*

UC 21149 (trade name): *see Aldicarb.*

UCON (trade name): *see Fluorotrichloromethane.*

UCON 12 (trade name): *see Dichlorodifluoromethane.*

UCON FLUOROCARBON 11 (trade name): *see Fluorotrichloromethane.*

UCON REFRIGERANT 11 (trade name): *see Fluorotrichloromethane.*

UNIFUME (trade name): *see Ethylene dibromide.*

UNIMOLL DB (trade name): *see N-butyl phthalate.*

UNIVERM (trade name): *see Carbon tetrachloride.*

UNSYM-DICHLOROETHYLENE: *see Vinylidene chloride.*

UNSYM-TRICHLOROBENZENE: *see 1,2,4-Trichlorobenzene.*

URAGON (trade name): *see Bromacil.*

UROX B (trade name): *see Bromacil.*

UROX HX (trade name): *see Bromacil.*

(VAN)DICHLOROPROPENE: *see Dichloropropene.*

VAPOPHOR (trade name): *see Parathion.*

VCL: *see Vinyl chloride.*

VCM: *see Vinyl chloride.*

VECTAL SC (trade name): *see Atrazine.*

VEGFRU FOSMITE (trade name): *see Ethion.*

VELSICOL COMPOUND "R" (trade name): *see Dicamba.*

VELSICOL 58-CS-11 (trade name): *see Dicamba.*

VENTOX (trade name): *see Acrylonitrile*

VERMOESTRICID (trade name): *see Carbon tetrachloride.*

VESTROL (trade name): *see Trichloroethylene.*

VIDDEN D (trade name): *see Propylene dichloride and Dichloropropene.*

VIDDEN DC (trade name): *see Dichloropropene.*

VINEGAR ACID: *see Acetic acid.*

VINYLBENZENE: *see Styrene.*

VINYL CHLORIDE CAS 75-01-4; **molecular weight** 62.50:

SYNONYMS: Chloroethylene, Chloroethene, VCL, Vinyl C monomer, VCM, Monochloroethylene.

DESCRIPTION: Vinyl chloride is a sweet smelling, very flammable, heavy, colorless gas. It clings to the ground and floats on water. Its odor is perceptible at 260 **ppm**. Vinyl chloride evaporates from water very quickly, and **polymerizes** in the presence of air, oxygen, sunlight, and heat. There is no **food chain contamination**.[1] Its **half-life** in air ranges from 1.2 to 1.8 days. Its half-life in water by chemical degradation is estimated to be around 10 years. Its half-life in soil is estimated to be 12 hours. Vinyl chloride is estimated to be very **mobile** in soil, thus having the ability to **leach** into ground water.[132] There is little information based on laboratory testing concerning the **persistence** of vinyl chloride in soil or ground water.[132]

USES AND SOURCES: Vinyl chloride is a gaseous raw material used in plastics, food and medical supply packaging, in electrical wire insulation, and in vinyl products including pipes, cable coatings, furniture, automobile upholstery, wall coverings, housewares, automotive parts. It is used as a refrigerant.[1,6,132] It was used as a propellant in aerosol containers prior to 1974.[6]

Domestic production of vinyl chloride during 1986 was 8.439 billion pounds. Around 200 million pounds were imported in 1987.[132]

NIOSH estimates that 27,00 workers are definitely exposed to vinyl chloride, and that 2.2 million more are probably exposed.[132]

Most of the vinyl chloride entering the environment ends up in the air. Levels of vinyl chloride in the environment are usually a thousand times lower than levels found in occupational settings. Highest outdoor levels have been measured near vinyl chloride factories or over chemical waste storage areas. Tests published in 1976 suggest that the air inside new cars may contain higher than expected levels of vinyl chloride (from .4 to 1.2 ppm), from seepage from new plastic parts. Levels are expected to drop during ventilation.[132] In the 1982 Groundwater Supply Survey, vinyl chloride was found in .74 percent of groundwater supplies, with the maximum concentration being 8.4 μg/l. In the 1976-1977 EPA National Organics Monitoring Survey, 2 samples out of 113 samples of finished drinking waters contained vinyl chloride, averaging .14 μg/l. Concentrations of vinyl chloride as high as 9.8 μg/l in surface waters, 380 μg/l in groundwater, and 10 μg/l in drinking water have been reported.[132] Concentrations of vinyl chloride in air near vinyl chloride plants have been recorded, from trace to 8.8 mg/m^3 (3.4 ppm). Concentrations in air over landfills have been recorded, from undetectable to 30.8 μg/m^3 (.012 ppm).[132] Concentrations in air elsewhere has been typically undetectable. Vinyl chloride has been found in vinegar at levels up to 9.4 ppm, in oils from .15 ppm to 14.8 ppm, and in butter at .05 ppm when they were packaged in PVC containers. Different results occurred in a 1985 study of PVC containers, which reported nearly zero migration of vinyl chloride.[132] The estimated average intake of vinyl chloride in drinking water drawn from PVC pipes ranges from .06 to 2.8 μg/day.[132] Vinyl chloride has been found in at least 133 of 1,177 hazardous waste sites on the National Priorities List.[132] It has been detected in tobacco smoke (at 5.6 to 28 ng/cigarette).[132]

Monitoring data on levels of vinyl chloride in food using plastic packaging and the amount of **leaching** of vinyl chloride into water from plastic pipes is lacking.[132]

Vinyl chloride is the degradation product of tetrachloroethylene, trichloroethylene, 1,1,2-trichloroethane, tetrachloroethane, and methylchloroform.[114,132]

See "Tetrachloroethylene", "Trichloroethylene", "1,1,2-Trichloroethane", "Tetrachloroethane", and "Methylchloroform".

See "More About Exposure Limits".

HARMFUL EFFECTS AND SYMPTOMS: Routes of harmful **exposure** to vinyl chloride include inhalation, ingestion, and skin contact.[6] Symptoms of harmful exposure include headache, respiratory irritation, dizziness, loss of muscular coordination, central nervous system depression, and loss of consciousness.[1,25,132] Chronic **exposure** may cause "vinyl chloride disease", of which the symptoms include severe liver damage (at 1000 **ppm** for up to 14 days and at 10 ppm for more than 14 days, in animals), effects on the lungs, poor circulation in the fingers, bone and **circulatory** changes (at 10 ppm for more than 14 days, in animals), and thickening of the skin.[1,132] Vinyl chloride is a **carcinogen** and a **mutagen**.[1,132] It is considered to be of high **toxicity** (3).[5]

Studies designed to determine if levels of vinyl chloride measured in outside air, drinking water, or food could cause harmful effects on humans have not been performed.[132]

Partial **data gaps** about human **exposure** by inhalation to vinyl chloride exist, including gaps concerning exposure levels causing death, **chronic systemic toxicity, reproductive toxicity,** and ability to cause cancer. Complete data gaps exist for **acute** and **intermediate systemic toxicity**, and there is no information on human exposure to vinyl chloride by oral and skin routes. Skin exposure is thought to be insignificant.[132]

Animal laboratory data is partially lacking concerning **acute** and **chronic systemic toxicity** and reproductive toxicity by inhalation of vinyl chloride, and **exposure** levels causing death by the oral route. No information exists in animal data concerning **acute systemic toxicity, developmental**, or **reproductive toxicity** by oral exposures. No information exists in animal data concerning exposure to vinyl chloride by skin exposure.[132]

Vinyl chloride is not harmful to aquatic life.[1]

EXPOSURE LIMITS:

AIR: OSHA TWA 1 **ppm**.

WATER: Proposed maximum contaminant level for drinking water .002 **mg/l**.[132] WA groundwater criteria .02 µg/l.[8]

INGESTION: Vinyl chloride content of plastics contacting food and water, 5 to 50 **ppm**.[133]

VINYL C MONOMER: *see Vinyl chloride.*

VINYL CYANIDE: *see Acrylonitrile.*

VINYL TRICHLORIDE: *see Trichloroethane(1,1,2-).*

VINYLIDENE CHLORIDE CAS 75-35-4; **molecular weight** 96.94:

SYNONYMS: 1,1-DCE; 1,1-Dichloroethylene; Dichloroethene; 1,1- Dichloroethane; Asdichloroethylene; Unsym-dichloroethylene.

DESCRIPTION: Vinylidene chloride is a watery colorless liquid that sinks to the bottom in bodies of water. Its sweet, chloroform-like odor is perceptible at 500 **ppm**. There is no information on its environmental fate by **biodegradation, photolysis, sorption**, oxidation, and chemical decomposition in water, but they are probable processes of degradation. Vinylidene chloride evaporates within a half hour from stirred water. In the **troposphere** it may undergo fairly rapid photooxidation. One oxidation product is formaldehyde. There may be **bioaccumulation.**[1]

See "Formaldehyde".

USES AND SOURCES: Vinylidene chloride is used as a chemical intermediate in the synthesis the chemical, methylchloroform, and in the production of polyvinyl chloride **copolymers**, which are used in cement latexes. It is used in barrier coatings in the packaging industry, in interior coatings for ship tanks, railroad cars, and fuel storage tanks, in the coating of steel pipes and structures, and in film coating lacquers, paper coatings and certain fibers.[1,6]

See "Methylchloroform."

HARMFUL EFFECTS AND SYMPTOMS: Routes of harmful **exposure** to vinylidene chloride include inhalation, ingestion, and skin contact.[6] The odor is not a good warning against excessive exposure.[1] Symptoms of harmful exposure include irritation to the eyes, skin, and respiratory system, dizziness, and central nervous system depression.[1,6] **Chronic** exposure to low concentrations by laboratory animals has resulted in liver cancer and kidney damage.[6] It is a possible **mutagen, carcinogen** and **teratogen.**[1,6,25] Vinylidene chloride is considered to be of high **toxicity** (3).[5]

The effects of low concentrations of vinylidene chloride on aquatic life is unknown.[1]

EXPOSURE LIMITS:

AIR: OSHA TWA 1 **ppm** (approximately 4 **mg/m^3**).[4]

WATER: Due to the potential **carcinogenic** effect of vinylidene chloride, its concentration should be zero. If this level is not attainable, levels which raise the human lifetime cancer risk to

one in ten thousand = .3300 **ppb**;
one in one million = .0330 ppb;
one in ten million = .0033 ppb.

Chronic aquatic toxicity limit 2.8 **ppm.**[1]

See "More About Exposure Limits."

VITRAN (trade name): *see Trichloroethylene.*

VITRIOL: *see Sulfuric acid.*

VITRIOL BROWN OIL: *see Sulfuric acid.*

VOCs: *see Acetone, Benzene, Bromoform, Carbon tetratchloride, Chlorobenzene, Chloroform, Dibromochloromethane, 1,2-Dichloroethylene, Dichloropropene, Ethylbenzene, Methyl bromide, Methyl chloride, Methylchloroform, Methylene chloride, Styrene, Tetrachloroethylene, Toluene, 1,1,2-Trichloroethane, Trichloroethylene, Vinyl chloride, and Xylene.*

VOLATILE ORGANIC COMPOUNDS: *see VOCs.*

VORANATE T-80 (trade name): *see Toluene-2,4-diisocyanate.*

VORLEX (trade name): *see Propylene dichloride and Dichloropropene.*

VORLEX 201 (trade name): *see Dichloropropene.*

VUAGT 1-4 (trade name): *see Disulfoton.*

VUAGT 1964 (trade name): *see Disulfoton.*

WESTROSOL (trade name): *see Trichloroethylene.*

WHITE ASBESTOS: *see Asbestos.*

WHITE TAR: *see Naphthalene.*

WHO OMS-771 (trade name): *see Aldicarb.*

WINTERWASH (trade name): *see 4,6-Dinitro-o-cresol.*

WITICIZER 300 (trade name): *see N-butyl phthalate.*

WUEHLMAUS-KOEDER (trade name): *see Zinc phosphide.*

WUEHLMAUSTOD ARVITEOL: *see Zinc phosphide.*

XYLENE CAS 1330-20-7; **molecular weight** 106.16:

Xylene is made of 3 **isomers**: (M) **CAS** 108-38-3, (O) **CAS** 95-47-6, and (P) **CAS** 106-42-3.

SYNONYMS: Dimethylbenzene, Xylol, 1,3-Dimethylbenzene, 1,2-Dimethylbenzene, 1,4-Dimethylbenzene.

DESCRIPTION: Xylene is a quite flammable colorless liquid that floats on water. Its sweet, heavy vapor may trail along the ground, and is perceptible at 1.1 **ppm**. Commercial xylene is a mixture of 3 **isomers**, m-, o-, and p-, with m-xylene predominating. It **biodegrades** very slowly, and has a **half-life** of 40 minutesin the top meter of a body of water. It dissipates from water through evaporation.[1]

USES AND SOURCES: Xylene is used as a solvent, in paints, paint removers, degreasing cleaners, lacquers, glues, and cements, metal manufacturing, cosmetics, vehicle maintenance, laboratories, pharmaceuticals, chemical production, printing, making **pesticides**, and as a vehicle for many pesticides. It is a component of gasoline, in concentrations of 3.22 to 8.31 percent by weight.[30] Xylene is one of the most common pesticide constituents in western Washington.[31] It is found at illegal drug laboratory **hazardous waste** sites, where cocaine, mesacalin, and methadone have been processed.[2] It is an impurity in petrochemicals, like benzene and toluene.[1] Xylene is found in cigarette smoke.[3]

See "Benzene", "Toluene", and "Gasoline." See "More About Pesticides".

HARMFUL EFFECTS AND SYMPTOMS: Routes of harmful **exposure** to xylene include inhalation, ingestion, and skin contact. Symptoms of harmful exposure include irritated eyes, nose, and throat, acne-like rash, headache, dizziness, confusion, giddiness, ringing in the ears, lack of appetite, abdominal pain, nausea (from 100 to 200 **ppm**), vomiting, irritability, weakness, slowed reaction time, feeling high (from 200 to 500 ppm), incoherence, loss of balance, clumsiness (from 800 to 10,000 ppm), loss of consciousness, and death (at exposures greater than 10,000 **ppm**). Symptoms of **chronic** exposures to xylene include fatigue, decreased coordination, difficulty in concentrating, loss of memory, increased anxiety, nervousness, and irritability.[134] Xylene is considered to be of moderate **toxicity** (2). Its **isomers** are considered to be of high **toxicity** (3).[5]

M-Xylene and p-xylene are harmful to aquatic life in very low concentrations, and o-xylene is harmful in high concentrations.[1]

EXPOSURE LIMITS:

AIR: OSHA TWA 100 **ppm** (approximately 435 **mg/m^3**).[4]

WATER: Recommended drinking water limit 2 **ppm**.[1]

See "More About Exposure Limits".

2,4-XYLENOL: *see 2,4-Dimethylphenol.*

XYLOL: *see Xylene.*

YALTOX (trade name): *see Carbofuran.*

(Z)-1,2-DICHLOROETHENE: *see 1,2-Dichloroethylene.*

(Z)-1,2-DICHLOROETHYLENE: *see 1,2-Dichloroethylene.*

ZINC CHROMATE: *see Chromium.*

ZINC PHOSPHIDE CAS 1314-84-7; **molecular weight** 258.09:

SYNONYMS: Trizinc diphosphide, Wuelmaustod arviteol.

TRADE NAMES: Phosvin, Delusal, Wuelmaus-koeder.

DESCRIPTION: Zinc phosphide is a nonflammable dark grey crystal or powder. In water it sinks and slowly decomposes. It has a faint odor. There is moderate **bioaccumulation**.[1]

USES AND SOURCES: Zinc phosphide is used as a rat and field mouse **pesticide** and as a medicine.[1]

See "More About Pesticides".

HARMFUL EFFECTS AND SYMPTOMS: Routes of harmful exposure to zinc phosphide include ingestion, inhalation, and skin absorption. Symptoms of **acute** exposure include eye, skin, mucous membrane and respiratory irritation, intense thirst, nausea, vomiting, diarrhea, lowered blood pressure, difficulty in breathing, paralysis, convulsions, and loss of consciousness. Symptoms of **chronic** exposure to low concentrations of zinc phosphide include visual, speech, and motor disturbances, anemia, bronchitus, central nervous system depression, **pulmonary edema**, and gastro-intestinal problems.[1] Zinc phosphide is considered to be of high **toxicity** (3).[5]

The effect of zinc phosphide in low concentrations on aquatic life is unknown.[1]

EXPOSURE LIMITS:

WATER: Recommended drinking water limit 5 **ppm.**[1]

See "More About Exposure Limits."

ZITHIOL (trade name): *see Malathion.*

ZYTOX (trade name): *see Methyl bromide.*

More About Exposure Limits

Setting **exposure** limits is complicated and requires risk assessment.

Risk assessment is the process of interpreting and quantifying available data to determine how toxic a chemical is, how likely individuals are to come in contact with the chemical, the probability that an adverse effect will result, and the **uncertainties** involved in the process. Other modifying considerations include economics, environmental health, environmental protection, and **aesthetics**.

Information about toxic chemicals concerning human health, concentration in the environment, and environmental impact is incomplete. Coordination in collecting information is often inadequate. For example, a National Academy of Sciences (NAS) committee evaluated a random sample of commercial chemicals to determine the adequacy of the testing done to measure possible human toxicity. No information could be found on possible human health impacts for seventy percent of the substances they reviewed. For another sixteen percent, there was some information, but it was less than the amount needed for even a partial hazard assessment. Also, little is known about the interaction of chemicals (their possible **synergistic** effects). In addition, less information is available on environmental **hazards** and effects of exposure on wildlife than is available on human health risks. No system has been established to coordinate and use the data generated within the various monitoring and research programs in the United States, let alone the data produced by other countries. Thus, not all current information is being used by all agencies involved in toxic pollutant control.

There are two avenues of gathering data on human health risks. One is **epidemiological** studies and the other is animal laboratory testing. Epidemiological studies can provide the most direct evidence that a chemical poses a **risk** to humans. Such evidence, however, is frequently not available because studies have not been done. Furthermore, interpretation of epidemiological studies is difficult because of the lack of controlled environment, the many factors involved, and in the research of cancer and other **chronic** diseases, a long waiting period. The other alternative is to do laboratory animal experiments and interpret them to find data meaningful for human exposures.

There is disagreement about the relevance of animal data to human exposures. Different animal species react differently to the same chemical. Large doses of chemicals, larger sometimes by several orders of magnitude than any possible estimated human exposure, are given to animals with limited life spans, with the results interpreted to approximate human lifespans and low doses. In the field of cancer research, it is widely accepted that if a chemical is **carcinogenic** in animals, it is a potential cancer risk to humans. However, it is debated whether accurate dose-response levels for humans can be quantified by **extrapolation** from animal data.

The end product of risk assessment is the numerical exposure limit. Risk assessment is not an exact science. Many estimates go into the setting of exposure limits. Critics argue that exposure limits based on risk assessment are very conservative, resulting in cleanup actions that are unnecessary and expensive. Others disagree. However, as imperfect as it is, risk assessment remains the only method available to determine exposure limits.

More About Pesticides

A pesticide is a substance consisting of one or more chemicals designed to kill, repel, or otherwise control unwanted organisms. Pesticides include insecticides, herbicides, algaecides, rodenticides, slimicides, and fungicides. Some chemicals may be used as a pesticide as well as for other domestic or industrial purposes.

Pesticide use is of concern because of the possibility of exposure, the lack of sufficient information for some pesticides about possible human effects and their concentration in the environment, environmental impacts, and the difficulty in gaining access to information about specific pesticide formulations.

Current pesticide production in the United States amounts to 2.7 billion pounds annually. Three quarters of the use of pesticides in this country goes to agriculture. One quarter goes to non-farm use including weed and pest control by households, government, and commercial institutions. Of the volume used in agriculture 85 percent of the herbicides and 70 percent of the insecticides in 1981 were used on 4 crops: corn, cotton, soybeans, and wheat.

Sources of pesticide exposure for humans and routes of entry into the environment by pesticides are extensive. Sources include occupational exposure (such as agriculture, wood treatment plants, and shipyards), diet (such as treated fruits, vegetables, grains, and the meat, milk, and milk products of animals who consume treated feed) and residential/recreational exposure (home use, right-of-ways, parks, school grounds, and timberlands). Routes of entry into the environment include normal use, improper disposal of empty containers, the rinsing of equipment, and by spills occurring at any stage of their use. Seriousness of any of these exposures for humans and life systems in the environment are dependent on factors such as the specific chemical's **persistence, bioaccumulation**, interaction with other chemicals (possible **synergistic** effects), and **toxicity**.

There is a similar lack of information and coordination in gathering information about pesticides as there is about chemicals in general noted in the section "More About Exposure Limits".

Pesticide registrations and exposures may involve more chemicals than are registered or listed on the label. Pesticides are made up of **active** and **inert** ingredients. The labels list only active ingredients, that is, the chemicals being used to have the intended control of the pest. Registration of a pesticide is only concerned with the test results of the active ingredient(s). The inert ingredients are the chemicals in pesticides for other purposes, including **emulsifiers, anti-evaporative agents**, diluting agents, and possibly contaminants. A pesticide may be almost entirely inert ingredients. Herbicides are often around 50 percent inert, and insecticides are often more than 50 percent inert. Twelve hundred chemicals are registered as inert in 4,500 pesticide makeups. Of the twelve hundred, 55 (including chemicals in this manual such as formaldehyde, pentachlorophenol, toluene, and carbon tetrachloride) are thought toxicologically significant because they have been shown to have human health consequences such as cancer, nerve damage, other **chronic** effects, or adverse reproductive effects. Oils, such as kerosene and diesel, are common carriers for oil soluble pesticides, and constitute additional chemical exposures.

Glossary

Absorbtion *See "adsorbtion."*

Accumulative poison An accumulative poison is a chemical to which frequent exposures have additive effects.

ACGIH ACGIH is the acronym for "The American Conference of Governmental Industrial Hygienists", a private organization which sets exposure limits.

Active ingredient Active ingredient is the chemical in a pesticide intended for pesticide control. This chemical's name must appear on the label. *See "inert ingredient".*

Acute effects Acute effects are the effects of exposure to a chemical that have a rapid onset, severe symptoms, and a relatively short course, and/or a single large exposure. *See "intermediate systemic toxicity" and "chronic effects".*

Acute systemic toxicity Acute systemic toxicity consist of the symptoms and effects over the whole body of immediate exposure (less than 14 days) to a chemical.

ADI ADI is the acronym for "Acceptable Daily Intake", the amount of a chemical that an individual can consume without adverse effects.

Adsorption Adsorption is the process of attracting and holding other substances or particles to a surface ("absorbtion" is the penetration of one substance into another). The process of adsorption often refers to how much soil, sediment, and organic matter attracts and holds specific chemicals. When chemicals adsorb to soil, sediment, or organic matter, they do not flow as freely into groundwater, or disperse as widely in surface water. ("Sorption" may be either absorbtion or adsorbtion, or both. This term is often used when the specific mechanism is not known.)

Aerobic Aerobic means in the presence of air or oxygen.

Aesthetics Aesthetics is a desirable appearance or sensation.

Alkalinity Alkalinity is an expression related to pH value. Neutral solutions have a pH of 7. This pH value increases with greater alkalinity and decreases with greater acidity. The more acidic or alkaline a solution is, the more "corrosive" it may be. Also, the more alkaline a substance is, the more resistent it is to something that is acidic. *See "pH."*

Anaerobic Anaerobic means a chemical reaction or micro-organism that does not require the presence of air or oxygen.

Anti-evaporative agent An anti-evaporative agent is a chemical used in a pesticide to slow down its evaporation from the surface on which the pesticide is applied.

Anuria Anuria means the failure of the kidneys to excrete urine.

ARC ARC is the acronym for "Anticipated Residue Contribution". This value is computed for chemicals used on food crops. It is assumed that residues are present at legal tolerance levels, and take into account percentage of crop treated and the effect of cooking and processing, where possible and when tests have been completed.

Area background Area background means the concentrations of chemicals that are consistently present in the environment in the vicinity of a site which are the result of human activities unrelated to releases from that site.

Atomic weight Atomic weight is the number representing the weight of one atom of an element.

Bioaccumulation Bioaccumulation is the characteristic of a substance to accumulate in the tissue of an organism due to slower excretion than intake, inability to metabolize it, or preference towards storage. Chemicals tend to become concentrated within organisms that eat high on the food chain, since bioaccumulation may occur in any or all of the lower links in the chain. Any chemical that is fat soluble is liable to be stored in the fat of the body rather than processed. Chemicals that are water soluble tend to be excreted in the urine, in expelled air through the lungs, and/or through the skin as sweat. If the liver and kidneys have to break them down into more harmless compounds, there may be a backlog of chemicals which must be processed. Storage in the liver and kidneys, as well as other organs may occur.

Bioconcentration Mathematically, bioconcentration is the ratio of the concentration of a chemical in an organism's tissues to the concentration of the chemical in some part of the environment. *See "bioaccumulation".*

Biomagnification Biomagnification is a chemical's ability to concentrate through levels of a food chain. For example plants may take up and concentrate a pesticide, which is further concentrated by animals grazing on the plants, which is still further concentrated by a predator or a human that eats the animal's meat. Biomagnification may be measured between different levels of a food chain by comparing tissue levels of a chemical in the different organisms.

Biotransformation Biotransformation means the chemical transformation of compounds foreign to an organism by various enzymes present in that organism.

Blowing Agent A blowing agent is a gas used to form hollow plastic forms. A tube of plastic is formed, air or a gas is introduced to cause the tube to expand into a freeblown hollow object, or against a mold to make an object of definite size and shape.

Carbamate pesticides Carbamate pesticides are a group of pesticides derived from carbamic acid. They are neurotoxic (adversely affect the nervous system), functioning by cholinesterase inhibition.

Carcinogen A carcinogen is any substance that causes the development of cancerous growths in an organism. A chemical can be an initiator or a promoter of cancer. An initiator is a chemical that can cause the initial step in the process of causing cancer. Initiation of cancer is generally thought to involve changes in the genetic material of the affected cells. A promoter is a chemical that, when administered after an initiator has been given, causes cell division, making initiator damage irreversible, and promoting the change of the initiated cell into a cancer.

Cardiac arrhythmias Cardiac arrhythmias are irregular heartbeats.

Cardiovascular system The cardiovascular system is the system of the heart and blood vessels in the body.

Carrier A carrier is a pesticide ingredient that serves as a vehicle for the active ingredient, the chemical designed pest control.

CAS CAS is the acronym for "Chemical Abstract Service", a division of the American Chemical Society, that assigns numbers to chemicals and provides abstracts that summarize chemical research.

Catalyst A catalyst is a substance that initiates a chemical reaction and enables it to proceed under milder conditions than otherwise possible.

CDI CDI is the acronym for "Chronic Daily Dose". *See "ADI".*

Celluloid Celluloid is a tough flammable thermoplastic composed essentially of cellulose nitrate and camphor.

CFC CFC is the acronym for "chlorofluorocarbons", compounds used largely as refrigerants and solvents suspected of contributing to the loss of ozone in the upper atmosphere. "Freon" is a trade name for some common forms of CFCs.

Chloracne Chloracne is a skin condition resembling acne caused by exposure to chlorinated hydrocarbons. It usually occurs on the head and upper body and often lasts for years after initial exposure.

Cholinesterase inhibition Cholinesterase inhibition is a process by which carbamate and organophosphate pesticides affect the body tissues of insects and animals.

Chronic effects Chronic effects are effects in a body due to exposure to a chemical occurring over a period of time from repeated exposures. See "acute effects".

Chronic systemic toxicity Chronic systemic toxicity consists of symptoms and effects over the whole body of long term exposure (more than 365 days) to a chemical.

Circulatory system The circulatory system is the system of the heart and blood vessels in the body.

Coagulation Coagulation means to curdle, to clot, or to thicken into a unified material.

Cocarcinogen A cocarcinogen is a chemical that increases the overall carcinogenic process when it is introduced to the body with a carcinogen.

Cumulative poison A cumulative poison is a chemical to which frequent exposures have additive effects.

Cyanosis Cyanosis means a bluish discoloration of skin due to lack of oxygen.

Data gap A data gap is a lack of information.

Detection limit A detection limit is the smallest discoverable amount of a chemical in a sample.

Developmental toxicity Developmental toxicity is the occurrence of adverse effects on the developing organism that may result from exposure to a chemical prior to conception (either parent), during prenatal development, or postnatally to the time of sexual maturation.

Diluent A diluent is a substance used to reduce the concentration of a chemical.

Dope A dope, as used in this document, is 1) a preparation for giving a desired quality to a substance, like an antiknock added to gasoline, and/or 2) absorbent or adsorbent material used in various manufacturing processes.

DWEL DWEL is the acronym for "Drinking Water Equivalent Level". It is the reference dose (RfD) adjusted for an adult (with a body weight assumed to be 70 kg) consuming 2 liters of water per day.

85th Percentile Concentration 85th percentile concentration is a value used in some reviews of chemicals in EPA's STORET file. It means that 85 percent of the values in the category are less than the value stated.

Elastomer An elastomer is an elastic polymer, that is, "rubber like".

Embryotoxicity Embryotoxicity consists of any toxic effect, including malformations, variations, altered growth, and in-utero death, on the embryo as a result of prenatal exposure to a chemical.

Emulsifiable concentrate A pesticide emulsifiable concentrate consists of two parts: 1) the active chemical, usually in 25 to 50 percent concentration and 2) a carrier which adheres to the chemical as well as to surfaces on which it will be sprayed.

Emulsifier Emulsifiers are substances in small amounts that create stable mixtures of two or more immiscible (substances than cannot usually be uniformly mixed or blended, like oil and water) liquids or powders by holding them in suspension. All emulsions are comprised of a continuous phase and a disperse phase. An example is milk, water is the continuous phase and butterfat (oil) the disperse phase. Emulsifiers are used to mix some pesticides with water.

Endocrine System The endocrine system in the body is a system of glands (such as the thyroid, adrenal, and pituitary) which produce one or more internal secretions (hormones) that, when introduced into the bloodstream, are carried to other parts of the body whose function they regulate and control.

Environmental fate The environmental fate is what will happen to a chemical when it escapes into the environment: how long it will last in its present form, into what other chemicals it will break down, and whether it will bioaccumulate.

Enzyme An enzyme is a protein molecule that acts as a catalyst in living organisms.

EPA EPA is the acronym for the federal "Environmental Protection Agency".

Epidemiology Epidemiology is the science which is concerned with patterns of disease occurrence in human populations and of the factors that influence these patterns.

Equivocal Equivocal means uncertain, undecided, doubtful, or questionable.

Ester An ester is any of a class of organic compounds corresponding to the inorganic salts formed from an acid by the replacement of hydrogen with an alkyl radical. They often have a fragrant odor.

Estuary An estuary is the part of a river that is in contact with the ocean and is mixed with seawater.

Exposure Exposure means coming into contact with a chemical by breathing it, getting it on the skin, or drinking or eating it. *See "hazard", "risk assessment", and "toxicity".*

Extrapolation Extrapolation is the process of estimating (a value, a quantity) on the basis of certain variables already known.

FAO FAO is the acronym for the "Food and Agriculture Organization", an agency of the World Health Organization of the United Nations. Its tasks include carrying out a major program of technical advice and assistance for the agricultural community on behalf of government agencies, collection, analysis, and dissemination of information, and advice to governments on policy and planning. One of its activities is publishing health standards for chemicals.

FDA FDA is the acronym for "Food and Drug Administration".

Fetotoxicity Fetotoxicity consists of any adverse effect, including malformations, variations, altered growth, and in-utero death, on the fetus as a result of prenatal exposure to a chemical.

FIFRA FIFRA is the acronym for the "Federal Insecticide, Fungicide, and Rodenticide Act". Its purpose is to regulate pesticides.

Flux Flux is a substance used to promote fusion, especially of metals or minerals.

Food chain contamination See "bioaccumulation" and "bioconcentration". Food chain contamination consists of the transferring of contaminating chemicals from one organism to another as they are eaten by animals "higher on the food chain", that is by animals that may obtain a significant portion of the diet from some other and then it in turn is consumed by another animal, and so on.

Fumigant A fumigant is a pesticide in the form of vapor. ("Vapor" is an air dispersion of the liquid or solid pesticide.)

Fungicide A fungicide is a substance that controls the growth of fungi.

Genotoxicity Genotoxicity consists of any adverse effect in the genetic material of living organisms as a result of exposure to a chemical.

Granule A granule is a particle that is grainy in texture.

Half-life The half-life is the amount of time that is required for half a substance to decompose or be eliminated.

Hazard Hazard, as used in this document, means 1) likelihood of exposure and 2) the inherent adverse effect that a chemical poses. *See "exposure", "risk assessment", and "toxicity".*

Hazardous waste Hazardous waste means a solid waste, or combination of solid wastes, which because of its quantity, concentration, or physical, chemical, or infectious characteristics may (A) cause, or significantly contribute to an increase in mortality, or an increase in serious irreversible, or incapacitating reversible, illness; or (B) pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported, disposed of, or otherwise managed. The term also has very specific definitions in waste management rules. If such rules, such as the state Dangerous Waste Regulations or the EPA RCRA rules apply, then those must be consulted.

Health Advisory A health advisory is an estimate by the EPA of acceptable drinking water levels for a chemical substance based on health effects information. A health advisory is not a legally enforceable federal standard, but serves as technical guidance to assist federal, state, and local officials. Health advisories are usually applicable to short periods of exposure to a chemical, usually on the order of 1 to 10 days.

Herbicide A herbicide is a pesticide that controls plants.

Hypoxemia Hypoxemia means oxygen deficiency.

IDLH IDLH is the acronym for "Immediately Dangerous to Life and Health", an exposure limit of the maximum concentration of a chemical in the air that is defined as the maximum concentration of a chemical in the air to which 30 minutes or less of exposure would not produce irreversible health effects or would not impair the escape functions of the mind and body.

Immobile To be immobile means a lack of potential for a chemical to migrate from its source. A chemical's immobility is determined by environmental factors, such as soil type, as well as physical and chemical characteristics of the chemical itself.

Immune system toxicity Immune system toxicity is the occurrence of adverse effects on the immune system in the body that may result from exposure to chemicals. This toxicity may result in greater susceptibility to infection.

Indemnity Indemnity means compensation for damage, loss, or injury.

Inert ingredient The inert ingredient is the chemical in pesticides not intended to control the pest, including contaminants, emulsifiers, and anti-evaporative agents. *See "active ingredient".*

Insecticide An insecticide is a pesticide that controls insects.

Intermediate systemic toxicity Intermediate systemic toxicity consists of symptoms and effects over the whole body of longer term exposure (more than 14, less than 365 days) to a chemical.

Ion An ion is an atom or radical (group of atoms) that has acquired an electrical charge.

Isomer Isomers are compounds with the same elemental composition but differ in the way the elements are connected or arranged in space. These structural differences can produce different chemical and physical properties.

LD50 LD50 is the abbreviation for the dose of a substance required to cause death for half the exposed subjects. Thus, it is a measure of toxicity.

Leaching Leaching is the seeping of chemicals through soil or other substance, during which substances may be dissolved and carried along with the liquid (leachate).

Lethality Lethality means causing death.

Long-Term Exposure Greater than 14 days.

LOAEL LOAEL is the acronym for "Lowest Observed Adverse Effect Level", a measurement based on acceptably designed human or animal studies.

Lymphatic system The lymphatic system in mammals is the system of organs, spaces, vessels, the fluid called lymph, and the white blood cells called lymphocytes, that act to remove bacteria and certain proteins from the tissues, and transport fat from the intestines. It is a part of the immune system of the body, which protects it from disease.

MCL MCL is the acronym for "maximum contaminant level", the maximum concentration of a chemical established by either the Washington State Board of Health or the U.S. EPA.

Metabolism Metabolism, in this document, means biotransformation, the chemical transformation of compounds foreign to an organism by various enzymes present in that organism.

Metabolite Any substance produced by or taking part in metabolization.

Metabolization Metabolization, in this document, means the transformation of compounds in an organism by various enzymes.

Microbial degradation Microbial degradation is the breakdown of chemicals into simpler compounds by microbes.

Mobility Mobility is the potential for a chemical to migrate from its source. A chemical's mobility is determined by environmental factors, such as soil type, as well as physical and chemical characteristics of the chemical itself such as solubility in water.

Molecular weight The molecular weight is the number representing the weight of one molecule of an element.

MPI MPI is the acronym for "maximum permitted intake".

MRLs An estimate of daily human exposure to a chemical that is likely to be without an appreciable risk of deleterious effects (noncancerous) over a specified duration of exposure.

Mutagen A mutagen is a chemical that causes mutations, that is, changes in the genetic structure of the organism. Mutagenicity is widely recognized as a property that indicates a substance is carcinogenic. Carcinogenic substances are not always mutagenic, however.

Narcotic Narcotic, in this document, means the quality of dulling and numbing the senses.

NAS NAS is the acronym for the "National Academy of Sciences". It is a private, honorary organization dedicated to the furtherance of science and engineering. It was founded by an act of Congress to serve as official adviser to the federal government on scientific and technical matters.

Natural background Natural background means the concentrations of chemicals present in the environment which have not been influenced by localized human activities.

Nematode A nematode is a certain kind of worm.

Neurotoxicity Neurotoxicity is the occurrence of adverse effects on the nervous system following exposure to a chemical.

NIOSH NIOSH is the acronym for the "National Institute of Occupational Safety and Health". NIOSH is concerned with determining the chronic toxicity of chemicals.

NOAEL NOAEL is the acronym for "No Observed Adverse Effect Level", the dose of a chemical at which there are no statistically or biologically significant increases in frequency or severity of adverse effects seen between the exposed population and its appropriate control (a similar population that has not been exposed). Effects may be produced at this dose, but they are not considered to be adverse.

Nonpoint sources Nonpoint sources are pollution sources that do not discharge through pipes or other structural conveyances. Examples of nonpoint sources include seepage, stormwater runoff form agricultural lands and urban streets, septic systems, and atmospheric deposition (such as "fugitive" emissions—that is "uncontrolled"—from a factory).

NRC NRC is the acronym for "National Research Council", a subgroup of the National Academy of Sciences. *See "NAS".*

Odor threshold The odor threshold is the lowest concentration of a chemical in the air that is detectable by the sense of smell (there can be a wide variance in the odor threshold amongst people).

Oncogenicity Oncogenicity is a synonym for carcinogenicity.

Organic chemicals Organic chemicals are chemicals that contain carbon bonded to hydrogen.

Organochlorine An organochlorine compound is a type of molecule made up of linked carbon atoms which in turn are linked to chlorine atoms.

Organophosphate An organophosphate compound contains a core consisting of a phosphorus atom bonded to either an oxygen or sulfur atom. A variety of organic side groups may be linked to the central phosphorus atom. Organophosphate compounds are structurally diverse. They are all neurotoxins which cause their major effects by cholinesterase inhibition. Organophosphate pesticides are among the most toxic currently used for pest control. Dangerous amounts may be absorbed through the skin.

OSHA OSHA is the acronym for the "Occupational Safety and Health Administration". It is the organization assigned the responsibility by the Occupational Safety and Health Act to protect health and safety in industrial environments. OSHA sets up standards and establishes reporting and monitoring requirements for toxic chemicals.

PADI PADI is the acronym for "Provisional Acceptable Daily Intake", the amount of a chemical that an individual can consume without adverse effects.

PEL PEL is the acronym for "Permissible Exposure Limit", the maximal allowable concentration of a chemical for workplace air. PELs dictate the average concentration to which a person may be exposed over any 8-hour workshift. Exposure may range above these limits (but not above "ceiling" and "excursion" limits) as long as it drops below the PEL at other times, so that a person's average exposure is the PEL or less.

Percolation Percolation means to drain or flow through.

Peripheral nervous system The peripheral nervous system in mammals is the part of the nervous system consisting of the cranial nerves, the spinal nerves, and the sympathetic nervous system.

Persistency Persistency is the tendency of a chemical to remain in an unchanged form in a specific part of the environment. Persistency is a function of the chemical's physical and chemical properties, as well as geological and biological qualities of the specific environment in which they are found.

Pesticide A pesticide is a chemical designed to kill, repel, or otherwise control unwanted organisms. Pesticides include insecticides, herbicides, algicides, rodenticides, slimicides, and fungicides.

pH pH is a measure of the acidity and/or alkalinity of a solution. Neutral solutions have a pH of 7. This value increases with greater alkalinity and decreases with greater acidity. Mathematically, pH is the negative logarithm of the hydrogen ion concentration in water. *See "alkalinity."*

Photodegradation Photodegradation is breakdown due to light. *See "photolysis."*

Photolysis Photolysis is the breakdown of chemicals into simpler compounds due to reaction to light. For example, with the use of catalysts, water can be broken into its formation elements of hydrogen and water using sunlight for energy. Pesticides or other organic substances can degrade by sunlight.

Pica Pica means a craving for unnatural foods, like earth or ashes or paint chips.

Point sources Point sources are sources of pollution which use a pipe or some other structural conveyance to discharge waste.

Polymer A polymer is a compound of high molecular weight with up to millions of repeated linked units of relatively simple light molecules.

Polymerize To polymerize means to form compounds of high molecular weight with up to millions of repeated linked units of relatively simple light molecules.

PPB PPB means parts per billion.

PPM PPM means parts per million.

PPT PPT means parts per trillion (some may use it for "parts per thousand" however).

Pulmonary edema Pulmonary edema means accumulation of fluid in the lungs, which causes swelling.

Preemergence pesticide A preemergence pesticide is one used before the plant sprouts.

Reference dose A reference dose (RfD) is an estimate derived from the NOAEL or LOAEL, with an uncertainty of perhaps an order of magnitude (10 times the number too high or 10 times the number too low), of a daily exposure that is likely to be without appreciable risk of damaging health effects in the human population (including sensitive subgroups) over a lifetime. NOAELs or LOAELs are divided by an uncertainty factor to derive RfDs. The uncertainty factor takes into account the quality and relevance of the data used to derive the NOAEL/LOAEL. If, for example, the data is from a high quality epidemiological study on humans, the uncertainty factor will be low, and the RfD will be close to the NOAEL/LOAEL. On the other hand, if the data is from a low quality laboratory study done on rodents, the uncertainty factor will be high, and the RfD will be decreased far below the NOAEL/LOAEL. Because of the uncertainty factor, RfDs are heavily biased towards protecting human health, and are thus less likely to result in exposures that will produce adverse human health effects.

Reproductive toxicity Reproductive toxicity is the occurrence of adverse effects on the reproductive system that may result from exposure of a chemical. The toxicity may be directed to the reproductive organs and/or the related endocrine system. The manifestation of such toxicity may be noted as alterations in sexual behavior, fertility, pregnancy outcomes, or modifications in other functions that are dependent on the integrity of this system.

Residue tolerance A residue tolerance is a derived value based on residue levels, toxicity data, food consumption levels, hazard evaluation and scientific judgement. It is the legal maximum concentration of a pesticide in or on a raw agricultural commodity or other human or animal food.

Respirable fraction Respirable fraction means the part of air that finds easy accessibility into the air pockets of the lungs. Generally the fraction measures less than 1 micron in size. (A "micron" is a millionth of a meter. "Industrial dust" is usually considered to be less than 10 microns in size.)

RfD *See "Reference dose."*

Risk assessment Risk assessment is the process of interpreting and quantifying available data to determine how toxic a chemical is, how likely individuals are to come in contact with the chemical, the probability that an adverse effect will result, and the uncertainties involved in the process. A simple, straightforward risk assessment equation might read: Hazard x (multiplied by) Exposure = Risk. *See "hazard", "exposure", and "toxicity". Also, see "More About Exposure Limits."*

Short-Term Exposure Less than or equal to 14 days.

SMCL SMCL is the acronym for "Secondary Maximum Contaminant Level", a measurement set by the EPA. SMCLs are not based on health effects, but upon aesthetic effects.

Sorption *See "Adsorbtion."*

Spreader *See "Wetting agent."*

STEL STEL is the acronym for "Short Term Exposure Limit", the maximal concentration of a chemical to which workers can be exposed for up to 15 minutes continually. No more than four exposures to this limit are allowed per day, and there must be at least 60 minutes between exposure periods.

Surfactant *See "Wetting agent."*

Systemic pesticide A systemic pesticide is one which is absorbed throughout the plant.

Systemic poison A systemic poison is one which affects a system, or systems, in the body.

Synergism Synergism is the action of two or more chemicals to achieve a more than additive effect.

Teratogen A teratogen is an agent that can cause developmental abnormalities (birth defects) in mammals.

Thyroid gland The thyroid gland is a large ductless gland lying in front of and on either side of the windpipe that secretes hormones that regulate the body's growth and metabolism.

TLV TLV is the acronym for "Threshold Limit Value", a concentration of a substance to which most workers can be exposed without adverse effect.

TMRC TMRC is the acronym for "Theoretical Maximum Residue Contribution".

Tolerance A tolerance is a derived value based on residue levels, toxicity data, food consumption levels, hazard evaluation and scientific judgement. It is the legal maximum concentration of a pesticide in or on a raw agricultural commodity or other human or animal food.

Toxicity Toxicity consists of the adverse health effects a substance is capable of causing. *See "hazard", "exposure"; and "risk assessment".*

Toxicology Toxicology is the study of the adverse effects of chemicals on living organisms.

Troposphere The troposphere is the layer of atmosphere nearest the earth.

TWA TWA is the acronym for "Time Weighted Average", an allowable exposure concentration averaged over a normal 8 hour workday or 40 hour workweek.

Uncertainty factor (UF) The uncertainty factor is one used in operationally deriving the RfD from experimental data. UFs are intended to account for (1) the variation in sensitivity among the members of the human population, (2) the uncertainty in extrapolating animal data to the case of humans, (3) the uncertainty in extrapolating from data obtained in a study that is of less than lifetime exposure, and (4) the uncertainty in using LOAEL data rather than NOAEL data. Usually each of these factors is set equal to 10, one order of magnitude. The uncertainty factor is derived by multiplying the individual factors together.

Urea A urea is a white crystalline or powdery compound found in mammalian urine and other body fluids, synthesized from ammonia and carbon dioxide, and used as fertilizer, in animal feed, and in the synthesis of plastics and resins.

Urethane Urethane is (1) a white, crystalline compound produced by the action of ammonia on ethyl carbonate or by heating urea nitrate and ethyl alcohol, or (2) any ester of carbamic acid.

USGS USGS is the acronym for "United States Geological Survey".

Vesiculation Vesiculation means full of or bearing small bladderlike cells or cavities.

Volatilization Volatilization is a synonym of evaporation.

Warning agent A warning agent is a chemical with distinctive features mixed in with a chemical that may produce adverse effects at levels undiscernible to an exposed person. A warning agent with a disagreeable odor is added to most natural gas which otherwise could not be detected by smell.

Wettable powder Wettable powder is a form of a pesticide that consists of two parts: 1) the active chemical itself, and 2) a clay carrier that will adhere both to the chemical and to the surface on which it will be sprayed, without becoming too gummy.

Wetting agent A soap-like ingredient that aids or enhances the surface modifying properties of a pesticide formulation. This allows the applied material to adhere better to the plant or organism. Other names: spreader and surfactant.

WHO WHO is the acronym for "World Health Organization", the agency of the United Nations responsible for international health matters and public health.

Chemicals Listed by Use or Production

Chemicals involved in manufacture that may not be present in the final product are noted by the word "manufacture".

Ammunition, Rockets, and Fireworks Manufacture

Aluminum
Ammonia
Antimony
Benzene
Cresol
Dimethyl phthalate
Dinitrotoluene
Formaldehyde
Kerosene
Methyl ethyl ketone
N-butyl phthalate
Nitric acid
Nitrogen oxides
Phenol
Phosphorus
Sulfuric acid
Toluene

Automobile Manufacturing

"Vehicle Maintenance" is a related list.

Acetic acid
Asbestos
Cadmium
Hydrochloric acid
Nitric acid
Sulfuric acid
Vinyl chloride
VOCs

Automobile Exhaust

Benzene
Beryllium
Cadmium
Carbon dioxide
Carbon monoxide
Dioxin
Ethylbenzene
Formaldehyde
Lead
Nickel
Nitrogen oxides
Toluene
PAHs
Particulates*
Propylene dichloride
Selenium

*Particulates are of concern because of their physical properties, not their chemical nature. Other chemicals, such as heavy metals, may adhere to their surfaces or they may be a respiratory risk.

Building and Insulating Materials

Asbestos
Tetrachloroethane
Vinyl chloride
CFCs
Dichlorodifluoromethane
Fluorotrichloromethane

Chemical and Plastics Production

Acetic acid
Acetone
Acrolein
Acrylonitrile
Ammonia
Aniline
Antimony
Arsenic
Benzene
Bromoform
1,3-Butadiene
Cadmium
Carbon monoxide
Carbon tetrachloride
Chlorine
Chlorobenzene
Chloroform
Chromium
Cresol
Dibromochloromethane
Dichlorobenzene
Dichlorodifluoromethane
Dichloroethylene
Dichloroethyl ether
2,4-Dimethyl phenol
Dimethyl phthalate
Dinitrotoluene
Dioctyl phthalate
Dioxane
Ethylbenzene

Chemical and Plastics Production (continued)

Ethylene dichloride
Ethylene oxide
Fluorotrichloromethane
Formaldehyde
Hexachlorobenzene
Hexachlorobutadiene
Hydrochloric acid
Hydrogen fluoride
Isophorone
Kerosene
Mercury
Methyl chloride
Methylchloroform
Methylene chloride
Methyl ethyl ketone
Naphthalene
N-butyl phthalate
Nitric acid
Nitrobenzene
Nitrogen oxides
Nitrophenol
Nitrosamines
Ozone
PCBs
Petroleum
Phenol
Phosphorus
Propylene dichloride
Selenium
Sodium hydroxide
Styrene
Sulfuric acid
Tetrachloroethane
Tetrachloroethylene
Toluene
Toluene-2,4-diisocyanate
1,1,2-Trichloroethane
Trichloroethylene
Vinyl chloride
Vinylidene chloride
Xylene

Cigarette Smoke

Acetic acid
Acetone
Ammonia
Aniline
Benzene
Beryllium
Cadmium
Carbon dioxide
Cyanide
2,4-Dimethyl phenol
Ethylbenzene
Formaldehyde
Methyl chloride
Nickel
Nitrosamines
PAHs
Phenol
Toluene
Xylene

Coal and Oil Burning By-Products

Arsenic
Beryllium
Cadmium
Carbon dioxide
Chromium
Cresol
2,4-Dimethyl phenol
Nickel
Nitrogen oxides
PAHs
Particulates*
Sulfur dioxide

*Particulates are of concern because of their physical properties, not their chemical nature. Other chemicals, such as heavy metals, may adhere to their surfaces and become respiratory risks.

Cosmetics, Perfumes, and Lotions Production

Acrolein
Aluminum
Ammonia
Benzene
Chloroform
Dichloroethylene
Dimethyl phthalate
Ethylene dichloride
Formaldehyde
Hydrochloric acid
Hydrogen fluoride
Methylchloroform
Methyl ethyl ketone
N-butyl phthalate
Nitric acid
Nitrobenzene
Nitrosamines
Ozone
Phenol
Selenium
Sodium hydroxide
Sulfuric acid
Toluene
Xylene

Drycleaning

Dichloroethyl ether
Ethylene dichloride
Methylchloroform
Propylene dichloride
Tetrachloroethane
Tetrachloroethylene
1,1,2-Trichloroethane
Trichloroethylene

Electrical Industry

- Chlorobenzene
- PCBs
- 1,2,4-Trichlorobenzene
- 1,1,2-Trichloroethane
- Vinyl chloride

Fertilizers

- Ammonia (manufacture)
- Cadmium (contaminant)
- Nitric acid (manufacture)
- Phenol (manufacture)
- Phosphorus
- Sulfuric acid (manufacture)

Food processing chemicals and contaminants

"Pesticides" is a related list.

- Aluminum
- Arsenic
- Benzene (oil extraction from seeds and nuts)
- 1,3-Butadiene
- Cadmium
- Carbon dioxide
- Dichlorobenzene
- Dichlorodifluoromethane (freezing foods)
- Dichloroethylene (caffeine extraction)
- Ethylene dichloride (caffeine extraction)
- Ethylene oxide
- Formaldehyde
- Hexane
- Methyl bromide
- Methyl chloride
- Nitrogen oxide
- Nitrosamines
- Ozone
- PAHs (contaminant)
- Sulfur dioxide
- Vinyl chloride

Furniture Making

- Acetic acid
- Acetone
- Benzene
- Ethylbenzene
- Ethylene dichloride
- Kerosene
- Methylene chloride
- Methyl ethyl ketone
- Toluene
- Vinyl chloride

Gasoline, Oil, and Fluid Additives and Constituents

- Acrolein
- Arsenic
- Asbestos
- Benzene
- Bromoform
- Cadmium
- Carbon dioxide
- Chlorine
- Ethylbenzene
- Ethylene dibromide
- Ethylene dichloride
- Formaldehyde
- Gasoline
- Hexachlorobutadiene
- Lead
- Naphthalene
- N-butyl phthalate
- Nitrogen oxides
- Nitrosamines
- PAHs
- PCBs
- Sulfur
- Toluene
- Xylene

Glass Manufacture

- Antimony
- Arsenic
- Cadmium
- Formaldehyde
- Hydrogen fluoride
- Selenium

Household Chemicals

Related lists include *"Food Additives and Contaminants"*, *"Paint and Dye Shops"*, *"Pesticides"*, *"Cosmetics, Perfumes, and Lotions"*, and *"Vehicle Maintenance"*.

- Acetic acid
- Acrolein
- Ammonia
- Aniline
- Formaldehyde
- Sodium hydroxide

Illegal Drug Laboratory Hazardous Waste Sites

- Acetic acid
- Acetone
- Aluminum
- Ammonia
- Aniline
- Benzene
- Carbon dioxide
- Carbon tetrachloride
- Chloroform
- Chromium
- Copper sulfate
- Dinitrotoluene
- Dioxane
- Ethylene dichloride
- Formaldehyde
- Hexane
- Kerosene
- Mercury
- Methylene chloride
- Nitric acid
- Nitric acid
- Nitrosamines
- Phosphorus
- Sodium hydroxide
- Toluene
- Xylene

Laboratories

- Acetic acid
- Acetone
- Ammonia
- Arsenic
- Bromoform
- Cadmium
- Carbon tetrachloride
- Chloroform
- Chromium
- Dioxane
- Hydrochloric acid
- Mercury
- Methylene chloride
- Methyl ethyl ketone
- Nitric acid
- Nitrosamines
- Sodium hydroxide
- Sulfuric acid
- Toluene
- Xylene

Lacquers Production

- Antimony
- Dichloroethylene
- Dimethyl phthalate
- Dioxane
- Isophorone
- Tetrachloroethane
- Vinylidene chloride
- Xylene

Metal Manufacturing

- Acetic acid
- Acetone
- Acrolein
- Ammonia
- Antimony
- Arsenic
- Benzene
- Beryllium
- Cadmium
- Carbon monoxide
- Chloroform
- Chromium
- Cresol
- Cyanide
- Hydrochloric acid
- Hydrogen fluoride
- Kerosene
- Lead
- Mercury
- Methylchloroform
- Methylene chloride
- Nickel
- Nitric acid
- Nitrobenzene
- Selenium
- Sodium hydroxide
- Sulfuric acid
- Tetrachloroethylene
- Toluene
- 1,1,2-Trichloroethane
- Trichloroethylene
- Xylene

Military Use

Related lists include *"Ammunition, Rockets, and Fireworks"*, *"Gasoline and Oil Additives"*, *"Solvents"*, and *"Vehicle Maintenance"*.

Acrolein
Dinitrotoluene

Paint and dye shops

Acetone
Aluminum
Aniline
Antimony
Arsenic
Benzene
1,3-Butadiene
Cadmium
Carbon tetrachloride
Chloroform
Dichloroethylene
Dichloroethyl ether
2,4-Dimethyl phenol
Dimethyl phthalate
Dinitrotoluene
Dioxane
Ethylbenzene
Ethylene dichloride
Formaldehyde
Hexachlorobenzene
Methylene chloride
Methyl ethyl ketone
Naphthalene
Nitrobenzene
Nitrophenol
PCBs
Phenol
Selenium
Sulfuric acid
Tetrachloroethylene
Toluene
Trialkyltin compounds
1,2,4-Trichlorobenzene
Trichloroethylene
1,2,4-Trichlorobenzene
Trichloroethylene
Xylene

Pesticides

See the section, *"More about Pesticides."* Systemic pesticides are noted; the residues of these chemicals are distributed throughout the plant.

Acrolein
Acrylonitrile
Alachlor
Aldicarb (systemic)
Aldrin
Ammonia
Aniline (manufacture)
Arsenic
Atrazine*
Benomyl (systemic)
Benzene (manufacture)
Bromacil*
Cadmium
Carbaryl*
Carbofuran
Carbon tetrachloride
Chlordane
Chlorine (manufacture)
Chlorobenzene
Chloroform (manufacture)
Chlorpyrifos*
Chromium
Copper sulfate
Cresol
Cyanide
2,4-D*
DDT
Diazinon*
Dibromochloromethane (manufacture)
Dicamba*
Dichlorobenzene (manufacture)
Dichloroethyl ether
Dichloropropene
Dieldrin
Dioxin
Disulfoton
Diuron*
Endosulfan
Ethion
Ethylbenzene
Ethylene dibromide
Ethylene dichloride
Ethylene oxide
Fenvalerate
Fluorides
Formaldehyde
Gasoline
Glyphosate* (systemic)
Guthion (systemic)
Heptachlor
Hexachlorobenzene
Hexachlorobutadiene
Hexachlorocyclohexane
Hydrogen fluoride
Isophorone
Kerosene
Lindane
Malathion
MCPA
Mercury
Methyl bromide*
Methyl chloride
Methylchloroform
Methylene chloride
Naphthalene
N-butyl phthalate
Nitrophenol
Nitrosamines
PAHs (manufacture)

Pesticides (continued)

Parathion
Pentachlorophenol
Phenol
Phorate
Phosphorus
Prometryn*
Pronamide
Propylene dichloride
Simazine*
Sulfur*
Sulfuryl fluoride*
Systox
Tebuthiuron*
Tetrachloroethane
Tetrachloroethylene
Toluene (manufacture)
Toxaphene
Trialkyltin compounds
Trichloroethylene (manufacture)
1,2,4-Trichlorobenzene
Trichloroethylene
2,4,6-Trichlorophenol
Triclopyr*
Trifluralin
Xylene*
Zinc phosphide

*Most commonly used pesticides in the Northwest.

Petroleum and Coal Tar Refining

Carbon monoxide
Cresol
Gasoline
Hydrochloric acid
Lead
Methyl chloride
Sodium hydroxide
Sulfuric acid
1,1,2-Trichloroethane

Pharmaceutical Preparations

Acetone
Acrolein
Ammonia
Aniline
Antimony
Arsenic
Benzene
Bromoform
Carbon dioxide
Chloroform
Ethylene dichloride
Ethylene oxide
Formaldehyde
Mercury
Methylene chloride
Nitrobenzene
Nitrogen oxides
Phenol
Toluene
Trichloroethylene
Xylene

Photography

Acrolein
Aluminum
Aniline
Cadmium
Carbon tetrachloride
Chromium
Cyanide
Ethylene dichloride
Formaldehyde
Selenium
1,1,2-Trichloroethane

Pottery and Enamels Production

Antimony
Arsenic
Beryllium
Hydrogen fluoride

Printing Industry

Acetic acid
Acetone
Ammonia
Benzene
Cadmium
Carbon tetrachloride
Chloroform
Chromium
Cyanide
Hydrochloric acid
Isophorone
Kerosene
Methylchloroform
Methylene chloride
Methyl ethyl ketone
Nickel
Nitric acid
Ozone
Sodium hydroxide
Sulfuric acid
Tetrachloroethylene
Toluene
Trichloroethylene
Xylene

Propellants

Carbon dioxide
Dibromochloromethane (manufacture)
Dichlorodifluoromethane
Dinitrotoluene
Fluorotrichloromethane
Methylchloroform
Nitrobenzene
Vinyl chloride

Refrigerants

Acrolein
Ammonia
Carbon dioxide
Chloroform (manufacture)
Dibromochloromethane (manufacture)
Dichlorodifluoromethane
Fluorotrichloromethane
Methyl bromide
Methyl chloride
Methylene chloride
Trichloroethylene
Vinyl chloride

Solvents

Acetone
Benzene
Bromoform
Carbon tetrachloride
Chlorobenzene
Chloroform
Cresol
Dichlorobenzene
Dichlorodifluoromethane
Dichloroethylene
Dichloroethyl ether
Dichloropropene
2,4-Dimethyl phenol
Dimethyl phthalate
Dioxane
Ethylbenzene
Ethylene dibromide
Fluorotrichloromethane
Gasoline
Hexachlorobenzene
Hexachlorobutadiene
Hexane
Isophorone
Methylene chloride
Methyl ethyl ketone
Methyl isobutyl ketone
Naphthalene
Nitrosamines
Tetrachloroethane
Tetrachloroethylene
Toluene
1,2,4-Trichlorobenzene
1,1,2-Trichloroethane
Trichloroethylene
Xylene

Textiles Manufacturing

Acetic acid
Acrolein
Acrylonitrile
Ammonia
Aniline
Arsenic
Asbestos
Benzene
Chlorine
Dichloroethyl ether
Ethylene oxide
Formaldehyde
Hydrochloric acid
Hydrogen fluoride
Methylene chloride
Nitric acid
Ozone
Phenol
Sulfuric acid
Tetrachloroethane
Tetrachloroethylene
Toluene
Trialkyltin compounds
Trichloroethylene
2,4,6-Trichlorophenol

Vehicle Maintenance

Related categories include *"Automobile Exhaust"*, *"Gasoline and Oil Additives"*, *"Paint and Dye Shops"*, and *"Solvents"*.

Acetone
Ammonia
Arsenic
Asbestos
Benzene
1,3-Butadiene
Carbon tetrachloride
Chlorobenzene
Chloroform
Chromium
Gasoline
Hydrochloric acid
Hydrogen fluoride
Lead
Mercury
Methylene chloride
Methyl ethyl ketone
Nickel
Nitric acid
Sodium hydroxide
Sulfuric acid
Tetrachloroethylene
Toluene
1,1,2-Trichloroethane
Trichloroethylene
Vinyl chloride
Xylene

Washington Hazardous Waste Clean-up Sites, Commonly Encountered Substances

Arsenic
Benzene
Cadmium
Chromium
Cyanide
Dioxin
Ethylene dibromide
Gasoline
Methane
Methylchloroform
Methylene chloride
PAHs
PCBs
Pentachlorophenol
Petroleum
Phenol
Tetrachloroethane
Tetrachloroethylene
Toluene
Trichloroethylene

Wood and Paper Industries

Ammonia
Arsenic
Carbon monoxide
Carbon tetrachloride
Chlorine
Chloroform
Chromium
Cresol
Dioxin
Formaldehyde
Hydrochloric acid
Hydrogen fluoride
Methylchloroform
Methylene chloride
Methyl ethyl ketone
N-butyl phthalate
Nitric acid
Ozone
Pentachlorophenol
Phenol
Sodium hydroxide
Sulfur dioxide
Sulfuric acid
Tetrachloroethylene
Trialkyltin compounds
1,1,2-Trichloroethane
Trichloroethylene
2,4,6-Trichlorophenol
Vinylidene chloride

Wood Stove Smoke

Carbon monoxide
Nitrous oxides
PAHs
Particulates

Chemicals Listed by CAS Number

50-00-0: see Formaldehyde.

50-29-3: see DDT.

50-32-8: see PAHs.

53-70-3: see PAHs.

56-23-5: see Carbon tetrachloride.

56-24-6: see Trialkyl tin compounds.

56-35-9: see Trialkyl tin compounds.

56-36-0: see Trialkyl tin compounds.

56-38-2: see Parathion.

57-12-5: see Cyanide.

57-74-9: see Chlordane.

58-89-9: see Lindane.

60-57-1: see Dieldrin.

62-53-3: see Aniline.

62-75-9: see Nitrosamines.

63-25-2: see Carbaryl.

64-19-7: see Acetic acid.

67-64-1: see Acetone.

67-66-3: see Chloroform.

71-43-2: see Benzene.

71-55-6: see Methylchloroform.

74-82-8: see Methane.

74-83-9: see Methyl bromide.

74-87-3: see Methyl chloride.

75-01-4: see Vinyl chloride.

75-09-2: see Methylene chloride.

75-21-8: see Ethylene oxide.

75-25-2: see Bromoform.

75-35-4: see Vinylidene chloride.

75-69-4: see Fluorotrichloromethane.

75-71-8: see Dichlorodifluoromethane.

76-44-8: see Heptachlor.

78-59-1: see Isophorone.

78-87-5: see Propylene dichloride.

78-93-3: see Methyl ethyl ketone.

79-00-5: see 1,1,2-Trichloroethane.

79-01-6: see Trichloroethylene.

79-34-5: see Tetrachloroethane.

83-32-9: see PAHs.

84-74-2: see N-butyl phthalate.

85-01-8: see PAHs.

86-50-0: see Guthion.

87-68-3: see Hexachlorobutadiene.

87-86-5: see Pentachlorophenol.

88-06-2: see 2,4,6-Trichlorophenol.

88-75-5: see Nitrophenol.

91-20-3: see Naphthalene.

93-72-1: see Triclopyr.

94-74-6: see MCPA.

94-75-7: see 2,4-D.

95-47-6: see Xylene.

95-48-7: see Cresol.

95-50-1: see 1,2-Dichlorobenzene.

98-95-3: see Nitrobenzene.

100-02-7: see Nitrophenol.

100-41-4: see Ethylbenzene.

100-42-5: see Styrene.

105-67-9: see 2,4-Dimethylphenol.

106-42-3: see Xylene.

106-46-7: see 1,4-Dichlorobenzene.

106-93-4: see Ethylene dibromide.

106-99-0: see 1,3-Butadiene.

107-02-8: see Acrolein.

107-06-2: see Ethylene dichloride.

107-13-1: see Acrylonitrile.

108-10-1: see Methyl isobutyl ketone.

108-38-3: see Xylene.

108-39-4: see Cresol.

108-88-3: see Toluene.

108-90-7: see Chlorobenzene.

108-95-2: see Phenol.
110-54-3: see Hexane.
110-916-91: see PCBs.
110-968-25: see PCBs.
111-44-4: see Dichloroethyl ether.
111-042-82: see PCBs.
111-411-65: see PCBs.
115-29-7: see Endosulfan.
116-06-3: see Aldicarb.
117-81-7: see Dioctyl phthalate.
118-74-1: see Hexachlorobenzene.
120-12-7: see PAHs.
120-82-1: see 1,2,4-Trichlorobenzene.
121-75-5: see Malathion.
122-34-9: see Simazine.
123-91-1: see Dioxane.
124-38-9: see Carbon dioxide.
124-48-1: see Dibromochloromethane.
126-722-96: see PCBs.
127-18-4: see Tetrachloroethylene.
129-00-0: see PAHs.
131-11-3: see Dimethyl phthalate.
143-39-9: see Cyanide.
151-50-8: see Cyanide.
156-59-2: see 1,2-Dichloroethylene.
156-60-5: see 1,2-Dichloroethylene.
193-39-5: see PAHs.
196-44-5: see Cresol.
205-32-8: see PAHs.
206-44-0: see PAHs.
207-08-9: see PAHs.
218-01-9: see PAHs.
298-02-2: see Phorate.
298-04-4: see Disulfoton.
309-00-2: see Aldrin.
314-40-9: see Bromacil.
330-54-1: see Diuron.
333-41-5: see Diazinon.
534-692-19: see PCBs.
540-59-0: see 1,2-Dichloroethylene.
541-73-1: see 1,3-Dichlorobenzene.
542-75-6: see Dichloropropene.
563-12-2: see Ethion.
584-84-9: see Toluene-2,4-diisocyanate.
606-20-2: see 2,6-Dinitrotoluene.
608-73-1: see Hexachlorocyclohexane.
621-64-7: see Nitrosamines.
630-08-0: see Carbon monoxide.
742-99-05: see Aluminum.
994-31-0: see Trialkyl tin compounds.
1067-97-6: see Trialkyl tin compounds.
1071-83-6: see Glyphosate.
1310-73-2: see Sodium hydroxide.
1314-84-7: see Zinc phosphide.
1319-77-3: see Cresol.
1330-20-7: see Xylene.
1332-21-4: see Asbestos.
1563-66-2: see Carbofuran.
1582-09-8: see Trifluralin.
1610-18-0: see Prometon.
1746-01-6: see Dioxin.
1912-24-9: see Atrazine.
1918-00-9: see Dicamba.
1983-10-4: see Trialkyl tin compounds.
2699-79-8: see Sulfuryl fluoride.
2921-88-2: see Chlorpyrifos.
4342-36-3: see Trialkyl tin compounds.
7439-92-1: see Lead.
7439-97-6: see Mercury.
7440-02-0: see Nickel.
7440-36-0: see Antimony.
7440-38-2: see Arsenic.
7440-41-7: see Beryllium.
7440-43-9: see Cadmium.
7440-47-3: see Chromium.
7446-09-5: see Sulfur dioxide.

7647-01-0: see Hydrochloric acid.

7664-39-3: see Hydrogen fluoride.

7664-41-7: see Ammonia.

7664-93-9: see Sulfuric acid.

7697-37-2: see Nitric acid.

7704-34-9: see Sulfur.

7723-14-0: see Phosphorus.

7758-98-7: see Copper sulfate.

7782-49-2: see Selenium.

7782-50-5: see Chlorine.

8001-35-2: see Toxaphene.

8002-05-9: see Petroleum.

8008-20-6: see Kerosene.

8006-61-9: see Gasoline.

8065-48-3: see Systox.

10024-97-2: see Nitrogen oxide.

10028-15-6: see Ozone.

10061-01-5: see Dichloropropene.

10061-02-6: see Dichloropropene.

11091-69-1: see PCBs.

11096-82-5: see PCBs.

11104-28-2: see PCBs.

11141-16-5: see PCBs.

12672-29-6: see PCBs.

12674-11-2: see PCBs.

15972-60-8: see Alachlor.

16984-48-8: see Fluorides.

17804-35-2: see Benomyl.

23950-58-5: see Pronamide.

25321-14-6: see 2,4-Dinitrotoluene.

34014-18-1: see Tebuthiuron.

51630-58-1: see Fenvalerate.

53469-21-9: see PCBs.

Telephone and Address References

Poison Center (Tacoma)	Toll free 1-800-542-6319
Police or other emergency:	911

For further information from the Department of Ecology:

Hazardous Substance Information Education Office
PO Box 47600
Olympia, WA 98504-7600

General inquiries:	1-800-633-7585
Air Program Information Line:	1-800-272-3780
Pesticides:	1-800-858-7378
Radon:	1-800-323-9727
Recycling:	1-800-732-9253
Spill Response, 24 hours a day:	
Northwest Region:	206-649-7000
Southwest Region:	206-753-2353
Central Region:	509-575-2490
Eastern Region:	509-456-2926
Wood smoke:	1-800-523-4636

Other useful sources of information, both government and private, may be obtained through the 2010 Citizen's Guide, available from:

Environment 2010
Washington Department of Ecology
PO Box 47600
Olympia, WA 98504-7600

A non-government local reference:

Washington Toxics Coalition:	206-632-1545

For additional copies of this manual, request Publication No. 92-66 and send $4.00 for each copy to:

Department of Ecology
Cashiering
PO Box 7613
Olympia, WA 98503-7613.

Questions should be directed to the Toxics Cleanup Program, PO Box 47600, Olympia, WA 98504-7600. Please make this in writing so we can easily refer your question to the correct person, but include your phone number so we can call with a response. Thank you.

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