Chemical Fact Sheets

Acetaldehyde, C_2H_4O
CAS No. 75-07-0

WHAT IS ACETALDEHYDE?

Acetaldehyde is a colorless, flammable gas or liquid with a pungent, suffocating odor that is slightly fruity when diluted.

USES

Acetaldehyde is used in the production of a wide range of organic chemicals; in the manufacture of synthetic resins, dyes, paraldehyde, acetic acid, butanol, perfumes, aniline dyes, plastics, synthetic rubber; in silvering mirrors and hardening gelatin fibers; and as a synthetic flavor ingredient useful in all fruits for lift, especially orange, apple, and butter. It is also an intermediate for pesticides and photographic formulations.

SOURCES

Acetaldehyde is a natural product of combustion and photo-oxidation of commonly found hydrocarbons in the atmosphere. It is also photo-chemically produced in surface water. It occurs naturally in certain foods, such as ripe fruits and coffee. Green plants produce Acetaldehyde as they break down food.

Auto exhaust, tobacco smoke, and emissions from power plants using fossil fuels, wood or trash are also sources of Acetaldehyde. Aldehyde emissions from residential woodburning is estimated to be between 14 and 54 gigagrams/year, which is comparable to power plant emissions and between 22 and 84% of all automobile emissions. It is likely that residential wood burning is the major source of primary aldehydes in some areas during winter months. Chlorination can result in the production of Acetaldehyde in water. Most direct releases of acetaldehyde to the environment are to air or to underground sites.

ENVIRONMENTAL LEVELS AND EXPOSURE

Exposure to Acetaldehyde might include:
- Breathing low background levels in the environment.
- Breathing higher levels of contaminated air in the workplace or from auto exhaust or fossil-fuel burning.
- Eating foods that naturally contain Acetaldehyde, such as fruit and coffee.
- Eating or drinking contaminated foods or water.
- Smoking or breathing second hand smoke.

ENVIRONMENTAL FATE AND BEHAVIOUR

- In the air it degrades in a matter of hours by reaction with sunlight and other chemicals.
- If released into water it will rapidly break down or go into the air.
- In a typical river one-half of the total amount breaks down every 3 hours.
- Acetaldehyde can contribute to the formation of photochemical smog when it reacts with other volatile organic carbon substances in air.
- If spilled it will quickly move into the air or into the ground where it will break down.
- Acetaldehyde does not build up in humans. It breaks down mainly to a chemical that is normally present in the human body.
- Acetaldehyde doesn't bind to soil or build up in animals.
- It is broken down by microorganisms in soil and water.
- It can move into groundwater from spills or landfills.

TOXICITY

Effects of Acetaldehyde on human health and the environment depend on the amount of Acetaldehyde present and the length and frequency of exposure. Effects also depend on the health of a person or the condition of the environment when exposure occurs.

- Acetaldehyde is classified as Group 2B: "possibly carcinogenic to humans."
- Breathing Acetaldehyde for short periods of time can irritate the human respiratory system. Effects of exposure include irritation and lung edema (fluid accumulation). Breathing Acetaldehyde may result in death if levels are high enough to cause respiratory paralysis (short-term) or edema (long-term). These effects are not likely to occur at levels of Acetaldehyde that are normally found in the environment.
- Breathing elevated levels of Acetaldehyde for short periods of time can also adversely affect the cardiovascular system.
- Breathing Acetaldehyde does not cause chronic poisoning,
- Symptoms of chronic intoxication resemble those of chronic alcoholism.
- Limited evidence from animal studies shows that acetaldehyde can adversely affect the developing fetus.
- Human health effects associated with breathing or otherwise consuming small amounts of Acetaldehyde over long periods of time are not known

OBJECTIVES AND GUIDELINES

Ambient Air Quality Objectives and Guidelines

Jurisdiction	**Objectives (μg/m^3)**				
	0.5hr	**1hr**	**8hr**	**24hr**	**Annual**
Alberta		90			
Ontario	500			500	
Texas		90			9

Adapted from:
Acetaldehyde OPPT Chemical Fact Sheets. United States Environmental Protection Agency 1994. http://www.epa.gov/docs/chemfact, ChemBank HSDB, IRIS, RTECS toxicity profiles.

Chemical Fact Sheets

Acetone, C_3H_6O
CAS No. 67-64-1

WHAT IS ACETONE?

Acetone is a colorless liquid with a distinct smell and taste. It is also called dimethyl ketone, 2-propanone, and beta-ketopropane.

USES

Acetone is used to make plastic, fibers, drugs, and other chemicals. It is also used to dissolve other substances.

SOURCES

Acetone is a manufactured chemical that is also found naturally in the environment. It occurs naturally in plants, trees, volcanic gases, forest fires, and as a product of the breakdown of body fat. It is present in vehicle exhaust, tobacco smoke, and landfill sites. Industrial processes contribute more acetone to the environment than natural processes.

ENVIRONMENTAL LEVELS AND EXPOSURE

Ambient air concentrations of acetone were not reported in 1997 or 1998 in Alberta.

Exposure to Acetone might include:

- Breathing low background levels in the environment.
- Breathing higher levels of contaminated air in the workplace or from using products that contain acetone (for example, household chemicals, nail polish, and paint).
- Drinking water or eating food containing acetone.
- Touching products containing acetone.
- For children, eating soil at landfills or hazardous waste sites that contain acetone.
- Smoking or breathing secondhand smoke.

ENVIRONMENTAL FATE AND BEHAVIOUR

- A large percentage (97%) of the acetone released during its manufacture or use goes into the air.
- In air, about one-half of the total amount breaks down from sunlight or other chemicals every 22 days.
- It moves from the atmosphere into the water and soil by rain and snow. It also moves quickly from soil and water back to air.

- Acetone doesn't bind to soil or build up in animals.
- It is broken down by microorganisms in soil and water.
- It can move into groundwater from spills or landfills.
- Acetone is broken down in water and soil, but the time required for this to happen varies.

TOXICITY

Effects of acetone on human health and the environment depend on the amount of acetone present and the length and frequency of exposure. Effects also depend on the health of a person or the condition of the environment when exposure occurs.

- If you are exposed to acetone, it goes into your blood which then carries it to all the organs in your body. If it is a small amount, the liver breaks it down to chemicals that are not harmful and uses these chemicals to make energy for normal body functions. Breathing moderate-to-high levels of acetone for short periods of time, however, can cause nose, throat, lung, and eye irritation; headaches; light-headedness; confusion; increased pulse rate; effects on blood; nausea; vomiting; unconsciousness and possibly coma; and shortening of the menstrual cycle in women.
- Swallowing very high levels of acetone can result in unconsciousness and damage to the skin in your mouth. Skin contact can result in irritation and damage to your skin.
- The smell and respiratory irritation or burning eyes that occur from moderate levels are excellent warning signs that can help you avoid breathing damaging levels of acetone.
- Health effects from long-term exposures are known mostly from animal studies. Kidney, liver, and nerve damage, increased birth defects, and lowered ability to reproduce (males only) occurred in animals exposed long-term. It is not known if people would have these same effects.
- The Department of Health and Human Services, the International Agency for Research on Cancer, and the Environmental Protection Agency (EPA) have not classified acetone for carcinogenicity.

OBJECTIVES AND GUIDELINES

Ambient Air Quality Objectives and Guidelines

Jurisdiction	**Guidelines (μg/m^3)**				
	0.5hr	**1hr**	**8hr**	**24hr**	**Annual**
Alberta		5,900			
Texas		5,900			590
Ontario	48,000			11,880	

Adapted from:
Acetone ToxFAQs. Agency for Toxic Substances and Disease Registry. http://www.atsdr.cdc.gov/toxfaq.html.

Chemical Fact Sheets

Acetylene, C_2H_2
CAS No. 74-86-2

WHAT IS ACETYLENE?

Acetylene is a colorless gas with a faint odor of garlic or ether. The smell of it may be unpleasant if phosphine is present as an impurity.

USES

Acetylene is used: as an illuminant; in oxyacetylene welding, cutting and soldering metals, signalling, and precipitating metals. It is also used in the manufacture of Acetaldehyde, Acetic acid, Vinyl chloride, Vinylidene chloride, Vinyl acetate, Acrylates, Acrylonitrile, Acetaldehyde, Perchloroethylene, trichloroethylene, Cyclooctatetrene, 1,4-butanediol, & carbon black; as a fuel for motor boats; a chemical intermediate for Acrylic acid, tetrahydrofuran, chlorinated solvents, & other chemicals; brazing, metallizing, hardening, flame scarfing, and local heating in metallurgy; and in the manufacture of synthetic rubber.

SOURCES

The main sources are due to industrial applications.

ENVIRONMENTAL LEVELS AND EXPOSURE

Exposure to Acetylene might include:
- Breathing low background levels in the environment or where there is smog.
- Breathing higher levels of contaminated air in the workplace or where acetylene is used.

Annual Averages of Ambient Levels of Acetylene in Alberta ($\mu g/m^3$)

Station	1999	2000
Calgary Central	4.7028	5.3530
Edmonton Central	5.0232	6.1559
Edmonton East	2.5234	3.2802

ENVIRONMENTAL FATE AND BEHAVIOUR

- Acetylene in air is broken down by plants and microorganisms.

TOXICITY

Effects of Acetylene on human health and the environment depend on the amount of Acetylene present and the length and frequency of exposure. Effects also depend on the health of a person or the condition of the environment when exposure occurs.

- Breathing high levels of Acetylene can cause reductions in the function of the brain and spinal cord (Central Nervous System), difficulty breathing, headache, suffocation and collapse.
- There is no evidence that repeated exposure to low levels has any effects on health.
- Phosphine in some commercial grades of Acetylene and other impurities must be considered in evaluating cases of exposure to Acetylene.

OBJECTIVES AND GUIDELINES

Ambient Air Quality Objectives and Guidelines

Jurisdiction	**Guidelines (μg/m^3)**				
	0.5hr	**1hr**	**8hr**	**24hr**	**Annual**
Alberta					
Texas	26,620				2,660
Ontario				56,000	

Adapted from:
ChemBank HSDB, IRIS, RTECS toxicity profiles.

Chemical Fact Sheets

Acrolein, C_3H_4O
CAS No. 107-02-8

WHAT IS ACROLEIN?

Acrolein is a colorless or yellowish liquid with an extremely sharp, piercingly disagreeable, extremely acrid, burnt sweet pungent odour.

USES

Acrolein is used in the manufacture of colloidal forms of metals, in making plastics and perfumes, and as a warning agent in methyl chloride refrigerant. It has been used in military poison gas mixtures. It is used as a chemical intermediate, an aquatic herbicide, biocide, slimicide and molluscicide, and as a liquid fuel. Acrolein has received quite a bit of attention as a tissue-fixative in histological work. This property has been utilized for the preservation of red blood cells. In World War I, it was used as a tear gas under the name papite. Use in Alberta as an aquatic herbicide is limited. Acrolein is used to control aquatic vegetation in irrigation canals via direct injection into the water column.

SOURCES

Sales of Acrolein in Alberta for 1998 for aquatic vegetation control was limited to 17,520 kg of active ingredient. Acrolein was not analyzed for in air samples collected at four sites in Alberta in 1999.

ENVIRONMENTAL LEVELS AND EXPOSURE

Ambient air concentrations of Acrolein were not reported in 1997 or 1998 in Alberta.

Exposure to Acrolein might include:
- Breathing or drinking higher levels in air contaminated by releases from emissions and effluent from Acrolein manufacturing plants and facilities using this compound.
- Breathing exhaust gas from combustion processes.
- Contact resulting from direct application to water during use as an aquatic herbicide and slimicide.
- Breathing air that contains Acrolein resulting from reaction of various hydrocarbon pollutants (such as 1,3-butadiene).

ENVIRONMENTAL FATE AND BEHAVIOUR

- In air, about half of the total amount is broken down every 10-13 hours, by chemicals generated in the presence of sunlight.
- When Acrolein breaks down in the air in the presence of sunlight, Carbon dioxide, formaldehyde, and glycoaldehyde are some of the substances produced.
- In the presence of Nitrogen oxides, products include peroxynitrate and Nitric acid.
- Small amounts of Acrolein may be removed from the atmosphere in rain, as evidenced by detection in rainwater samples.

TOXICITY

Effects of Acrolein on human health and the environment depend on the amount of Acrolein present and the length and frequency of exposure. Effects also depend on the health of a person or the condition of the environment when exposure occurs.

- Breathing high levels of Acrolein may lead to irritation of the skin, mucous membranes such as the lining of the mouth and the inside of the nose, and the eyes. It can cause chest tightness and shortness of breath, nausea and vomiting. It may cause asthmatic reactions in asthmatics. If the amount of Acrolein breathed in is great enough, there may be severe damage to the lungs and air passages. If the victim recovers there will be permanent damage.
- Breathing, touching, eating or drinking Acrolein in significant amounts can cause death.

OBJECTIVES AND GUIDELINES

Ambient Air Quality Objectives and Guidelines

Jurisdiction	**Guidelines (µg/m^3)**				
	0.5hr	**1hr**	**8hr**	**24hr**	**Annual**
Alberta					
Texas	2.3				0.23
Ontario	0.24		0.08		

Adapted from:
ChemBank HSDB, IRIS, RTECS toxicity profiles.

Chemical Fact Sheets

Acrylamide, C_3H_5NO
CAS No. 79-06-1

WHAT IS ACRYLAMIDE?

Acrylamide is an odorless solid that exists as flake-like crystals.

USES

The largest users of acrylamide are companies that make polyacrylamide polymers. Companies also use acrylamide to make N-butoxyacrylamide and N-methylolacrylamide. Products such as clarifying agents, adhesives, printing ink emulsion stabilizers, thickening agents for agricultural sprays, and water retention aids can also contain acrylamide.

SOURCES

It does not occur naturally. Most direct releases of acrylamide to the environment are to underground sites or to air.

ENVIRONMENTAL LEVELS AND EXPOSURE

Ambient air concentrations of Acrylamide were not reported in 1997 or 1998 in Alberta.

Exposure to Acrylamide might include:
- Breathing higher levels of contaminated air.
- Eating food contaminated by releases to air, water, land, or groundwater.
- Absorbing it through skin contact.

ENVIRONMENTAL FATE AND BEHAVIOUR

- In air, acrylamide breaks down to other chemicals.
- Acrylamide dissolves when mixed with water.
- Acrylamide doesn’t bind to soil and is not likely to build up in plants or animals.
- It is broken down by microorganisms in soil or water.
- It can move into groundwater from spills or landfills.

TOXICITY

Effects of acrylamide on human health and the environment depend on how much acrylamide is present and the length and frequency of exposure. Effects also depend on the health of a person or the condition of the environment when exposure occurs.

- If you are exposed to acrylamide for short periods of time it can adversely affect your nervous system. Effects range from drowsiness to in-coordination, hallucinations, and confusion. Direct contact with dissolved acrylamide irritates the skin. Acrylamide dust irritates the respiratory system. These effects are not likely to occur at levels of acrylamide that are normally found in the environment.
- Human health effects associated with breathing or otherwise consuming small amounts of acrylamide over long periods of time are not known. Workers repeatedly exposed to acrylamide have developed neurologic symptoms such as abnormal sensation, muscle weakness, and in-coordination. Laboratory studies show that repeat exposure to acrylamide causes similar adverse nervous system effects in animals. Studies show that repeat exposure to acrylamide also causes general toxicity, adverse blood effects, and adverse reproductive effects in animals. Lifetime exposure to small amounts of acrylamide in drinking water causes cancer in animals. Repeat exposure to acrylamide may likewise cause cancer in humans.
- Acrylamide is not likely to cause environmental harm at levels normally found in the environment.

OBJECTIVES AND GUIDELINES

Ambient Air Quality Objectives and Guidelines

Jurisdiction	**Guidelines (μg/m^3)**				
	0.5hr	**1hr**	**8hr**	**24hr**	**Annual**
Alberta					
Texas		0.3			0.03
Ontario	45			15	

Adapted from:
Acrylamide OPPT Chemical Fact Sheets. United States Environmental Protection Agency 1994. http://www.epa.gov/docs/chemfact.

Chemical Fact Sheets

Acrylic acid, $C_3H_4O_2$
CAS No. 79-10-7

WHAT IS ACRYLIC ACID?

Acrylic acid is a colorless, corrosive liquid.

USES

The largest users of Acrylic acid are companies that make acrylic esters and resins, chemicals added to protective surface coatings and adhesives. The fastest growing use of Acrylic acid is in the production of superabsorbent polyacrylic acid polymers. Companies also use acrylic acid to make oil treatment chemicals, detergent intermediates, and water treatment chemicals.

SOURCES

It occurs naturally, being produced by several species of marine algae and in the stomach of sheep. Most direct releases of acrylic acid to the environment are to underground sites or to air.

ENVIRONMENTAL LEVELS AND EXPOSURE

Exposure to Acrylic acid might include:
- Breathing higher levels of contaminated air.
- Eating food contaminated by releases to air, water, land, or groundwater.

ENVIRONMENTAL FATE AND BEHAVIOUR

- In air, Acrylic acid breaks down to other chemicals.
- Acrylic acid evaporates when exposed to air.
- It dissolves when mixed with water.
- It is broken down by microorganisms in soil and water.
- Acrylic acid does not bind well to soil and is not likely to build up in plants or animals.
- It can move into groundwater from spills or landfills.

TOXICITY

Effects of acrylic acid on human health and the environment depend on how much acrylic acid is present and the length and frequency of exposure. Effects also depend on the health of a person or the condition of the environment when exposure occurs.

- Breathing acrylic acid vapors for short periods of time irritates the human respiratory system.
- Touching liquid acrylic acid irritates the skin and eyes.
- Human health effects associated with breathing or otherwise consuming small amounts of acrylic acid over long periods of time are not known. Laboratory studies show that repeat exposure to acrylic acid vapor damages the lining of the nose of animals. The acrylic acid industry has recently completed several animal studies in response to an EPA request for testing. Acrylic acid causes reduced birth weight in pups of animals consuming acrylic acid in drinking water. These studies report no other adverse effects on the reproductive system or on the development of the fetus of animals.
- Acrylic acid by itself is not likely to cause environmental harm at levels normally found in the environment. Acrylic acid can contribute to the formation of photochemical smog when it reacts with other volatile organic carbon substances in air.

OBJECTIVES AND GUIDELINES

Ambient Air Quality Objectives and Guidelines

Jurisdiction	**Guidelines (μg/m^3)**				
	0.5hr	**1hr**	**8hr**	**24hr**	**Annual**
Alberta		60			1.0
Texas			60		6
Ontario					

Adapted from:
Acrylic Acid OPPT Chemical Fact Sheets. United States Environmental Protection Agency 1994. http://www.epa.gov/docs/chemfact.

Chemical Fact Sheets

Acrylonitrile, C_3H_3N
CAS No. 107-13-1

WHAT IS ACRYLONITRILE?

Acrylonitrile (also called AN and vinyl cyanide) is a colorless, flammable liquid. Its vapors may explode when exposed to an open flame.

USES

The largest users of Acrylonitrile are companies that make acrylic and modacrylic fibers. Companies also use AN to make: high impact Acrylonitrile-Butadiene-Styrene (ABS) plastics used in business machines, luggage, and construction material; Styrene-Acrylonitrile (SAN) plastics used in automotive and household goods and in packaging material; Adiponitrile, a chemical used to make nylon; and dyes, drugs, and pesticides.

SOURCES

Acrylonitrile does not occur naturally. Most releases of Acrylonitrile to the environment are to underground sites or to air.

ENVIRONMENTAL LEVELS AND EXPOSURE

Ambient air concentrations of Acrylonitrile were not reported in 1997 or 1998 in Alberta.

Exposure to Acrylonitrile might include:

- Breathing air or eating food contaminated by releases to air, water, land, or groundwater.
- Touching products that contain Acrylonitrile.
- Inhaling smoke from cigarettes or breathing cigarette smoke.

ENVIRONMENTAL FATE AND BEHAVIOUR

- Once in air, Acrylonitrile breaks down to other chemicals.
- Acrylonitrile evaporates from water and soil exposed to air.
- It does not remain in the body due to its breakdown and removal.
- It dissolves when mixed with water.
- Acrylonitrile doesn't bind to soil and is not likely to build up in animals and plants.
- It is broken down by microorganisms in soil and water.
- It can move into groundwater from spills or landfills.

TOXICITY

Effects of Acrylonitrile on human health and the environment depend on the amount of Acrylonitrile present and the length and frequency of exposure. Effects also depend on the health of a person or the condition of the environment when exposure occurs.

- If you breathe Acrylonitrile for short periods of time it adversely affects your nervous system, blood, kidneys, and liver. These effects subside when exposure stops. Nervous system effects of Acrylonitrile range from headaches and dizziness to irritability, rapid heart beat, and death. Symptoms of Acrylonitrile poisoning may occur quickly after exposure or after levels of breakdown products like cyanide build up in the body. Direct contact with Acrylonitrile liquid severely damages the skin. Acrylonitrile liquid or vapor irritates the eyes, the nose, and the throat. These effects are not likely to occur at levels of Acrylonitrile that are normally found in the environment.
- There are several health effects case studies of Acrylonitrile workers. The methods used in these studies limit conclusions that can be made from the results. These studies show that workers repeatedly breathing small amounts of Acrylonitrile over long periods of time may develop cancer. Cancer occurs primarily in the respiratory tract. Laboratory studies show that repeated exposure to Acrylonitrile in air or in drinking water over a lifetime also causes cancer in animals. Studies also show that repeated exposure to Acrylonitrile adversely affects the respiratory and central nervous systems and causes developmental toxicity in laboratory animals.
- Acrylonitrile has moderate toxicity to aquatic life. By itself it is not likely to cause environmental harm at levels normally found in the environment. Acrylonitrile can contribute to the formation of photochemical smog when it reacts with other volatile substances in air.

OBJECTIVES AND GUIDELINES

Ambient Air Quality Objectives and Guidelines

Jurisdiction	**Guidelines (μg/m^3)**				
	0.5hr	**1hr**	**8hr**	**24hr**	**Annual**
Alberta		43			2
Texas		40			4
Ontario	1.8			0.6	

Adapted from:
Acrylonitrile OPPT Chemical Fact Sheets. United States Environmental Protection Agency 1994. http://www.epa.gov/docs/chemfact.

ALUMINUM

The attendees of the 2004 Priority Setting Workshop identified aluminum (Al) as a potential substance of concern. They have requested background information to determine whether an Ambient Air Quality Objective for aluminum should be a priority.

WHAT IS ALUMINUM?

Aluminum (Al) is a very soft, lightweight, silvery-white metal that lacks strength. Aluminum is a naturally occurring element that constitutes approximately 8% of the Earth's surface. Table 1 outlines some of the properties of Al.

Table 1 Properties of Aluminum

Property	Value
Chemical Formula	Al
CAS Registry number	7429-90-5
RTECS number	BD0330000
UN number	UN 1309, UN 9260 UN 1396 Flammable solid
Common Synonyms and Trade names	Aluminum, Alumina fibre, Molten, Aluminum powder, Pyrophoric, Metana Aluminum Bronze Aluminum dehydrated Aluminum flake Aluminum-27Jisc 3108/3110, Noral Aluminum, Pap-1
Molecular Weight (g/mol)	26.98154
Atomic number	13
Physical state (at 298 K, approx. 25ºC)	Solid
Melting Point (ºC)	660.1
Boiling Point (ºC)	2327
Density (g/L) at 101.3 kPa and 25°C	2.702
Specific gravity (water = 1)	4
Solubility in water	Insoluble
Comments	Tin-white or silvery coloured powdered metal, air sensitive, moisture sensitive

USES

Aluminum is often combined with other metals to form aluminum alloys use for aircrafts, cookware and bake ware. Aluminum additives are used in water treatment, food processing of certain types of food (e.g. processed cheese, cakes, and soy-based infant formula may contain aluminum compounds), and a number of consumer products contain Al including; antacids, antiulcer medications, anti-diarrheals, internal analgesics (buffered aspirin), antiperspirants, and some cosmetics.

SOURCES

Aluminum is a reactive element and is not found as a free metal in nature, but most often combines with oxygen, silicone, and fluorine. Aluminum compounds are commonly found in soil, rocks, and clay. Weathering of rocks and soil dust and volcanic activity generate airborne particulates containing aluminum.

Mining, processing of aluminum ores, production of aluminum metal, compounds, and alloys, coal-fired power plants, and incinerators release aluminum into the environment. Emitted aluminum particles are often attached to very small particulate matter. These particles are washed out of the air by rain or settle to the ground, eventually ending up in soil or sediment.

ALUMINUM EMISSIONS AND AMBIENT LEVELS

Average levels of aluminum in Canadian ambient air vary over a wide range. In rural locations, the range is from 0.013 to 1.42 $\mu g\ m^{-3}$. In urban locations, the range is from about 0.17 to 3.6 $\mu g\ m^{-3}$

Table 2 gives the releases to air for Alberta reported to the National Pollutant Release Inventory (NPRI) for 2007.

Table 2 Aluminum releases (dust or fumes) to air in Alberta according to the NPRI for 2007

Location	On-Site Releases to Air (Tonnes)
Sulzer Metco (Canada) Inc, Fort Saskatchewan	0.047
Georgia-Pacific Canada Edmonton Gypsum	0.010
TOTAL	**0.057**

ENVIRONMENTAL EFFECTS

Aluminum compounds are generally insoluble in soil and water unless the pH is acidic. As the pH of soil or water decreases, the solubility of Al increases, thus, increasing its availability for uptake by plants. Increased uptake of Al can result in reduced root and shoot growth. However, aluminum is not known to bioaccumulate up the food chain. One notable exception is the tea plant which can accumulate aluminum in old leaves at a concentration up to 30,000 mg kg^{-1}; whereas, the Al concentration in new leaves can be only 600 mg kg^{-1}. The tea plant is able to grow in very acidic soils where Al is readily available for uptake by the roots.

ALUMINUM EXPOSURE AND HEALTH EFFECTS

Health Canada has calculated that approximately 97% of the normal daily intake of Al for an adult is from food and the remainder is from drinking water; the contribution from ambient air is insignificant (e.g. assuming a daily contribution of 8 mg (average of 7-9 mg d^{-1}) from food, 0.0042 mg (maximum daily intake in Ontario) from air and 0.26 mg (global mean level 0.17 mg L^{-1}, daily intake 1.5 L) from water, an adult would take in about 8.26 mg of aluminum per day). The highest levels of aluminum in foods are found in nuts, some dairy products, and grain-based commodities. Small amounts of Al can enter foods that are cooked using aluminum cookware.

Occupational exposure to Al during mining, processing of aluminum ore, production of materials containing Al compounds, and aluminum welding occurs when workers breathe in aluminum dust particles in workplace air. The most common respiratory effect reported by workers chronically exposed to aluminum dust is pulmonary fibrosis.

Infants and adults who received large doses of aluminum as a treatment for another problem developed bone diseases, which suggests that aluminum may cause skeletal problems. Some people with sensitive skin develop rashes from using aluminum chlorohydrate deodorants.

OTHER JURISDICTIONS

Few jurisdictions currently have ambient air quality objectives for Al.

Table 3 Aluminum air objectives and guidelines in other jurisdictions

Agency	Guideline Description	Air Quality Guideline		
		1 Hour ($\mu g\ m^{-3}$)	24 Hours ($\mu g\ m^{-3}$)	Annual ($\mu g\ m^{-3}$)
Texas	Effects Screening Level	50		5
Ontario	Point of Impingement 30-minute	100		
	Ambient Air Quality Criteria		120	

According to the Texas Commission on Environmental Quality "ESLs are used to evaluate potential for effects to occur as a result of exposure to concentrations of constituents in the air. ESLs are based on data concerning health effects, odor/nuisance potential, and effects on vegetation. They are not ambient air standards. If predicted or measured airborne levels of a constituent **do not exceed** the screening level, adverse health or welfare would not be expected to result. If ambient levels of constituents in air **exceed** the screening level, it does not necessarily indicate a problem, but a more in-depth review is conducted".

Chemical Fact Sheets

Aluminum, Al
CAS No. 7429-90-5

WHAT IS ALUMINUM?

Aluminum is a silver-white, flexible metal.

USES

Aluminum is used in several forms including aluminum nitrate, aluminum oxide, aluminum hydroxide (used in antacids), aluminum chlorohydrate (used in deodorants), and aluminum sulfate (used to treat drinking water). It is used in paints and printing inks, explosives and fireworks, and to produce glass, rubber, and ceramics. Aluminum is an important structural material in the building, canning, automobile, and aviation industries. It is also used in the manufacture of steel, in dental alloys; in testing for gold, arsenic, mercury; and precipitating copper. Fine aluminum powder is used for flashlights in photography. Applications for aluminum also reach to the automobile industry, the jewelry industry, and the building and construction industry.

SOURCES

Aluminum is widely distributed in earth's crust in combination with oxygen, fluorine, silicon and other constituents. Its most important sources from the industrial point of view are bauxite, cryolite, aluminum, corundum and the kaolin minerals. Aluminum does not occur free in nature. Aluminum occurs as $Al(OH)_4^{-1}$ dissolved in seawater at a concentration of 2 µg/l.

ENVIRONMENTAL LEVELS AND EXPOSURE

Ambient air concentrations of Aluminum were not reported in 1997 or 1998 in Alberta.

Exposure to Aluminum might include:

- Breathing aluminum bound to particles in the air.
- Breathing higher levels of aluminum in contaminated workplace air.
- Drinking water with high levels of aluminum near waste sites, manufacturing plants, or areas naturally high in aluminum
- Eating substances containing high levels of aluminum (such as antacids)
- It is present in natural diet, in amounts varying from very low in animal products to relatively high in plants.
- Very little enters your body from aluminum cooking utensils. Use of aluminum saucepans, aluminum-lined cooking utensils and containers may increase the content of aluminum in food.

ENVIRONMENTAL FATE AND BEHAVIOUR

- Aluminum binds to particles in the air.
- Content in urban air is reported up to about 10 ug/m^3; in nonurban areas values lower than 0.5 ug/m^3
- It can dissolve in lakes, streams, and rivers depending on the quality of the water.
- Acid rain may dissolve aluminum from soil and rocks.
- It can be taken up into some plants from soil.

TOXICITY ASSESSMENT

Effects of Aluminum on human health and the environment depend on the amount of Aluminum present and the length and frequency of exposure. Effects also depend on the health of a person or the condition of the environment when exposure occurs.

- If you are exposed low levels of aluminum from food, air, water, or contact with skin it is not thought to harm your health. Aluminum, however, is not a necessary substance for our bodies and too much may be harmful.
- People who are exposed to high levels of aluminum in air may have respiratory problems including coughing and asthma from breathing dust.
- Some studies with high levels in mice and rabbits show that aluminum may harm young animals more because it can cause delays in skeletal and neurologic development.
- Aluminum has been linked to Alzheimer's disease because those patients have high levels of aluminum in their brains. We do not know whether aluminum causes the disease or whether the buildup of aluminum happens to people who already have the disease.
- Infants and adults who received large doses of aluminum as a treatment for another problem developed bone diseases, which suggests that aluminum may cause skeletal problems.
- Some sensitive people develop skin rashes from using aluminum chlorohydrate deodorants.
- There is no evidence that aluminum affects reproduction in people or animals.

OBJECTIVES AND GUIDELINES

Ambient Air Quality Objectives and Guidelines

Jurisdiction	**Guidelines (μg/m^3)**				
	0.5hr	**1hr**	**8hr**	**24hr**	**Annual**
Alberta					
Texas		50			5
Ontario					

Adapted from:
Aluminum TOXFAQs. Agency for Toxic Substances and Disease Registry.
ChemBank HSDB, IRIS, RTECS toxicity profiles.

Chemical Fact Sheets

Ammonia, NH_3
CAS No. 7664-41-7

WHAT IS AMMONIA?

Ammonia is a colorless, corrosive alkaline gas with a very sharp odor. This intensely irritating odor is characteristic of drying urine. The odor is familiar to most people because ammonia is used in smelling salts, household cleaners, and window cleaning products. In water, most of the ammonia changes to ammonium, which is not a gas and does not smell. Ammonia is necessary to animal and human life. The chemical is found in water, soil, and air, and is a source of much-needed nitrogen for plants and animals.

USES

Eighty percent of all man-made ammonia is used as fertilizer. A third of this is applied directly as pure ammonia. The rest is used to make other fertilizers that contain ammonium. Ammonia is also used to manufacture synthetic fibers, plastics, and explosives. Many cleaning products also contain ammonia. Ammonia in solution, at varying concentrations, is used in a variety of products such as liniments and aromatic spirits. Ammonia used in metal treating operations and other applications where a protective atmosphere is required. Dissociated ammonia is used as a convenient source of hydrogen for the hydrogenation of fats and oils. Ammonia can also be used to control fungal growth during warehousing and as a catalyst for synthetic resin production.

SOURCES

Natural sources of ammonia exceed those of man-made sources. However, high local concentrations are usually due to human activities. Most of the ammonia in the environment comes from the natural breakdown of manure and dead plants and animals.

ENVIRONMENTAL LEVELS AND EXPOSURE

Annual Averages of Ambient Levels of Ammonia in Alberta ($\mu g/m^3$)

Station	1997	1998
Fort Saskatchewan	0.835	3.69

Ammonia was only monitored by Alberta Environment at the Fort Saskatchewan station in 1997 and 1998.

Exposure to Ammonia may include:

- Exposure to naturally-occurring low levels of ammonia in air, soil, and water.

- Breathing air or eating food or water contaminated by fertilizers, alkalizers, metal extraction agents and household cleaners.
- Exposure to ammonia-contaminated soil and water at hazardous waste sites.
- Inhalation of high levels of ammonia originating from leaks and spills at production plants, storage facilities, pipelines and shipping vessels, including tank trucks, rail cars, ships and barges.
- Exposure to ranching and chicken-raising operations.

ENVIRONMENTAL FATE AND BEHAVIOUR

- Ammonia readily dissolves in water, in which an equilibrium is formed between ammonia and ammonium. Dissolution increases the pH of water. In wells, rivers, lakes, and wet soils, the ammonium form is most common.
- Airborne ammonia may combine with sulfate ions to create fine particles in the air.
- Precipitation removes ammonia from the atmosphere.
- Aerobic bacteria may convert aqueous ammonia into nitrates, thus causing anoxic conditions in water bodies.
- Ammonia binds strongly to soil, and to sediment particles and colloids in water. Binding increases in water of higher oxygen content.

TOXICITY

- Vapours are extremely irritating and corrosive. Vapours may cause severe burns to the skin, eyes, throat and lungs. Exposure to high levels may be fatal.
- Ingestion of ammonia can cause burns to the mouth, throat and stomach.
- The Department of Health and Human Services (DHHS), the International Agency for Research on Cancer (IARC), and the EPA have not classified ammonia for carcinogenicity

OBJECTIVES AND GUIDELINES

Ambient Air Quality Objectives and Guidelines

Jurisdiction	**Guidelines (μg/m^3)**				
	0.5hr	**1hr**	**8hr**	**24hr**	**Annual**
Alberta		1,400			
Texas		170			17
Ontario	300			100	

Adapted from:
ChemBank HSDB, IRIS, RTECS toxicity profiles.

Chemical Fact Sheets

Antimony, Sb
CAS No. 7440-36-0

WHAT IS ANTIMONY?

Antimony is a silvery-white metal.

USES

Antimony isn't used alone because it breaks easily, but when mixed into alloys, it is used in lead storage batteries, solder, sheet and pipe metal, bearings, castings, and pewter. Antimony oxide is added to textiles and plastics to prevent them from catching fire. It is also used in paints, ceramics, and fireworks, and as enamels for plastics, metal, and glass. Antimony ores are mined and then mixed with other metals to form Antimony alloys or combined with oxygen to form Antimony oxide.

SOURCES

Antimony is a natural element that is found in the earth's crust.

ENVIRONMENTAL LEVELS AND EXPOSURE

Ambient concentrations of Antimony were not reported in 1997 or 1998.

Exposure to Antimony may include:

- Breathing, drinking and eating low levels of it in food, drinking water, and air, because it is a natural substance.
- Breathing air near industries that process or release it, such as smelters, coal-fired plants, and refuse incinerators.
- Breathing, drinking or eating higher levels in contaminated air, water, and soil in areas that have high levels of Antimony.
- Workers in industries that process it or use antimony ore may be exposed to higher levels.

ENVIRONMENTAL FATE AND BEHAVIOUR

- In the air, Antimony is attached to very small particles that may stay in the air for many days.
- Most Antimony ends up in soil, where it binds strongly to particles that contain iron, manganese, or aluminum.
- Antimony is found at low levels in some rivers, lakes, and streams.

TOXICITY

Effects of Antimony on human health and the environment depend on the amount of Antimony present and the length and frequency of exposure. Effects also depend on the health of a person or the condition of the environment when exposure occurs.

- Exposure to Antimony at high levels can result in a variety of adverse health effects. Breathing high levels for a long time can irritate your eyes and lungs and can cause heart and lung problems, stomach pain, diarrhea, vomiting, and stomach ulcers.
- In short-term studies, animals that breathed very high levels of Antimony died. Animals that breathed high levels had lung, heart, liver, and kidney damage. In long-term studies, animals that breathed very low levels of Antimony had eye irritation, hair loss, lung damage, and heart problems. Problems with fertility were also noted. In animal studies, problems with fertility have been seen when rats breathed very high levels of Antimony for a few months.
- Ingesting large doses of Antimony can cause vomiting. We don't know what other effects may be caused by ingesting it. Long-term animal studies have reported liver damage and blood changes when animals ingested antimony. Antimony can irritate the skin if it is left on it.
- Antimony can have beneficial effects when used for medical reasons. It has been used as a medicine to treat people infected with parasites.

OBJECTIVES AND GUIDELINES

Ambient Air Quality Objectives and Guidelines

Jurisdiction	**Guidelines (μg/m^3)**				
	0.5hr	**1hr**	**8hr**	**24hr**	**Annual**
Alberta					
Texas		5			0.5
Ontario	75			25	

Adapted from:
Antimony ToxFAQs. Agency for Toxic Substances and Disease Registry.
http://www.atsdr.cdc.gov/toxfaq.html.

Chemical Fact Sheets

Arsenic, As
CAS No. 7440-38-2

WHAT IS ARSENIC?

Most arsenic compounds have no smell or special taste.

USES

Inorganic arsenic compounds are mainly used to preserve wood. They are also used to make insecticides and weed killers. You can check the labels of treated wood and insecticides to see if they contain arsenic. Copper and lead ores contain small amounts of arsenic.

SOURCES

Arsenic is found in nature at low levels. It is mostly in compounds with oxygen, chlorine, and sulfur. These are called inorganic arsenic compounds. Arsenic in plants and animals combines with carbon and hydrogen. This is called organic arsenic. Organic arsenic is usually less harmful than inorganic arsenic.

ENVIRONMENTAL LEVELS AND EXPOSURE

Ambient air concentrations of Arsenic were not reported in 1997 or 1998 in Alberta.

Exposure to Arsenic may include:

- Breathing sawdust or burning smoke from wood containing arsenic.
- Breathing workplace air.
- Breathing, eating, or drinking contaminated water, soil, or air at waste sites.
- Breathing, eating or drinking contaminated water, soil, or air near areas naturally high in arsenic.

ENVIRONMENTAL FATE AND BEHAVIOUR

- Arsenic doesn't evaporate.
- Most arsenic compounds can dissolve in water.
- It gets into air when contaminated materials are burned.
- It settles from the air to the ground.
- It doesn't break down, but can change from one form to another.
- Fish and shellfish build up organic arsenic in their tissues, but most of the arsenic in fish isn't toxic.

TOXICITY

Effects of Arsenic on human health and the environment depend on the amount of Arsenic present and the length and frequency of exposure. Effects also depend on the health of a person or the condition of the environment when exposure occurs.

- Inorganic arsenic is a human poison. Organic arsenic is less harmful.
- High levels of inorganic arsenic in food or water can be fatal. A high level is 6×10^7 $\mu g/m^3$. Arsenic damages many tissues including nerves, stomach and intestines, and skin.
- Breathing high levels can give you a sore throat and irritated lungs.
- Lower levels of exposure to inorganic arsenic may cause: nausea, vomiting, and diarrhea; decreased production of red and white blood cells; abnormal heart rhythm; blood vessel damage; and a "pins and needles" sensation in the hands and feet.
- Long term exposure to inorganic arsenic may lead to a darkening of the skin and the appearance of small "corns" or "warts" on the palms, soles, and torso.
- Direct skin contact may cause redness and swelling.
- Breathing inorganic arsenic increases the risk of lung cancer. Ingesting inorganic arsenic increases the risk of skin cancer and tumors of the bladder, kidney, liver, and lung.

OBJECTIVES AND GUIDELINES

Ambient Air Quality Objectives and Guidelines

Jurisdiction	**Guidelines ($\mu g/m^3$)**				
	0.5hr	**1hr**	**8hr**	**24hr**	**Annual**
Alberta		0.1			0.01
Texas		0.1			0.01
Ontario	1.0			0.3	

Adapted from:
Arsenic ToxFAQs. Agency for Toxic Substances and Disease Registry.
http://www.atsdr.cdc.gov/toxfaq.html.

Chemical Fact Sheets

Benzene, C_6H_6
CAS No. 71-43-2

WHAT IS BENZENE?

Benzene is a colorless liquid with a sweet odor. It evaporates into the air very quickly and dissolves slightly in water. It is highly flammable and is formed by both natural processes and human activities.

USES

Some industries use benzene to make other chemicals which are used to make plastics, resins, and nylon and synthetic fibers. Benzene is also used to make some types of rubbers, lubricants, dyes, detergents, drugs, and pesticides.

SOURCES

Natural sources of benzene include volcanoes and forest fires. Benzene is also a natural part of crude oil, gasoline, and cigarette smoke.

ENVIRONMENTAL LEVELS AND EXPOSURE

Exposure to Benzene might include:

- Breathing outdoor air, which contains low levels of Benzene from tobacco smoke, automobile service stations, exhaust from motor vehicles, and industrial emissions.
- Breathing indoor air, which generally contains higher levels of Benzene from products that contain it such as glues, paints, furniture wax, and detergents.
- Breathing air around hazardous waste sites or gas stations, which will contain higher levels of Benzene.
- Drinking contaminated water. Leakage from underground storage tanks or from hazardous waste sites containing benzene can result in benzene contamination of well water.
- People working in industries that make or use benzene may be exposed to the highest levels of it.

Annual Averages of Ambient Levels of Benzene in Alberta ($\mu g/m^3$)

Station	1999	2000
Calgary Central	1.6846	1.7507
Edmonton Central	1.6821	1.8302
Edmonton East	1.6017	2.0300

ENVIRONMENTAL FATE AND BEHAVIOUR

- Industrial processes are the main source of Benzene in the environment.
- Benzene can pass into the air from water and soil.
- It reacts with other chemicals in the air and breaks down within a few days.
- Benzene in the air can bind to rain or snow and be carried back down to the ground.
- It breaks down more slowly in water and soil, and can pass through the soil into underground water.
- Benzene does not build up in plants or animals.

TOXICITY

Effects of Benzene on human health and the environment depend on the amount of Benzene present and the length and frequency of exposure. Effects also depend on the health of a person or the condition of the environment when exposure occurs.

- Breathing very high levels of benzene can result in death, while high levels can cause drowsiness, dizziness, rapid heart rate, headaches, tremors, confusion, and unconsciousness. Eating or drinking foods containing high levels of benzene can cause vomiting, irritation of the stomach, dizziness, sleepiness, convulsions, rapid heart rate, and death.
- The major effect of benzene from long-term (365 days or longer) exposure is on the blood. Benzene causes harmful effects on the bone marrow and can cause a decrease in red blood cells leading to anemia. It can also cause excessive bleeding and can affect the immune system, increasing the chance for infection. Some women who breathed high levels of benzene for many months had irregular menstrual periods and a decrease in the size of their ovaries. It is not known whether benzene exposure affects the developing fetus in pregnant women or fertility in men. Animal studies have shown low birth weights, delayed bone formation, and bone marrow damage when pregnant animals breathed benzene.
- The Department of Health and Human Services (DHHS) has determined that benzene is a known human carcinogen. Long-term exposure to high levels of benzene in the air can cause leukemia, cancer of the blood-forming organs.

OBJECTIVES AND GUIDELINES

Ambient Air Quality Objectives and Guidelines

Jurisdiction	**Guidelines (μg/m^3)**				
	0.5hr	**1hr**	**8hr**	**24hr**	**Annual**
Alberta		30			
Texas		170			4.5
Ontario					

Adapted from:

Benzene ToxFAQs. Agency for Toxic Substances and Disease Registry. http://www.atsdr.cdc.gov/toxfaq.html.

Chemical Fact Sheets

Benzo(a)pyrene, $C_{20}H_{12}$
CAS No. 50-32-8

WHAT IS BENZO(A)PYRENE?

Benzo(a)pyrene (BaP) exists as pale yellowish needles from benzene and methanol. The crystals may be monocyclic or orthorhombic. Benzo(a)pyrene has a faint aromatic odor.

USES

There is no commercial production or known use for BaP.

SOURCES

BaP occurs in fossil fuels and is released to the environment as a product of incomplete combustion. Direct relationships have been found between concentrations of BaP and the intensity of motor transport flow.

ENVIRONMENTAL LEVELS AND EXPOSURE

Ambient air concentrations of BaP were not reported in 1997 or 1998 in Alberta.

Ambient airborne concentrations of BaP at suburban sites 11 – 17 km from city centres are approximately similar inside and outside detached residential houses.

Exposure to Benzo(a)pyrene might include:
- Breathing emissions from typical gasoline and diesel engines.
- Drinking hydrocarbon contaminated water
- Touching coal tar, creosote and shake oils containing polyaromatic hydrocarbons.
- Breathing higher levels in air in workplace situations that involve heating organic materials.
- Breathing coke oven emissions.
- Breathing smoke from cigarettes, cigars or marijuana cigarettes.
- Touching various crude oils and fresh or used motor oils
- BaP has also been identified in charcoal-broiled steaks, various processed foods, fruits, vegetables, cereals, roasted coffee, tea and fats (margarine, butter).

ENVIRONMENTAL FATE AND BEHAVIOUR

- If released into air, benzo(a)pyrene is incorporated into particles in the air.
- Particulates in the air that contain BaP are move into water and soil when the particles settle to the ground or are washed out by rain.
- BaP binds strongly to soil.
- BaP is not likely to move from soil into groundwater.
- BaP does not move easily from soil surfaces into air.
- BaP is not broken down easily by microorganisms in the soil.

TOXICITY

Effects of Benzo(a)pyrene on human health and the environment depend on the amount of Benzo(a)pyrene present and the length and frequency of exposure. Effects also depend on the health of a person or the condition of the environment when exposure occurs.

OBJECTIVES AND GUIDELINES

Ambient Air Quality Objectives and Guidelines

Jurisdiction	**Guidelines (μg/m^3)**				
	0.5hr	**1hr**	**8hr**	**24hr**	**Annual**
Alberta					0.0003
Texas		0.03			0.003
Ontario – single source	0.0033			0.0011	
Ontario – all sources					0.0003

Adapted from:
ChemBank HSDB, IRIS, RTECS toxicity profiles.

Chemical Fact Sheets

Beryllium, Be
CAS No. 7440-41-7

WHAT IS BERYLLIUM?

Pure beryllium is a hard, grayish metal. In nature, Beryllium can be found in compounds in mineral rocks, coal, soil, and volcanic dust. Beryllium compounds have no particular smell.

USES

Beryllium is purified for use in electrical parts, machine parts, ceramics, aircraft parts, nuclear weapons, and mirrors.

SOURCES

Beryllium compounds are commercially mined. Beryllium dust gets into air from burning coal and oil. Background levels in air, food, and water are low.

ENVIRONMENTAL LEVELS AND EXPOSURE

Ambient air concentrations of Beryllium were not reported in 1997 or 1998 in Alberta.

Exposure to Beryllium might include:
- Breathing contaminated workplace air (e.g., mining or processing ores, alloy and chemical manufacturing with beryllium, machining or recycling metals containing beryllium).
- Breathing tobacco smoke from leaf high in beryllium.
- Breathing contaminated air or ingesting water or food near industry or hazardous waste sites.

ENVIRONMENTAL FATE AND BEHAVIOUR

- Beryllium dusts settles from air to the soil and water.
- It enters water from rocks and soil, and from industrial waste.
- Some Beryllium compounds dissolve in water, but most settle to the bottom as particles.
- Beryllium particles in ocean water may take a few hundred years to settle to the bottom.
- Most Beryllium in soil doesn't move up to the surface or into the groundwater.
- Fish do not build up beryllium in their bodies from the surrounding water to any great extent.

TOXICITY

Effects of Beryllium on human health and the environment depend on the amount of Beryllium present and the length and frequency of exposure. Effects also depend on the health of a person or the condition of the environment when exposure occurs.

- Beryllium can be harmful if you breathe it. The effects depend on how much you are exposed to and for how long.
- High levels of Beryllium in air cause lung damage and a disease that resembles pneumonia. If you stop breathing Beryllium dust, the lung damage may heal.
- Some people become sensitive to Beryllium. This is called a hypersensitivity or allergy. These individuals develop an inflammatory reaction to low levels of Beryllium. This condition is called chronic Beryllium disease, and can occur long after exposure to small amounts of beryllium. This disease can make you feel weak and tired, and can cause difficulty in breathing.
- Both the short-term, pneumonia-like disease and the chronic Beryllium disease can cause death.
- Swallowing Beryllium has not been reported to cause effects in humans because very little Beryllium can move from the stomach and intestines into the bloodstream.
- Beryllium contact with scraped or cut skin can cause rashes or ulcers.
- The United States Department of Health and Human Services (DHHS) has determined that Beryllium and certain Beryllium compounds may reasonably be anticipated to be carcinogens.

OBJECTIVES AND GUIDELINES

Ambient Air Quality Objectives and Guidelines

Jurisdiction	**Guidelines (μg/m^3)**				
	0.5hr	**1hr**	**8hr**	**24hr**	**Annual**
Alberta					
Texas		0.02			0.002
Ontario	0.03			0.01	

Adapted from:
Beryllium ToxFAQs. Agency for Toxic Substances and Disease Registry.
http://www.atsdr.cdc.gov/toxfaq.html.

Chemical Fact Sheets

Butyric Acid, $C_4H_80_2$
CAS No. 107-92-6

WHAT IS BUTYRIC ACID?

Butyric Acid is a colourless, oily liquid with an unpleasant, rancid or persistant, penetrating, butter-like odour.

USES

Butyric Acid is used as a chemical intermediate for cellulose derivatives in laquers and plastics, in pharmaceuticals emulsifiers and disinfectants, a leather tanning agent for deliming and swelling hides, and as a sweetening agent in gasolines. It is also used in butter, cheese, butterscotch, caramel, fruit and nut flavors, in the manufacture of esters, and in animal feed.

SOURCES

Butyric Acid is both a natural and a commercially produced organic compound. Runoff from fire control or dilution water may be corrosive or toxic and cause pollution.

ENVIRONMENTAL LEVELS AND EXPOSURE

Ambient air concentrations of Butyric acid were not reported in 1997 or 1998 in Alberta.

Exposure to Butyric Acid might include:

- Drinking or eating items contaminated with Butyric Acid from fugitive emissions released during its production and formulation, the effluent of commercial processes, sewage treatment plants, landfills, and in the exhaust of motor vehicles.

ENVIRONMENTAL FATE AND BEHAVIOUR

- If released to soil, it binds somewhat but can still spread.
- It is not expected to move from either moist or dry soil to the air in large amounts through evaporation.
- In air, about one-half of the total amount breaks down every 8 days from reactions with chemicals produced in sunlight.
- It can move from the air into water and soil by rain and snow.
- It is easily mixed with water.

TOXICITY

Effects of Butyric acid on human health and the environment depend on the amount of Butyric acid present and the length and frequency of exposure. Effects also depend on the health of a person or the condition of the environment when exposure occurs.

- Breathing, eating, or touching Butyric Acid may cause severe injury or death.
- Effects of breathing or touching Butyric acid may not occur immediately after you are exposed.
- Irritating, toxic or corrosive gases may be released when Butyric acid is burnt.
- Touching Butyric acid may cause moderate burning, and slight epidermal scaling may follow.

OBJECTIVES AND GUIDELINES

Ambient Air Quality Objectives and Guidelines

Jurisdiction	**Guidelines (μg/m^3)**				
	0.5hr	**1hr**	**8hr**	**24hr**	**Annual**
Alberta					
Texas		3.6			0361
Ontario					

Adapted from:
Butyric Acid ToxFAQs. Agency for Toxic Substances and Disease Registry.
http://www.atsdr.cdc.gov/toxfaq.html.

Chemical Fact Sheets

Cadmium, Cd
CAS No. 7440-43-9

WHAT IS CADMIUM?

It doesn't have a definite taste or odor.

USES

Cadmium does not corrode easily and has many uses. In industry and consumer products, it is used for batteries, pigments, metal coatings, and plastics.

SOURCES

Cadmium is a natural element in the earth's crust. All soils and rocks, including coal and mineral fertilizers, have some cadmium in them. It is usually found as a mineral combined with other elements such as oxygen (cadmium oxide), chlorine (cadmium chloride), or sulfur (cadmium sulfate, cadmium sulfide). Cadmium enters air from mining, industry, and burning coal and household wastes. The cadmium that industry uses is extracted during the production of other metals like zinc, lead, and copper.

ENVIRONMENTAL LEVELS AND EXPOSURE

Ambient air concentrations of Cadmium were not reported in 1997 or 1998 in Alberta.

Exposure to cadmium might include:
- Breathing contaminated workplace air (battery manufacturing, metal soldering or welding)
- Eating foods containing it; low levels in all foods (highest in shellfish, liver, and kidney meats)
- Breathing cadmium in cigarette smoke (doubles the average daily intake)
- Drinking contaminated water
- Breathing contaminated air near the burning of fossil fuels or municipal waste

ENVIRONMENTAL FATE AND BEHAVIOUR

- Cadmium particles in air can travel long distances before falling to the ground or water.
- It enters water and soil from waste disposal and spills or leaks at hazardous waste sites.
- It binds strongly to soil particles.
- Some cadmium dissolves in water.

- It doesn't break down in the environment, but can change forms.
- Fish, plants, and animals take up cadmium from the environment.
- Cadmium stays in the body a very long time and can build up from many years of exposure to low levels.

TOXICITY

Effects of Cadmium on human health and the environment depend on the amount of Cadmium present and the length and frequency of exposure. Effects also depend on the health of a person or the condition of the environment when exposure occurs.

- Breathing high levels of cadmium severely damages the lungs and can cause death.
- Eating food or drinking water with very high levels severely irritates the stomach, leading to vomiting and diarrhea.
- Long term exposure to lower levels of cadmium in air, food, or water leads to a build up of cadmium in the kidneys and possible kidney disease. Other potential long term effects are lung damage and fragile bones.
- Animals given cadmium in food or water show high blood pressure, iron-poor blood, liver disease, and nerve or brain damage. We don't know if humans get any of these diseases from eating or drinking cadmium.
- Skin contact with cadmium is not known to cause health effects in humans or animals.
- The Department of Health and Human Services (DHHS) has determined that cadmium and cadmium compounds may reasonably be anticipated to be carcinogens. This is based on weak evidence of increased lung cancer in humans from breathing cadmium and on strong evidence from animal studies. We do not know if cadmium causes cancer from skin contact or from eating or drinking contaminated food and water.

OBJECTIVES AND GUIDELINES

Ambient Air Quality Objectives and Guidelines

Jurisdiction	**Guidelines (μg/m^3)**				
	0.5hr	**1hr**	**8hr**	**24hr**	**Annual**
Alberta					
Texas		0.1			0.01
Ontario	5			2	

Adapted from:
Cadmium ToxFAQs. Agency for Toxic Substances and Disease Registry.
http://www.atsdr.cdc.gov/toxfaq.html.

Chemical Fact Sheets

Carbon dioxide, CO_2
CAS No. 124-38-9

WHAT IS CARBON DIOXIDE?

Carbon dioxide is a colorless gas or liquid. It can also be present as a solid in the form of white solid snow-like flakes or cubes (dry ice).

USES

Some uses of Carbon dioxide include: along with oxygen, to avoid a reduction of Carbon dioxide tension of blood, as a refrigerant, carbonation of beverages, in sheilded-arc welding, as a respiration stimulant, and in the manufacture of aspirin.

Carbon dioxide is essential to photosynthesis and plant growth. Carbon dioxide absorbed by leaves & water absorbed by roots are converted to simple sugars by sun's energy in plant chlorophyll. It is necessary for respiration cycle of animals.

SOURCES

Carbon dioxide is found in solution in spring water, which is sometimes so charged with gas under pressure that it is effervescent. It is evolved in large quantities from vents and fissures in earth in volcanic regions. Anthropogenic sources include fuel combustion.

ENVIRONMENTAL LEVELS AND EXPOSURE

Ambient air concentrations of Carbon dioxide were not reported in 1997 or 1998 in Alberta.

Exposure to Carbon dioxide might include:

- Breathing low background levels in the environment. Analysis of air in temperate zones of earth show 0.027 to 0.036% (vol/vol) of Carbon dioxide.
- Breathing higher levels of contaminated air in mines, pits with rotting vegetation, grain elevators and ships' holds loaded with agricultural products (onions liberate large amounts of carbon dioxide)

TOXICITY

Effects of Carbon dioxide on human health and the environment depend on the amount of Carbon dioxide present and the length and frequency of exposure. Effects also depend on the health of a person or the condition of the environment when exposure occurs.

- You are exposed to Carbon dioxide on a daily basis. Breathing in Carbon dioxide on a regular basis at levels from 0.5 to 1.5% at 1 atm is well tolerated by normal individuals.
- Breathing Carbon dioxide vapors may cause dizziness or asphyxiation without warning. Vapors from liquefied gas are initially heavier than air and spread along the ground. Contact with gas or liquefied gas may cause burns, severe injury and/or frostbite.
- If you breathe Carbon dioxide at high levels you may suffocate.

OBJECTIVES AND GUIDELINES

Ambient Air Quality Objectives and Guidelines

Jurisdiction	**Guidelines (μg/m^3)**				
	0.5hr	**1hr**	**8hr**	**24hr**	**Annual**
Alberta					
Texas		90,000			9,000
Ontario					

Adapted from:
ChemBank HSDB, IRIS, RTECS toxicity profiles.

Chemical Fact Sheets

Carbon disulfide, CS_2
CAS No. 75-15-0

WHAT IS CARBON DISULFIDE?

Pure Carbon disulfide is a colorless liquid with a pleasant odor that is like the smell of chloroform. The impure Carbon disulfide that is usually used in most industrial processes is a yellowish liquid with an unpleasant odor, like that of rotting radishes. Carbon disulfide evaporates at room temperature, and the vapor is more than twice as heavy as air. It easily explodes in air and also catches fire very easily.

USES

The largest users of Carbon disulfide are chemical companies that make rayon. Companies use smaller amounts of the chemical to make agricultural fumigants, rubber chemicals, and cellulose. Companies also use Carbon disulfide to clean metal surfaces. Olive oil processors use the chemical to extract olive oil.

SOURCES

In nature, small amounts of Carbon disulfide are found in gases released to the earth's surface as, for example, in volcanic eruptions. It occurs naturally mostly due to the action of microorganisms living in sediments found on the sea floor and in marshes. It is found in coastal and ocean waters.

Commercial Carbon disulfide is made by combining carbon and sulfur at very high temperatures. The amount of Carbon disulfide released into the air through natural processes is difficult to judge because it is so small. Most Carbon disulfide in the air and surface water is from manufacturing and processing activities.

ENVIRONMENTAL LEVELS AND EXPOSURE

Ambient air concentrations of Carbon disulphide were not reported in 1997 or 1998 in Alberta.

Exposure to Carbon disulphide might include:
- Breathing higher levels of contaminated air in the workplace at plants that use Carbon disulphide in their manufacturing processes.
- Breathing air, drinking water, or eating foods that contain it.
- Touching soil, water, or other substances that contain carbon disulphide.

ENVIRONMENTAL FATE AND BEHAVIOUR

- In air, it breaks down to other chemicals.
- Carbon disulfide moves easily into air from water or when spilled on soil.
- Carbon disulphide does not bind to soils and is not likely to build up in plants and animals.
- Carbon disulphide does not appear to be taken up in significant amounts by the organisms living in water.

TOXICITY

Effects of Carbon disulphide on human health and the environment depend on the amount of Carbon disulphide present and the length and frequency of exposure. Effects also depend on the health of a person or the condition of the environment when exposure occurs.

- Breathing or otherwise consuming Carbon disulfide for short periods of time adversely affects the human nervous system. Effects range from dizziness and headaches, to blurred vision and agitation, to convulsions, coma, and death. Carbon disulfide vapor also irritates the nose and the throat. Direct skin contact with liquid Carbon Disulfide causes chemical burns. Carbon disulfide can severely damage the eyes. These effects are not likely to occur at levels of Carbon disulfide that are normally found in the environment.
- Breathing or otherwise consuming small amounts of Carbon disulfide over long periods of time can cause potentially permanent damage to the human nervous system. Effects range from tremors and weakness to mental impairment. Carbon disulfide can also damage the human cardiovascular system, resulting in increased blood pressure and coronary heart disease.
- Workers repeatedly exposed to Carbon disulfide have developed gastro-intestinal and immune insufficiency problems. Laboratory studies show that exposure to large amounts of Carbon disulfide during pregnancy adversely affects the developing fetus of animals. Studies also show that repeated exposure to carbon disulfide causes adverse kidney effects in animals.
- Carbon disulfide by itself is not likely to cause environmental harm at levels normally found in the environment. Carbon disulfide can contribute to the formation of photochemical smog when it reacts with other volatile organic substance in air.
- The Department of Health and Human Services (DHHS), the International Agency for Research on Cancer (IARC), and the EPA have not classified Carbon disulfide for carcinogenicity.

OBJECTIVES AND GUIDELINES

Ambient Air Quality Objectives and Guidelines

Jurisdiction	**Guidelines (μg/m³)**				
	0.5hr	**1hr**	**8hr**	**24hr**	**Annual**
Alberta		30			
Texas		30			3
Ontario	330			330	

Adapted from:
Carbon Disulfide OPPT Chemical Fact Sheets. United States Environmental Protection Agency 1994. http://www.epa.gov/docs/chemfact.

Carbon Disulfide ToxFAQs. Agency for Toxic Substances and Disease Registry. http://www.atsdr.cdc.gov/toxfaq.html.

Chemical Fact Sheets

Carbon monoxide, CO
CAS No. 630-08-0

WHAT IS CARBON MONOXIDE?

Carbon monoxide is a colorless, odorless, tasteless gas.

USES

Carbon monoxide is used in metallurgical operations, in the manufacture of metal carbonyls, and in certain processes for petroleum-type products. It is also used in the manufacture of zinc white pigments. Carbon monoxide is increasingly being used on a very large scale for the production of chemical intermediates. It is used in the production of the intermediate syngas, which can be used in making ammonia. Carbon monoxide is used for the synthesis of commodity chemicals and fuels by using syngas as an alternative to petroleum based feedstocks. It is a reducing agent in blast furnaces. A large variety of chemicals, ranging from saturated hydrocarbons to oxygenated compounds (i.e. methanol), are produced using syngas.

SOURCES

Natural sources such as atmospheric oxidation of methane, forest fires, terpene oxidation and the ocean (where microorganisms produce Carbon Monoxide) are responsible for about 90% of atmospheric Carbon Monoxide; human activity produces about 10%.

A small amount of Carbon monoxide is produced normally in the body. The Carbon monoxide produced within the body is sufficient in amount to maintain a Carbon Monoxide hemoglobin saturation of about 0.4 to 0.7 percent. In some persons with blood disease, such as hemolytic anemia, the Carbon Monoxide saturation may reach 6 percent.

Motor vehicles account for about 55 to 60% of global man-made emissions of Carbon monoxide.

Carbon monoxide was not reportable to the NPRI in 2001.

ENVIRONMENTAL LEVELS AND EXPOSURE

Exposure to Carbon monoxide might include:

- Breathing cigarette smoke: cigarette smoke contains over 2% Carbon monoxide, but the average concentration in the smoke that reaches the lungs is about 400 ppm.

- Breathing automobile exhaust: concentrations as high as 30% have been measured in automobile exhaust gas, although 7% is more common.

Annual Averages of Ambient Levels of Carbon Monoxide in Alberta (ppm)

Station	1999	2000
Calgary Central	0.7958	0.6994
Edmonton Central	0.7223	0.7386
Edmonton East	0.3703	0.4029

ENVIRONMENTAL FATE AND BEHAVIOUR

Carbon monoxide is eliminated through the lungs when air free of Carbon monoxide is inhaled.

TOXICITY

Effects of Carbon monoxide on human health and the environment depend on the amount of Carbon monoxide present and the length and frequency of exposure. Effects also depend on the health of a person or the condition of the environment when exposure occurs.

- Chronic exposure to low concentrations may evoke a gradual and cumulative toxicity. Significantly, active cigarette smokers exhibited pronounced elevations of carboxyhemoglobin in blood levels
- When the Carbon Monoxide level in the air exceeds 3%, death occurs almost at once
- The fetus may be extremely susceptible to effects of Carbon monoxide. Infants born to women who have survived short term exposure to a high concentration of the gas while pregnant often display neurological aftereffects.

OBJECTIVES AND GUIDELINES

Ambient Air Quality Objectives and Guidelines

Jurisdiction	**Guidelines (μg/m^3)**				
	0.5hr	**1hr**	**8hr**	**24hr**	**Annual**
Alberta		15,000	6,000		
Texas		40,000	10,000		
Ontario – single source	6,000				
Ontario – multiple sources		36,200	15,700		

Adapted from:
ChemBank HSDB, IRIS, RTECS toxicity profiles.

Chlorine, Cl_2
CAS No. 7782-50-5

WHAT IS CHLORINE?

Chlorine is a greenish-yellow, diatomic gas, with a suffocating, pungent, irritating odor. Contaminants found in chlorine are traces of bromide, hexachloroethane, hexachlorobenzene, and water.

USES

Companies use Chlorine in the manufacture of chlorinated lime (used to bleach fabric), in the manufacture of synthetic rubber and plastics, in the purification of water, for detinning and dezincing iron, and for disinfecting. Chlorine is also used to manufacture many other chemicals, including trichloroethylene and chlorinated hydrocarbons.

Applications of Chlorine include: biofouling control agent in cooling systems, fungicidal agent for foot baths, root canals or tooth extraction, cleaning dairy equipment, the manufacture of pesticides, and disinfection in laundries.

SOURCES

Chlorine is produced on a large scale by electrolysis from fused chlorides. It is also a co-product of metals manufacture.

ENVIRONMENTAL LEVELS AND EXPOSURE

Ambient air concentrations of Chlorine were not reported in 1997 or 1998 in Alberta.

Exposure to Chlorine might include:
- Breathing Chlorine gas during a storage, transportation, or industrial accident involving pressurized liquid Chlorine, during school chemistry experiments, following accidental release of chlorine from swimming pool operations, or while mixing cleaning gases (adding acidic cleaning agents to hypochlorite bleach releases chlorine gases).

ENVIRONMENTAL FATE AND BEHAVIOUR

- Chlorine reacts with organic substances that are found in many source waters to produce a potential carcinogen, chloroform
- Chlorine does not build up in animals.

- Chlorine gas has been found to build up in the leaves of plants.

TOXICITY

Effects of Chlorine on human health and the environment depend on the amount of Chlorine present and the length and frequency of exposure. Effects also depend on the health of a person or the condition of the environment when exposure occurs.

- Chlorine is highly toxic to aquatic life.
- Exposure to Chlorine may be fatal if large amounts are inhaled or absorbed through skin.
- Contact with gas or liquefied gas may cause burns, severe injury and/or frostbite.

OBJECTIVES AND GUIDELINES

Ambient Air Quality Objectives and Guidelines

Jurisdiction	**Guidelines (μg/m^3)**				
	0.5hr	**1hr**	**8hr**	**24hr**	**Annual**
Alberta		15			
Texas		15			1.5
Ontario	30			10	

Adapted from:
ChemBank HSDB, IRIS, RTECS toxicity profiles.

Chemical Fact Sheets

Chlorine dioxide, ClO_2
CAS No. 10049-04-4

WHAT IS CHLORINE DIOXIDE ?

Chlorine dioxide is a yellow to reddish-yellow gas at room temperature, and has an unpleasant odor similar to chlorine and nitric acid.

USES

Uses of Chlorine dioxide is used for bleaching cellulose, flour, leather, oils, textiles, and beeswax. It is also used in the purification, taste and odor control of water. The processes of cleaning and detanning of leather use Chlorine dioxide. It also has applications in the manufacture of chlorine salts; as an oxidizing agent; a bactericide and as an antiseptic. It is used for swimming pool water purification.

ENVIRONMENTAL LEVELS AND EXPOSURE

Ambient air concentrations of Chlorine dioxide were not reported in 1997 or 1998 in Alberta.

ENVIRONMENTAL FATE AND BEHAVIOUR

- It breaks down to other chemicals in open water bodies and reservoirs.
- It can remain for days in clean distribution systems.

TOXICITY

Effects of Chlorine dioxide on human health and the environment depend on the amount of Chlorine dioxide present and the length and frequency of exposure. Effects also depend on the health of a person or the condition of the environment when exposure occurs.

- Breathing Chlorine dioxide for short periods of time can irritate the human eyes respiratory system, and in large amounts can lead to death.
- Chlorine dioxide has a carcinogenicity classification of D: not classifiable as to human carcinogenicity.
- Chlorine dioxide is by itself not likely to cause environmental harm at levels normally found in ambient air.

OBJECTIVES AND GUIDELINES

Ambient Air Quality Objectives and Guidelines

Jurisdiction	**Guidelines ($\mu g/m^3$)**				
	0.5hr	**1hr**	**8hr**	**24hr**	**Annual**
Alberta		2.8			
Texas		3			0.3
Ontario	85			30	

Adapted from:
ChemBank HSDB, IRIS, RTECS toxicity profiles.

Chemical Fact Sheets

Chloroform, $CHCl_3$

CAS No. 67-66-3

WHAT IS CHLOROFORM?

Chloroform is a colorless liquid with a pleasant, nonirritating odor and a slightly sweet taste. It will burn only when it reaches very high temperatures. Other names for chloroform are trichloromethane and methyl trichloride.

USES

In the past, chloroform was used as an inhaled anesthetic during surgery, but it isn't used that way today. Today, chloroform is used to make other chemicals and can also be formed in small amounts when chlorine is added to water.

SOURCES

Sources of chloroform are associated with its manufacture and use.

ENVIRONMENTAL LEVELS AND EXPOSURE

Ambient air concentrations of chloroform were not reported in 1997 or 1998 in Alberta.

Exposure to Chloroform might include:

- Drinking water or beverages made using water containing chloroform
- Breathing indoor or outdoor air containing it, especially in the workplace
- Eating food that contains it
- Skin contact with chloroform or water that contains it, such as in swimming pools

Annual Averages of Ambient Levels of Chloroform in Alberta ($\mu g/m^3$)

Station	1999	2000
Calgary Central	0.1390	0.1340
Edmonton Central	0.1151	0.1382
Edmonton East	0.1052	0.1126

ENVIRONMENTAL FATE AND BEHAVIOUR

- Chloroform evaporates easily into the air.
- Most of the chloroform in air breaks down eventually, but it is a slow process.

- The breakdown products in air include phosgene and hydrogen chloride, which are both toxic.
- It doesn't stick to soil very well and can travel through soil to groundwater.
- Chloroform dissolves easily in water and some of it may break down to other chemicals.
- Chloroform lasts a long time in groundwater.
- Chloroform doesn't appear to build up in great amounts in plants and animals.

TOXICITY

Effects of Chloroform on human health and the environment depend on the amount of Chloroform present and the length and frequency of exposure. Effects also depend on the health of a person or the condition of the environment when exposure occurs.

- Breathing about 900 parts of chloroform per million parts air (900 ppm) for a short time can cause dizziness, fatigue, and headache. Breathing air, eating food, or drinking water containing high levels of chloroform for long periods of time may damage your liver and kidneys. Large amounts of chloroform can cause sores when chloroform touches your skin.
- It isn't known whether chloroform causes reproductive effects or birth defects in people.
- Animal studies have shown that miscarriages occurred in rats and mice that breathed air containing 30–300 ppm chloroform during pregnancy and also in rats that ate chloroform during pregnancy. Offspring of rats and mice that breathed chloroform during pregnancy had birth defects. Abnormal sperm were found in mice that breathed air containing 400 ppm chloroform for a few days.
- The Department of Health and Human Services (DHHS) has determined that chloroform may reasonably be anticipated to be a carcinogen. Rats and mice that ate food or drank water with chloroform developed cancer of the liver and kidneys.

OBJECTIVES ANDGUIDELINES

Ambient Air Quality Objectives and Guidelines

Jurisdiction	**Guidelines (μg/m^3)**				
	0.5hr	**1hr**	**8hr**	**24hr**	**Annual**
Alberta					
Texas		100			10
Ontario	3			1	

Adapted from:
Chloroform ToxFAQs. Agency for Toxic Substances and Disease Registry.
http://www.atsdr.cdc.gov/toxfaq.html.

Chemical Fact Sheets

Chlorpyrifos, $C_9H_{11}Cl_3NO_3PS$

(O,O-diethyl O-(3,5,6-trichloro-2-pyridyl) phosphorothioic acid)

CAS No. 2921-88-2

WHAT IS CHLORPYRIFOS?

Chlorpyrifos is an insecticide that is a white crystal-like solid with a strong odor of sulfur.

USES

Chlorpyrifos is widely used in homes and on farms. In the home, it is used to control cockroaches, fleas, and other structural pests; it is also used in some pet flea and tick collars. On the farm, it is used to control ticks on cattle and as a spray to control crop pests.

SOURCES

- There are no natural sources of Chlorpyrifos to the environment. Chlorpyrifos enters the environment through direct application to crops, lawns, and pets. It may also enter the environment through volatilization, spills, and the disposal of Chlorpyrifos waste.

ENVIRONMENTAL LEVELS AND EXPOSURE

Exposure to Chlorpyrifos may include:

- Inhalation or skin contact during application to control household pests such as fleas or cockroaches.
- Breathing air in a field where Chlorpyrifos was sprayed on crops.

Ambient air concentrations of Chlorpyrifos were not reported in 1997 or 1998 in Alberta.

ENVIRONMENTAL FATE AND BEHAVIOUR

- Chlorpyrifos is moderately persistent in soils. It adsorbs to soil particles and is not readily soluble in water. Leaching to groundwater is of little concern.
- Once in the environment, it is broken down by sunlight, bacteria, or other chemical processes.

TOXICITY

- Chlorpyrifos is an organophosphate insecticide, which disrupts proper functioning of cholinesterase (an enzyme responsible for nerve function).

- Chlorpyrifos is readily absorbed into the bloodstream through the gastrointestinal tract if ingested, through the lungs if inhaled, or through the skin if there is dermal exposure.
- Acute exposure to Chlorpyrifos results in nervous system effects such as headaches, blurred vision, and salivation. It may also result in unstable blood pressure, diarrhea, nausea, and muscle cramps.
- Ingesting very high concentrations of Chlorpyrifos can cause paralysis, seizures, loss of consciousness, and death, while high concentrations can cause dizziness, runny nose, confusion, salivation, and rapid heart rate.

OBJECTIVES AND GUIDELINES

Ambient Air Quality Objectives and Guidelines

Jurisdiction	**Guidelines (μg/m^3)**				
	0.5hr	**1hr**	**8hr**	**24hr**	**Annual**
Alberta					
Texas		2			0.2
Ontario					

Adapted from:
Chlorpyrifos ToxFAQs. Agency for Toxic Substances and Disease Registry.
http://www.atsdr.cdc.gov/toxfaq.html.

Chemical Fact Sheets

Chromium, Cr
CAS No. 7440-47-3

WHAT IS CHROMIUM?

Chromium is a naturally occurring element. Chromium has three main forms chromium(0), chromium(III), and chromium(VI). Chromium(III) compounds are stable and occur naturally, in the environment. Chromium(0) does not occur naturally and chromium (VI) occurs only rarely. Chromium compounds have no taste or odor.

USES

Chromium(III) is an essential nutrient in our diet, but we need only a very small amount. Other forms of chromium are not needed by our bodies. Chromium is used for making steel and other alloys, bricks in furnaces, and dyes and pigments, and for chrome plating, leather tanning, and wood preserving.

SOURCES

Chromium is found naturally in rocks, soil, plants, animals, and in volcanic dust and gases.

ENVIRONMENTAL LEVELS AND EXPOSURE

Ambient air concentrations of Chromium were not reported in 1997 or 1998 in Alberta.

Exposure to Chromium might include:
- Breathing contaminated workplace air (stainless steel welding, chromate or chrome pigment production, chrome plating, leather tanning)
- Handling or breathing sawdust from chromium treated wood
- Breathing contaminated air, or ingesting water, or food from soil near waste sites or industries that use chromium
- Very small amounts of chromium(III) are in everyday foods

ENVIRONMENTAL FATE AND BEHAVIOUR

- Manufacturing, disposal of products or chemicals containing chromium, or burning of fossil fuels release chromium to the air, soil, and water.
- Chromium particles settle from air in less than 10 days.
- Chromium sticks strongly to soil particles.

- Most chromium in water sticks to dirt particles that fall to the bottom; only a small amount dissolves.
- Small amounts move from soil to groundwater.
- Fish don't take up or store chromium in their bodies.

TOXICITY

Effects of Chromium on human health and the environment depend on the amount of Chromium present and the length and frequency of exposure. Effects also depend on the health of a person or the condition of the environment when exposure occurs.

- All forms of chromium can be toxic at high levels, but chromium(VI) is more toxic than chromium(III).
- Breathing very high levels of chromium(VI) in air can damage and irritate your nose, lungs, stomach, and intestines. People who are allergic to chromium may also have asthma attacks after breathing high levels of either chromium(VI) or (III).
- Long term exposures to high or moderate levels of chromium(VI) cause damage to the nose (bleeding, itching, sores) and lungs, and can increase your risk of non-cancer lung diseases.
- Ingesting very large amounts of chromium can cause stomach upsets and ulcers, convulsions, kidney and liver damage, and even death.
- We don't know if chromium harms the fetus or our ability to reproduce. Mice that ingested large amounts of chromium had reproductive problems and offspring with birth defects.
- Skin contact with liquids or solids containing chromium(VI) may lead to skin ulcers. Some people have allergic reactions including severe redness and swelling.
- The Department of Health and Human Services has determined that certain chromium(VI) compounds are known carcinogens. This is based on increased lung cancer in some workers who were exposed to chromium. Animal studies also indicate chromium(VI) is a carcinogen. We do not have enough data to determine if chromium(0) or chromium(III) are carcinogens.

OBJECTIVES AND GUIDELINES

Ambient Air Quality Objectives and Guidelines

Jurisdiction	**Guidelines (μg/m^3)**				
	0.5hr	**1hr**	**8hr**	**24hr**	**Annual**
Alberta		1			
Texas		1			0.1
Ontario (di-, tri-, and hexavalent forms)	5			1.5	

Adapted from:
Chromium ToxFAQs. Agency for Toxic Substances and Disease Registry.
http://www.atsdr.cdc.gov/toxfaq.html.

Cobalt, Co
CAS No. 7440-48-4

WHAT IS COBALT?

Cobalt is a compound that occurs in nature. It occurs in many different chemical forms. Pure cobalt is a steel-gray, shiny, hard metal.

USES

All cobalt used in industry is imported or obtained by recycling scrap metal that contains cobalt. It is used in industry to make alloys (mixtures of metals), colored pigments, and as a drier for paint and porcelain enamel used on steel bathroom fixtures, large appliances, and kitchen wares.

SOURCES

Small amounts of cobalt naturally occur in food. In addition, vitamin B12 is a cobalt-containing compound that is essential for good health.

Some important natural sources of cobalt in the environment are soil, dust, and seawater. Cobalt is also released to the environment from burning coal and oil, and from exhaust from cars and trucks.

ENVIRONMENTAL LEVELS AND EXPOSURE

Ambient air concentrations of Cobalt were not reported in 1997 or 1998 in Alberta.

Exposure to Cobalt might include:
- Breathing and eating or drinking cobalt at low levels in air, water, and food. Everyone is exposed to small amounts of cobalt this way.
- Breathing and eating or drinking cobalt at higher levels near hazardous waste sites containing cobalt, or while working in industries that process cobalt or make products containing it.

ENVIRONMENTAL FATE AND BEHAVIOUR

- Cobalt stays in the air for a few days.
- Pure cobalt does not dissolve in water, but some of its compounds do.
- Cobalt can stay for years in water and soil. It can move from the soil to underground water.

- Cobalt is taken up by plants from the soil.

TOXICITY

Effects of Cobalt on human health and the environment depend on the amount of Cobalt present and the length and frequency of exposure. Effects also depend on the health of a person or the condition of the environment when exposure occurs.

- Cobalt has both beneficial and harmful effects on human health. Cobalt is beneficial because it is part of Vitamin B12. Cobalt has also been used as a treatment for anemia, because it causes red blood cells to be produced.
- Exposure to high levels of cobalt can harm your health. Effects on the lungs, including asthma, pneumonia, and wheezing, have been found in workers who breathed high levels of cobalt in the air.
- In the 1960s, some breweries added cobalt to beer to stabilize the foam. Some people who drank large quantities of the beer experienced nausea, vomiting, and serious effects on the heart. However, effects on the heart were not seen in people with anemia or pregnant women treated with cobalt.
- Animal studies have found problems with the development of the fetus in animals exposed to high concentrations of cobalt during pregnancy. However, cobalt is also essential for the growth and development of certain animals.
- The International Agency for Research on Cancer has determined that cobalt is a possible carcinogen to humans.
- Studies in animals have shown that cobalt causes cancer when placed directly into the muscle or under the skin. Cobalt did not cause cancer in animals that were exposed to it in the air, in food, or in drinking water. Studies on people are inconclusive regarding cobalt and cancer.

OBJECTIVES AND GUIDELINES

Ambient Air Quality Objectives and Guidelines

Jurisdiction	**Guidelines (μg/m^3)**				
	0.5hr	**1hr**	**8hr**	**24hr**	**Annual**
Alberta					
Texas		0.2			0.02
Ontario	0.3			0.1	

Adapted from:
Cobalt ToxFAQs. Agency for Toxic Substances and Disease Registry.
http://www.atsdr.cdc.gov/toxfaq.html.

COBALT

The attendees of the 2004 Priority Setting Workshop identified cobalt (Co) as a potential substance of concern. They have requested background information to determine whether an Ambient Air Quality Objective for cobalt should be a priority.

WHAT IS COBALT?

In its elemental state, cobalt is a brittle, hard, shiny, dark grey metal. Cobalt is the 33rd most common element on the earth, and makes up 0.0025% of the Earth's crust.

Table 1 Properties of cobalt

Property	Value
Chemical Formula	Co
CAS Registry number	7440-48-4
RTECS number	GF8750000
UN number	UN1318
Common Synonyms and Trade Names	Cobalt-59, cobalt metal
Molecular Weight (g mol^{-1})	58.93
Melting Point (˚C)	1495
Boiling Point (˚C)	2870
Density (g cm^{-1}) at 101.3 kPa and 20˚C	8.9
Specific Gravity (water=1)	8.92
Solubility in Water	Insoluble

USES

Cobalt is used to form super alloys, magnetic metals, as a base coat for porcelain enamelling and as an ingredient in many pigments for ceramics and glassware. Some radioactive isotopes of cobalt can be used in medical treatments.

SOURCES

Cobalt and its compounds are only released to the atmosphere as particulate matter, as it does not form gaseous compounds. Natural sources of cobalt include soil, seawater spray, volcano ash, and forest fires. Anthropogenic sources include: coal combustion, vehicle and industry emissions. Natural sources of cobalt generate more atmospheric particulates than anthropogenic sources.

COBALT EMISSIONS AND AMBIENT LEVELS

Emissions

The National Pollutant Release Inventory (NPRI) states that Canada released 11 tonnes of cobalt to the air in 2007 and of this Alberta released 0.438 tonnes.

Ambient Air Levels

Atmospheric cobalt is associated with particulate matter and levels at unpolluted sites are less than 2 ng m^{-3}. In Canada urban levels can range from 1 to 7.9 ng m^{-3}. Above the open ocean, these values can be smaller, from 0.0004 to 0.08 ng m^{-3}. Generally the amount of cobalt that a person breathes in is less than what they consume in food and water.

ENVIRONMENTAL EFFECTS

Cobalt has not been found to bio-magnify, but it does accumulate in aquatic organisms, especially in the skin. Cobalt is not listed in the Canadian Environmental Protection Act's Domestic Substances List.

HEALTH EFFECTS

Cobalt is an essential micronutrient in humans; it is part of the Vitamin B_{12} complex. When ingested, cobalt can also be used as a treatment for anaemia, as it stimulates the production of red blood cells.

Particulate cobalt may obstruct respiratory passages and cause wheezing and coughing. Prolonged cobalt exposure can also create an allergic reaction in the lungs. When cobalt is the only particulate inhaled, symptoms are usually mild to moderate, and rarely escalate to permanent lung damage. Humans can be exposed to airborne cobalt via hard metals, tool construction, metal refinery, welding, and being in close proximity to industrial areas. When cobalt comes into contact with the skin, it may cause contact dermatitis. It is one of the three most common metallic sources of contact dermatitis.

The International Agency for Research on Cancer evaluates cobalt metal as possibly carcinogenic to humans (group 2B).

OTHER JURISDICTIONS

Many jurisdictions have elected to control cobalt through limitation of emissions not ambient air quality objectives. The US has National Emissions Standards for Hazardous Air Pollutants (NESHAPs) which establish limits on emissions of hazardous air pollutants. NESHAPs are developed based on industry categories and target the HAPs mostly likely present in these industry processes. Cobalt compounds are included on the list of HAPs.

Occupational-based exposure limits exist through The Occupational Health and Safety Administration (0.1 mg m^{-3} in workplace air for an 8-hour workday, 40-hour work week); The American Conference of Governmental Industrial Hygienists (0.02 mg m^{-3} for an 8-hour workday, 40-hour work week); and the National Institute for Occupational Safety and Health (0.05 mg/m3 for cobalt for a 10-hour workday, 40-hour workweek).

Table 2 Cobalt air objectives and guidelines in other jurisdictions

Agency	Guideline Description	Air Quality Guideline		
		1 Hour (µg m^{-3})	24 Hours (µg m^{-3})	Annual (µg m^{-3})
Texas	Effects Screening Level	0.2		0.02
Ontario	Point of Impingement 30-minute	0.3		
	Ambient Air Quality Criteria		0.1	

Chemical Fact Sheets

Copper, Cu
CAS No. 7440-50-8

WHAT IS COPPER?

Copper is a reddish, lustrous, malleable solid with no odor.

USES

Copper has a wide variety of industrial and household uses. It is found in wires in electrical and electronic products, in corrosion-resistant piping, and in the electroplated protective coatings on some cooking utensils. It may be used as an ingredient in pigments. Insecticides, herbicides, and fungicides have been created that contain copper.

SOURCES

Copper is widely distributed in nature in the elemental state. Occurrence of all forms of Copper in the earth's crust is 70 ppm, in seawater: 0.001-0.02 ppm.

On a global basis, the amount of copper entering the air because of man's activities are approximately three times higher than the amount entering the air from natural sources. Non-ferrous metal production is a large contributor of atmospheric copper.

ENVIRONMENTAL LEVELS AND EXPOSURE

Ambient air concentrations of Copper were not reported in 1997 or 1998 in Alberta.

Exposure to Copper might include:
- Breathing copper dust generated by copper processing operations is the primary source of air exposures.
- Breathing tobacco smoke and stack emissions of coal burning power plants.
- Breathing fumes in industrial operations. Fumes occur in copper and brass plants and in welding copper containing metals
- Drinking or eating food with higher levels of copper from the vicinity of copper mines or smelting works, if the water and pasture have been contaminated with copper.
- Drinking water that has contacted Copper pipes. The reaction of soft water with the copper pipes that are used in some household plumbing systems contributes to the copper levels in water at the tap.

ENVIRONMENTAL FATE AND BEHAVIOUR

- Copper may be bound in rocks and soil.
- When copper-containing rocks and soil are exposed to acid rain or other acid conditions the copper may dissolve into the water.
- There is no evidence that it is broken down by microorganisms in water

TOXICITY

Effects of Copper on human health and the environment depend on the amount of Copper present and the length and frequency of exposure. Effects also depend on the health of a person or the condition of the environment when exposure occurs.

- It is not clear what the impact of long-term exposure to Copper is. Many cases of illness formerly attributed to copper poisoning are now believed to have been due to other metals, especially lead.
- If you are exposed to Copper itself there will probably be little or no toxic effects, although there are conflicting reports in literature.
- Copper salts are generally believed to be more toxic than Copper itself.
- When acid conditions increase the amount of copper found in a water body, microorganism and aquatic animal populations may be changed.
- In soils exposed to acid rain, high levels of copper may be directly toxic to certain soil microorganisms and can disrupt important microbial processes in soil.

OBJECTIVES AND GUIDELINES

Ambient Air Quality Objectives and Guidelines

Jurisdiction	**Guidelines (μg/m^3)**				
	0.5hr	**1hr**	**8hr**	**24hr**	**Annual**
Alberta					
Texas		10			1
Ontario	100			50	

Adapted from:
ChemBank HSDB, IRIS, RTECS toxicity profiles.

Chemical Fact Sheets

Cumene, C_9H_{12}
CAS No. 98-82-8

WHAT IS CUMENE?

Cumene is a colorless liquid with a sharp, penetrating, aromatic gasoline-like odor.

USES

Cumene is used as a constituent for some petroleum-based solvents used as paint and enamel thinners. It is a component of high octane aviation fuel. Cumene is also used in Styrene, Phenol, Acetone, Acetophenone and alpha-methylstyrene production. Minor amounts are used in gasoline blending. It is a proposed replacement for Benzene in many industrial uses.

SOURCES

Cumene can be produced from coal tar naptha fractions or from petroleum, or from propylene and benzene. It is also a natural constituent of a variety of foods and vegetation.

ENVIRONMENTAL LEVELS AND EXPOSURE

Exposures to cumene might include:

- Breathing air contaminated with cumene. This is the main way in which people are exposed. You are more likely to be exposed if you work in industrial settings where cumene is processed or produced. The human odor perception level for Cumene is 0.06 mg/m^3 (0.012 ppm).
- Breathing low levels in contaminated air at a gasoline station or in the presence of gasoline or other petroleum products.
- Eating or drinking food and water contaminated with it.
- Touching it or products that contain it.

Annual Averages of Ambient Levels of Cumene in Alberta ($\mu g/m^3$)

Station	1997	1998
Calgary Central	0.0997	0.1073
Edmonton Central	0.0850	0.0848
Edmonton East	0.0930	0.0741

ENVIRONMENTAL FATE AND BEHAVIOUR

- In air, about one-half of the total amount breaks down from reaction with chemicals generated in the presence of sunlight every 5-14 days.

- It is broken down by organisms in the soil, or evaporates from the soil surface.
- It binds strongly to soil and is not expected to move into groundwater.
- It is broken down by microorganisms in water, or evaporates from the water surface. About one-half of the total amount is broken down by microorganisms every 14 days.
- It is not expected to build up in animals.

TOXICITY

Effects of cumene on human health and the environment depend on how much Cumene is present and the length and frequency of exposure. Effects also depend on the health of a person or the condition of the environment when exposure occurs.

- When absorbed through skin, the major portion is excreted in the urine as alcohols or acids.
- Inhalation may irritate or burn the skin and the eyes.
- Breathing, eating or drinking large amounts of it may cause effects including nausea, vomiting, salivation, pain in the middle of the chest, cough, confusion, and hoarseness.
- It may be fatal if inhaled, ingested or absorbed through the skin in large quantities.
- You are more likely to be affected by exposure to cumene if you have kidney, chronic respiratory, liver or skin disease.

OBJECTIVES AND GUIDELINES

Ambient Air Quality Objectives and Guidelines

Jurisdiction	**Guidelines (μg/m^3)**				
	0.5hr	**1hr**	**8hr**	**24hr**	**Annual**
Alberta		500			
Texas		500			50
Ontario					

Adapted from:
ChemBank HSDB, IRIS, RTECS toxicity profiles.