UNITED NATIONS

RC

UNEP/FAO/RC/CRC.1/25/Add.1

Distr.: General
11 January 2005

English only

United Nations Environment Programme

Food and Agriculture Organization of the United Nations

Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade
Chemical Review Committee
First meeting
Geneva, 11–18 February 2005
Item 7 (l) of the provisional agenda*

Inclusion of chemicals in Annex III of the Rotterdam Convention: review of notifications of final regulatory actions to ban or severely restrict a chemical: carbon tetrachloride

Carbon tetrachloride: supporting documentation from Canada

Note by the secretariat

The secretariat has the honour to provide, in the annex to the present note, the supporting documentation received from Canada in support of its notification of final regulatory action on carbon tetrachloride. The focused summary is attached in annex I, and the full supporting documentation in annex II.

* UNEP/FAO/RC/CRC.1/1.

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Annex I

Focused summary for carbon tetrachloride by Canada

Introduction

Overview of Canada's regulatory system

As one of the signatories to the Montreal Protocol on Substances that Deplete the Ozone Layer in 1987, Canada has implemented measures to reduce the emissions of ozone-depleting substances (ODS) through strong control measures implemented by federal, provincial and territorial governments, changes in technologies and voluntary actions by industry. The federal government is generally responsible for implementing the provisions of the Montreal Protocol, including controls on the manufacture, import and export of ODSs under the *Canadian Environmental Protection Act* (CEPA).

The *Pest Control Products Act* (PCPA) is the primary federal legislation to control the import, manufacture, sale and use of all pesticides in Canada.
In keeping with Canada's commitments to the Montreal Protocol, the operation of the PCPA respects the provisions of the ODS Regulations involving evaluation of risks to health and the environment.

Events that led to the regulatory action in Canada

On September 16, 1987, the Montreal Protocol on Substances that Deplete the Ozone Layer was signed by 24 countries, including Canada. The Montreal Protocol is an international agreement to control the production and exchange of certain ozone-depleting substances. The *Ozone-depleting Substances Regulations, 1998* reflect Canada's commitment to meet its requirements under the Montreal Protocol on Substances that Deplete the Ozone Layer (Montreal Protocol).

Significance of the regulatory action

The Regulations prohibit the manufacture, use, sell or offer for sale, import or export of bulk virgin carbon tetrachloride, except for the following, allowed uses:

- essential uses, which are to be identified at the international level on the basis of essential-use criteria adopted by the Parties. Canada considers these exemptions on a case-by-case basis.
- feedstock
- analytical standard

The Regulations prohibit the import of recovered, recycled, reclaimed or used carbon tetrachloride, except for use as feedstock or for an essential purpose.

The Regulations prohibit the manufacture and import of products that contain or is intended to contain carbon tetrachloride, except for the following allowed uses.

- military ships until January 1, 2003;
- in a pest control product until January 1, 2000 provided that the product was registered under the *Pest Control Products Act* before January 1, 1999;
- aircraft, ships or any vehicle manufactured before January 1999;
- a product imported in a consignment of personal or household effects and intended for the importer's personal use only;
- a product that is an animal or human health care product, including any bronchial dilator, inhalable steroid, topical anaesthetic and veterinary powder wound spray;
- a product that is supplied in a container of 3 L or less and that is to be used for an essential use that is a laboratory or analytical use.

Scope of the regulatory action

The ODS Regulations, 1998 includes controls for tetrachloromethane (carbon tetrachloride; CCl_4) as bulk virgin product; as recovered, recycled, reclaimed or used product; and, products containing carbrontetrachloride.

Risk Evaluation

The measures of the Montreal Protocol to control on the production and consumption of ozone-depleting substances are science based and rely on the reports prepared by assessment panels of international experts (for example, the United Nations Environment Program report *Environmental Effects of Ozone Depletion: 1991 Update, Panel Report*, Pursuant to Article 6 of the Montreal Protocol on Substances that Deplete the Ozone Layer Under the Auspices of UNEP, November 1991).

Key to the regulatory actions taken, is the fact that carbon tetrachloride has an ozone-depleting potential of 1.1. Stratospheric ozone depletion leads to an increase in the intensity of UV-B rays that reach the earth's surface, where they can disrupt important biological processes and affect air quality.

The ozone layer is beneficial to life on earth as it absorbs the harmful ultra violet (UV) radiation from the sun. Scientific research has explained the cause of ozone depletion - the release of certain industrial chemicals into the atmosphere, particularly CFCs (chlorofluorocarbons) and halons - and provided guidance for policy makers as to how these substances should be reduced. Scientific research is also providing information about the impacts of ozone depletion.

The thinning off the earth's ozone layer has allowed greater amounts of skin-burning UV radiation from the sun to reach the earth. Increased exposure to UV has been shown to harm human health, damage freshwater and marine ecosystems, reduce crop yields, and affect forests.

The most basic impact for humans is the increase in skin cancers. Over-exposure to the sun's UV rays can also cause eye damage, including cataracts, and may even weaken the immune system.

Increased UV levels will also have an impact on agriculture, including many of the world's major food crops. It has been observed that some crops, such as barley and oats, have shown decreased growth as a result of exposure to increased UV radiation.

In marine ecosystems, UV can damage the tiny single-celled plants, known as phytoplankton, which form the base of the food chain. Decreases in the food source at this early stage, may have effects throughout the entire system, and could ultimately affect fish populations.

In the Arctic, the sun never rises very high above the horizon, and much of its rays are absorbed by the atmosphere, meaning levels of UV are normally very low. If considerable ozone loss occurs in the far north, UV could rise to levels as high as those encountered in southern Canada, and Arctic residents would have to take extra steps to protect themselves. UV reflecting off snow and ice could become a particular concern. Vegetation and wildlife in the Arctic have evolved under very low levels of UV, and may have only limited natural protection against over exposure. Some species may prove to be extremely sensitive to higher UV levels.

Risk Reduction and relevance to other States

Production of the industrial chemicals which once posed a major threat to the ozone layer has been greatly reduced, and levels of some of these chemicals are now beginning to decline in the lower atmosphere.

The ozone layer is expected to eventually recover, if all nations maintain their efforts to reduce ozone-destroying chemicals. However, it will probably be more than a decade before we begin to see definite signs of a recovery, and at least the year 2050 before any substantial recovery occurs. At present, the layer is still thinning, especially at the earth's poles. The "hole" over the Antarctic continues to remain large and considerable depletions are occurring in the Arctic.

Trade

Carbon tetrachloride is not manufactured in Canada, but has been imported in Canada in 2003.

Annex II

C H E M I N F O

Canadian Centre for Occupational Health and Safety
Issue : 99-2 (May, 1999)

*** SECTION 1. CHEMICAL IDENTIFICATION ***

EMINFO RECORD NUMBER : 117
OHS CHEMICAL NAME : Carbon tetrachloride
NONYMS :
* Tetrachloromethane
* Perchloromethane
* Tetrachlorure de carbone
* Carbon tet
S REGISTRY NUMBER : 56-23-5
/NA NUMBER(S) : 1846
ECS NUMBER(S) : FG4900000
EINECS/ELINCS NUMBER : 200-262-8
EMICAL FAMILY : Halogenated alkane / chlorinated methane
LECULAR FORMULA : C-Cl4

STATUS :
The CHEMINFO record for this chemical is complete. The full format ("TOTAL") provides a detailed evaluation of health, fire and reactivity hazards, as well as recommendations on topics such as handling and storage, personal protective equipment, accidental release and first aid.

*** SECTION 2. DESCRIPTION ***

PEARANCE AND ODOUR :
lourless liquid with a sweetish, chloroform-like odour
OUR THRESHOLD :
Greater than 10 ppm
RNING PROPERTIES :
Not reliable - odour threshold exceeds the TLV. Adaptation to the odour can occur.
ES AND OCCURRENCES :
Mainly used in the synthesis of chlorofluoromethanes (FC12 and FC11). Other minor uses include metal degreasing agent, refrigerant, agricultural fumigant; used in laboratories. Carbon tetrachloride use has been decreasing during recent years.

** POTENTIAL HEALTH EFFECTS **

ECTS OF SHORT-TERM (ACUTE) EXPOSURE :
HALATION :
Carbon tetrachloride can cause central nervous system (CNS) effects as well as liver and kidney injury. A short-term exposure (1-14 days) to 1 ppm poses minimal risk. Exposure for 8 hours to about 20 ppm can cause mild CNS effects such as headache, dizziness, loss of coordination and nausea. Repeated (weeks to months) 8 hour daily exposures to 200 ppm can cause kidney and liver injury. Brief exposures (15 minutes) to 250 ppm may be lethal to sensitive individuals (e.g. alcoholics). Pulmonary edema (a life-threatening accumulation of fluid in the lungs) has occurred 8 days or more after an exposure but it is a result of the kidney injury (8).
N CONTACT :
Can cause burning sensation and mild reddening of skin. Carbon tetrachloride is rapidly absorbed through the skin and can cause systemic effects such as nausea, vomiting and liver and kidney injury (8).
CONTACT :
Vapour or liquid can cause slight irritation. It is suspected that carbon tetrachloride can impair vision, but there is no solid evidence to support this (7)
ESTION :

Ingestion of as little as 1.5 mL of carbon tetrachloride has caused death although 50-150 mL is usually reported as the lethal dose. Liver damage and other effects described for inhalation (CNS depression, liver injury, kidney injury) as well as stomach irritation occur following ingestion (8). Because of its high vapour pressure, it may present an aspiration hazard.

FECTS OF LONG-TERM (CHRONIC) EXPOSURE :
Repeated exposure to carbon tetrachloride may cause severe kidney and liver damage. Heart and lung failure may occur as a result.

An airborne concentration of 0.015 ppm is estimated to present minimal risk; exposure to 200 ppm for 8 hours/day for weeks/months may cause liver and kidney injury (8).

RCINOGENICITY :
Carbon tetrachloride has produced liver tumors in several animal species. Human data is limited and inconclusive (3). Overall, IARC concludes carbon tetrachloride is a 2B carcinogen (possibly carcinogenic to humans) and the ACGIH has listed it as an A2 carcinogen (suspected human carcinogen). The U.S. National Toxicology Program (NTP) identifies this chemical as one which may reasonably be anticipated to be a carcinogen.

RATOGENICITY AND EMBRYOTOXICITY :
Carbon tetrachloride can cross the placental barrier. In animal test carbon tetrachloride was decreased at doses which also caused toxicity in the mother rats.

PRODUCTIVE TOXICITY :
No human information available. In animal studies, carbon tetrachloride decreased fertility and caused testicular damage in inhalation studies but no effect was seen in feeding studies.

TAGENICITY :
No human information available. Not mutagenic in tests using bacteria and no genotoxicity when rats were given oral doses.

XICOLOGICALLY SYNERGISTIC MATERIALS :
Alcohols, such as common ethanol consumed by humans and ketones can dramatically increase the toxicity of carbon tetrachloride. Other chemicals such as phenobarbital, pesticides and haloalkanes can also increase the toxicity of carbon tetrachloride. Carbon disulfide is thought to decrease the toxicity of carbon tetrachloride (8).

TENTIAL FOR ACCUMULATION :
Complete clearance of carbon tetrachloride from the body may require 2-3 weeks.

*** SECTION 4. FIRST AID MEASURES ***

HALATION :
Take proper precautions to ensure your own safety before attempting rescue, e.g. wear appropriate protective equipment, use the "buddy" system. Remove source of contamination or move victim to fresh air.
If breathing has stopped, properly trained personnel should begin artificial respiration immediately. Avoid mouth-to-mouth contact.
If heart has stopped, properly trained personnel should begin cardiopulmonary resuscitation (CPR) immediately.
Transport victim to an emergency care facility immediately.

IN CONTACT :
Avoid direct contact with this chemical. Wear chemical protective gloves, if necessary. Quickly and gently blot or brush away excess chemical. Wash gently and thoroughly with water and non-abrasive soap for 20 minutes or until chemical is removed. Under running water, remove contaminated clothing, shoes and leather goods (e.g. watchbands, belts). If irritation persists, repeat flushing. If breathing has stopped, trained personnel should begin artificial respiration (AR) or if the heart has stopped, cardiopulmonary resuscitation (CPR). Obtain medical attention immediately. Discard contaminated clothing, shoes and leather goods.

E CONTACT :
Quickly and gently blot or brush away excess chemical on skin around the eye(s). Immediately flush the contaminated eye(s) with lukewarm, gently flowing water for 5 minutes or until chemical is removed, holding the eyelid(s) open. Obtain medical advice immediately.

GESTION :
Never give anything by mouth if victim is rapidly losing consciousness or is unconscious or convulsing. DO NOT INDUCE VOMITING. Have victim drink 240 to 300 mL (8 to 10 ozs) of water to dilute material in stomach. If vomiting occurs naturally, have victim lean forward to reduce risk of aspiration. Repeat administration of water.
If breathing has stopped, trained personnel should begin artificial respiration or, if the heart has stopped, cardiopulmonary resuscitation (CPR) immediately. Quickly transport victim to an emergency facility.
RST AID COMMENTS :
Provide general supportive measures (comfort, warmth, rest). Consult a physician and/or the nearest Poison Control Centre for all exposures except minor instances of inhalation or skin contact. All first aid procedures should be periodically reviewed by a physician familiar with the material and its condition of use in the workplace.

*** SECTION 5. FIRE FIGHTING MEASURES ***

ASH POINT :
Does not burn
VER FLAMMABLE (EXPLOSIVE) LIMIT (LFL/LEL) :
Not applicable
PER FLAMMABLE (EXPLOSIVE) LIMIT (UFL/UEL) :
Not applicable
TOIGNITION (IGNITION) TEMPERATURE :
Not applicable
MBUSTION AND THERMAL DECOMPOSITION PRODUCTS :
Phosgene, hydrogen chloride, chlorine, carbon monoxide and carbon dioxide
RE HAZARD COMMENTS :
Carbon tetrachloride does not burn but can decompose when strongly heated. Toxic and corrosive fumes may be released.
TINGUISHING MEDIA :
Not applicable
RE FIGHTING INSTRUCTIONS :
Move containing vessels from fire area if without risk. Cool containing vessels with flooding quantities of water until well after fire is out.

** NATIONAL FIRE PROTECTION ASSOCIATION (NFPA) HAZARD INDEX **

PA - HEALTH	: 3 - Short exposure could cause serious temporary or residual injury.
PA - FLAMMABILITY	: 0 - Will not burn
PA - REACTIVITY	: 0 - Normally stable under fire conditions, and not reactive with water.

*** SECTION 6. ACCIDENTAL RELEASE MEASURES ***

CAUTIONS :
Restrict access to area until completion of clean-up. Ensure clean-up is conducted by trained personnel only. Provide adequate personal protective equipment. Ventilate area. Remove sources of heat or flame to prevent formation of hazardous thermal decomposition products. Contact manufacturer/supplier for advice.

Notify government occupational health and safety and environmental agencies.
AN-UP :
Small spills: Take up with inert sorbent material. Place in suitable, covered, labelled containers. Flush area with water.

Large spills: Dike with earth, sand or inert sorbent material to contain spill. Contact occupational health and safety and environment agencies as well as supplier.

Contaminated sorbent may pose the same hazards as the spilled product.

NDLING :
Use in minimal quantities in designated areas with adequate ventilation. Avoid generating mists. Do not use near welding operations, flames or hot surfaces.

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Wear appropriate personal protective equipment. Have suitable emergency equipment (for fires, spills, leaks, etc.) readily available.

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Use approved portable containers in the work area. Empty containers may be hazardous due to residual material.

'ORAGE :
Store in a cool, dry, well-ventilated area, out of direct sunlight, away from incompatible materials and heat. Store in suitable, labelled containers, kept tightly closed when not in use and when empty, and protected from damage. Use suitable, approved storage tanks, buildings, rooms and cabinets.

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Limit quantity of material in storage. Restrict access to storage area. Post warning signs when appropriate. Keep storage area separate from populated work areas. Inspect periodically for deficiencies such as damage or leaks.

*** SECTION 8. EXPOSURE CONTROLS/PERSONAL PROTECTION ***

NOTE : Exposure to this material can be controlled in many ways. The measures appropriate for a particular worksite depend on how this material is used and on the extent of exposure. This general information can be used to help develop specific control measures. Ensure that control systems are properly designed and maintained. Comply with occupational, environmental, fire, and other applicable regulations.

MPLING AND ANALYSIS :
Sampling should only be done by trained personnel using appropriate instrumentation and sampling strategy (location, timing, duration, frequency and number of samples). Interpretation of the sampling results is related to these variables and the analytical method. Sampling should be carried out by trained personnel.

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OSHA METHOD 07 - ORGANIC VAPOURS INCLUDING CARBON TETRACHLORIDE. OSHA Analytical Methods Manual. 2nd ed. Part 1. Vol. 1. US Dept. of Labour, January 1990. Fully validated method. Collection on coconut shell charcoal sorbent tube. Desorption with carbon disulphide (CS2). Analysis by gas chromatography using flame ionization detector (FD).

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The method described below has been reported for hydrocarbons, halogenated including carbon tetrachloride.

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NIOSH METHOD 1003 - NIOSH Manual of Analytical Methods. 4th ed. Vol. 2. Partially evaluated method. Collection on coconut shell activated charcoal sorbent tube. Desorption with carbon disulphide (CS2). Analysis by gas chromatography using flame ionization detector (FID). Estimated detection limit: 0.01 mg.

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DIRECT READING INSTRUMENTS: Methods of detection in commercially available devices which may be suitable: flame ionization detector, infrared photometer, photometric analyzer, electronic capture gas detector, photoionization analyzer, gas chromatograph analyzer.

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Analytical methods are reviewed in ref. 3.

INEERING CONTROLS :
Engineering control methods to reduce hazardous exposures are preferred. Methods include mechanical ventilation (dilution and local exhaust),

process or personnel enclosure, control of process conditions and process modification (e.g. substitution of a less hazardous material). Administrative controls and personal protective equipment may also be required.

Because of the high potential hazard associated with this substance, stringent control measures such as process enclosure or isolation may be necessary in addition to local exhaust ventilation.

Use a ventilation system separate from other exhaust ventilation systems. Exhaust directly to the outside.

Supply sufficient replacement air to make up for air removed by exhaust systems.

RSONAL PROTECTIVE EQUIPMENT :

If engineering controls and work practices are not effective in controlling exposure to this material, then wear suitable personal protection equipment including approved respiratory protection. Have appropriate personal protection equipment available for use in emergencies such as spills or fire.

If respiratory protection is required, institute a complete respiratory protection program including selection, fit testing, training, maintenance and inspection. Refer to the CSA Standard Z94.4-93, "Selection, Use and Care of Respirators," available from the Canadian Standards Association, Rexdale, Ontario, M9W 1R3.

SPIRATORY PROTECTION GUIDELINES :

NIOSH RECOMMENDATIONS FOR CARBON TETRACHLORIDE (5):

AT CONCENTRATIONS ABOVE THE NIOSH REL, OR WHERE THERE IS NO REL, AT ANY DETECTABLE CONCENTRATION: Positive pressure, full-facepiece SCBA; or positive pressure, full-facepiece SAR with an auxiliary positive pressure SCBA.

ESCAPE: Gas mask with organic vapour canister; or escape-type SCBA.

The NIOSH Recommended Exposure Limit (REL) for carbon tetrachloride is a STEL of 2 ppm (60-minute time-weighted average).

NOTE: NIOSH has classified this material as a potential occupational carcinogen, according to specific NIOSH criteria. This classification is reflected in these recommendations for respiratory protection, which specify that only the most reliable and protective respirators be worn. The requirements in Canadian jurisdictions may vary.

The respirator use limitations specified by the approving agency and the manufacturer must be observed. Air-purifying respirators do not protect against oxygen-deficient atmospheres.
Recommendations apply only to NIOSH approved respirators.

ABBREVIATIONS: SAR = supplied-air respirator; SCBA = self-contained breathing apparatus. IDLH = Immediately Dangerous to Life or Health.

E/FACE PROTECTION :

Chemical safety goggles. A face shield may also be necessary.

N PROTECTION :

Chemical protective gloves, coveralls, boots, and/or other resistant protective clothing.

ISTANCE OF MATERIALS FOR PROTECTIVE CLOTHING :

Guidelines for carbon tetrachloride (11):
RECOMMENDED (resistance to breakthrough longer than 8 hours): Polyvinyl alcohol, Viton(TM), Barricade(TM), Responder(TM), 4H(TM) (polyethylene/ethylene vinyl alcohol).
RECOMMENDED (resistance to breakthrough longer than 4 hours): Teflon(TM).
CAUTION, use for short periods only (resistance to breakthrough within 1 to 4 hours): Tychem 10000(TM).
NOT RECOMMENDED (resistance to breakthrough less than 1 hour): Butyl

rubber, natural rubber, neoprene, nitrile rubber, polyethylene, polyvinyl chloride.
This material is a recognized skin absorption hazard (ACGIH or OSHA). Recommendations are valid for permeation rates reaching 0.1 ug/cm2/min or 1 mg/m2/min and over. Resistance of specific materials can vary from product to product. Breakthrough times are obtained under conditions of continuous contact, generally at room temperature. Evaluate resistance under conditions of use and maintain clothing carefully.

POSURE CONTROLS/PERSONAL PROTECTION COMMENTS :
Remove contaminated clothing promptly. Keep contaminated clothing in closed containers. Discard or launder before rewearing. Inform laundry personnel of contaminant's hazards.

Do not smoke, drink or eat in work areas. Wash hands thoroughly after handling this material. Maintain good housekeeping.

** EXPOSURE GUIDELINES **

* THRESHOLD LIMIT VALUES (TLVs) / AMERICAN CONFERENCE OF GOVERNMENTAL INDUSTRIAL HYGIENISTS (ACGIH) / 1999 *

ME-WEIGHTED AVERAGE (TLV-TWA) : 5 ppm (31 mg/m3) - Carcinogenicity Designation A2 - Skin

ORT-TERM EXPOSURE LIMIT (TLV-STEL) :
10 ppm (63 mg/m3) - Carcinogenicity Designation A2 - Skin

V BASIS - CRITICAL EFFECT(S) : Liver
Cancer

V COMMENTS :
CARCINOGENICITY DESIGNATION A2 - Suspected Human Carcinogen: Substance is carcinogenic in laboratory animals under conditions that are considered relevant to worker exposure. Available human studies are conflicting or insufficient to confirm an increased risk of cancer in exposed humans. Worker exposure to an A2 carcinogen should be controlled to levels as low as reasonably achievable below the TLV.

"SKIN" NOTATION: Contact with skin, eyes and mucous membranes can contribute to the overall exposure and may invalidate the TLV. Consider measures to prevent absorption by these routes.

NOTE: In many jurisdictions, exposure limits are similar to the ACGIH TLVs. Since the manner in which exposure limits are established, interpreted and implemented can vary, obtain detailed information from the appropriate government agency in each jurisdiction.

* PERMISSIBLE EXPOSURE LIMITS (PELs) / FINAL RULE LIMITS / U.S. OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION (OSHA) *

IE WEIGHTED AVERAGE (PEL-TWA) : 2 ppm (12.6 mg/m3)

NOTE: The OSHA PEL Final Rule Limits are currently non-enforceable due to a court decision. The OSHA PEL Transitional Limits are now in force.

* PERMISSIBLE EXPOSURE LIMITS (PELs) / TRANSITIONAL LIMITS / U.S. OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION (OSHA) *

LING EXPOSURE LIMIT (PEL-C) : 10 ppm; CEILING: 25 ppm
NSITIONAL LIMIT PEL COMMENTS :
ACCEPTABLE MAXIMUM PEAK ABOVE THE ACCEPTABLE CEILING CONCENTRATION FOR AN 8-HR SHIFT: 200 ppm (5 minutes in any 4-hr-maximum duration.) (Table Z-2).

* EMERGENCY RESPONSE PLANNING GUIDELINES (ERPGs) / AMERICAN INDUSTRIAL HYGIENE ASSOCIATION (AIHA) *

ERPG-1 : 20 ppm
ERPG-2 : 100 ppm
ERPG-3 : 750 ppm (12)

The ERPG-1 is the maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to 1 hr without experiencing other than mild transient adverse health effects or perceiving a clearly defined, objectional odor.

The ERPG-2 is the maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to 1 hr without experiencing or developing irreversible or other serious health effects or symptoms which could impair an individual's ability to take protective action.

The ERPG-3 is the maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to 1 hr without experiencing or developing life-threatening health effects.

NOTE : Users of the ERPG values are strongly encouraged to consult the documentation before use.

*** SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES ***

LECULAR WEIGHT : 153.84
NVERSION FACTOR :
1 ppm = 6.29 mg/m3; 1 mg/m3 = 0.159 ppm
LTING POINT : -23 deg C (-9.4 deg F)
ILING POINT : 76.5 deg C (170 deg F)
LATIVE DENSITY (SPECIFIC GRAVITY) :
1.594 (water = 1)
LUBILITY IN WATER :
Very low (0.05 mL/100 mL)
LUBILITY IN OTHER LIQUIDS :
Soluble in acetone; miscible with alcohol, benzene, chloroform, ether, carbon disulfide, petroleum ether.
POUR DENSITY : 5.32 (air = 1)
POUR PRESSURE : 91.3 mm Hg at 20 deg C
URATION VAPOUR CONCENTRATION : 12% at 20 deg C
APORATION RATE : 12.8 (butyl acetate = 1)
VALUE : Not applicable
TICAL TEMPERATURE : Not available
EFFICIENT OF OIL/WATER DISTRIBUTION (PARTITION COEFFICIENT) :
LOG KOW = 2.64

*** SECTION 10. STABILITY AND REACTIVITY ***

ABILITY :
Stable
ARDOUS POLYMERIZATION :
Does not occur
OMPATIBILITY - MATERIALS TO AVOID :
FLUORINE - reacts strongly
SODIUM AND POTASSIUM METALS - explosive reaction
ALUMINUM - reacts strongly
ROSIVITY TO METALS :
Not corrosive to iron and nickel. Reacts slowly with copper and lead. Can react explosively with aluminum (3).

*** SECTION 11. TOXICOLOGICAL INFORMATION ***

LD50 (rat, oral): 2800-2920 mg/kg (3)
LD50 (mouse, oral): 12.1-14.4 g/kg (3)
LD50 (guinea pig, dermal): greater than 15000 mg/kg (8)
LC50 (mouse): 9500 ppm (8-hour exposure)

CARCINOGENICITY: Carbon tetrachloride caused liver tumours when administered orally to mice, rats and hamsters. It also caused liver tumours in rats which inhaled carbon tetrachloride daily for 7 months (3). IARC concludes there is sufficient evidence of carcinogenicity in experimental animals.

TERATOGENICITY AND FETOTOXICITY: No teratogenic effects have been seen in rat studies. Some fetotoxicity has been seen in rat studies but it occurred at dose levels that also caused maternal toxicity (4).

REPRODUCTIVE EFFECTS: An airborne concentration of 200 ppm decreased fertility of rats in one study, and in another study 200 ppm caused some testicular damage (8). No reproductive effects were seen in other studies where rats were fed 80 or 200 ppm carbon tetrachloride in the diet (4).

MUTAGENICITY: No mutagenic effects seen in bacterial studies (3). No gerotoxic effects seen where rats were given oral doses (8).

*** SECTION 12. ECOLOGICAL INFORMATION ***

NOTE : This section is subject to future development.

*** SECTION 13. DISPOSAL CONSIDERATIONS ***

Review federal, provincial and local government requirements prior to disposal.

Disposal by incineration or secure landfill may be acceptable.

*** SECTION 14. TRANSPORT INFORMATION ***

** CANADIAN TRANSPORTATION OF DANGEROUS GOODS (TDG) SHIPPING INFORMATION **

DESCRIPTION AND SHIPPING NAME: Carbon tetrachloride (R10)
PRODUCT IDENTIFICATION NUMBER (PIN): 1846
CLASSIFICATION: 6.1 - Poisonous substance; 9.2 - Substance hazardous to the environment
SPECIAL PROVISIONS: 109
PACKING GROUP: II
REGULATED LIMIT: 230 kg

NOTE: This information incorporates Schedule No. 21 amendments to the Transportation of Dangerous Goods Act, 1992, effective December 13, 1995.

** U.S. DEPARTMENT OF TRANSPORT (DOT) HAZARDOUS MATERIALS SHIPPING INFORMATION (49 CFR) **

HAZARDOUS MATERIAL DESCRIPTION AND PROPER SHIPPING NAME: Carbon tetrachloride
HAZARD CLASS OR DIVISION: 6.1
IDENTIFICATION NUMBER: UN1846
PACKING GROUP: II

NOTE : This information was taken from the U.S. Code of Federal Regulations Title 49 - Transportation and is effective October 1, 1997.

*** SECTION 15. REGULATORY INFORMATION ***

** CANADIAN WORKPLACE HAZARDOUS MATERIALS INFORMATION SYSTEM (WHMIS) **

POSED WHMIS CLASSIFICATION :
D1A - Poisonous and infectious material - Immediate and serious effects -

Very toxic
D2A - Poisonous and infectious material - Other effects - Very toxic
D2B - Poisonous and infectious material - Other effects - Toxic
MIS HEALTH EFFECTS :
TDG class 6.1 group II - very toxic - immediate
Chronic toxicity - toxic - other
Carcinogenicity - very toxic - other
MIS INGREDIENT DISCLOSURE LIST :
Included for disclosure at 0.1% or greater
TAILED WHMIS CLASSIFICATION ACCORDING TO CRITERIA :
CLASS A - COMPRESSED GAS: Does not meet criteria
CLASS B - FLAMMABLE & COMBUSTIBLE MATERIAL: Does not meet criteria. Does not burn.
CLASS C - OXIDIZING MATERIAL: Does not meet criteria
CLASS D - POISONOUS AND INFECTIOUS MATERIAL. DIVISION 1 - IMMEDIATE AND SERIOUS TOXIC EFFECTS: Meets criteria for "Very toxic material"
Acute Lethality: Does not meet criteria
Transportation of Dangerous Goods (TDG): "Very toxic"; class 6.1, packing group II
CLASS D - POISONOUS AND INFECTIOUS MATERIAL. DIVISION 2 - OTHER TOXIC EFFECTS: Meets criteria for both "Very toxic material" and "Toxic material"; see detailed evaluation below.
CHRONIC HEALTH EFFECTS: "Toxic"; liver damage from repeated exposure at 50 ppm
CARCINOGENICITY: "Very toxic"; listed in IARC group 2B.(3)
TERATOGENICITY AND EMBRYOTOXICITY: Insufficient information
REPRODUCTIVE TOXICITY: Insufficient information
MUTAGENICITY: Insufficient information
RESPIRATORY TRACT SENSITIZATION: Does not meet criteria; not reported as human respiratory sensitizer.
SKIN SENSITIZATION: Does not meet criteria
SKIN IRRITATION: "Toxic"; direct contact causes burning and reddening of skin in humans.
EYE IRRITATION: Insufficient information
CLASS E - CORROSIVE MATERIAL: Does not meet criteria
CLASS F - DANGEROUSLY REACTIVE MATERIAL: Does not meet criteria

** U.S. OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION (OSHA)
HAZARD COMMUNICATION STANDARD (29 CFR 1910.1200) **

IA HAZARD COMMUNICATION EVALUATION :
Meets criteria for hazardous material, as defined by 29 CFR 1910.1200.

** EUROPEAN UNION (EU)
CLASSIFICATION AND LABELLING INFORMATION **

CLASSIFICATION :
Carcinogenic, Category 3; Toxic; Dangerous for the environment.
[Carc.Cat.3;T;R52-53;N] (13)
RISK PHRASES :
Toxic by inhalation, in contact with skin, and if swallowed. Possible risk of irreversible effects. Toxic: danger of serious damage to health by prolonged exposure through inhalation. Harmful to aquatic organisms, may cause long-term adverse effects in the aquatic environment. Dangerous for the ozone layer. [R:23/24/25-40-48/23-52/53-59].
SAFETY PHRASES :
Keep locked up and out of reach of children.* Do not breathe gas/fumes/vapour/spray (appropriate wording to be specified by the manufacturer). Wear suitable protective clothing and gloves. In case of accident or if you feel unwell, seek medical advice immediately (show label where possible). Refer to manufacturer/supplier for information on recovery/recycling. Avoid release to the environment. Refer to special instructions/safety data sheet. [S:(1/2)*23-36/37-45-59-61]
*This safety phrase can be omitted from the label when the substance or preparation is sold for industrial use only.
Safety phrases relate to the highest concentration division indicated, but

may also be applicable to lower concentrations.

COMMENTS :

CONCENTRATION GREATER THAN OR EQUAL TO 1%: Toxic. Toxic by inhalation, in contact with skin, and if swallowed. Possible risk of irreversible effects. Toxic: danger of serious damage to health by prolonged exposure through inhalation. [T;R23/24/25-40-48/23]

CONCENTRATIONS GREATER THAN OR EQUAL TO 0.2% AND LESS THAN 1%: Harmful. Harmful by inhalation, in contact with skin and if swallowed. Harmful: danger of serious damage to health by prolonged exposure through inhalation. [Xn;R20/21/22-48/20]

*** SECTION 16. OTHER INFORMATION ***

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Information on chemicals reviewed in the CHEMINFO database is drawn from a number of publicly available sources. A list of general references used to compile CHEMINFO records is available in the database Help.

/IEW/PREPARATION DATE :

1987-07-24

/ISION INDICATORS :

NFPA (health); 1993-03
NFPA (reactivity); 1993-03
Carcinogenicity; 1993-03
Trans PEL-TWA; 1993-04
EU number; 1995-10
EU Safety; 1995-10
Sampling; 1995-10
Respiratory guidelines; 1995-10
ERPG: 1995-10
TDG; 1995-10
PEL-TWA: 1996-06
Ceiling exposure limit: 1996-06
TLV-TWA; 1996-09

TLV-STEL; 1996-09
WHMIS (detailed class); 1997-07
WHMIS (proposed class); 1997-07
US transport; 1998-03
Resistance of materials; 1998-05
TLV comments; 1998-08
EU Classification; 1998-11
EU Risk; 1998-11
Bibliography; 1999-02

*** END OF RECORD ***

EPA United States Environmental Protection Agency
Office of Air Quality Planning & Standards OAQPS
TTNWeb Technology Transfer Network
UATW Urban Air Toxics Website

CARBON TETRACHLORIDE

56-23-5

Hazard Summary

- Acute (short-term) inhalation and oral exposures to carbon tetrachloride have been observed to **damage primarily the liver and kidneys of humans**. Depression of the central nervous system (CNS) has also been reported. Symptoms of acute exposure in humans include headache, weakness, lethargy, nausea, and vomiting.
- Chronic (long-term) inhalation or oral exposure to carbon tetrachloride produces **liver and kidney damage** in humans.
- The U.S. Environmental Protection Agency (EPA) has not established a Reference Concentration (RfC) for carbon tetrachloride.
- The Reference Dose (RfD) for carbon tetrachloride is 0.0007 mg/kg/d.[a] EPA estimates that consumption of this dose or less, over a lifetime, would not likely result in the occurrence of chronic, noncancer effects.[b]
- No information is available on the reproductive or developmental effects of carbon tetrachloride in humans. Reproductive effects, such as decreased fertility in rats, decreased sperm production in male rats, degenerative changes in the testes, and a decreased survival rate of newborns, have been observed in animals exposed to carbon tetrachloride orally and by inhalation. Birth defects have not been observed in animals.
- Human data on the carcinogenic effects of carbon tetrachloride are limited. Studies in animals have shown that ingestion of carbon tetrachloride increases the risk of **liver cancer.** EPA has classified carbon tetrachloride as a Group B2, **probable human carcinogen of low carcinogenic hazard,** with a $1/ED_{10}$ value of 0.34 per (mg/kg)/d[c] and an inhalation unit risk of 1.5×10^{-5} $(\mu g/m^3)^{-1}$.

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[a] Milligrams per kilogram per day is one way to measure the amount of the contaminant that is consumed in food.

[b] The RfD is not a direct estimator of risk but rather a reference point to gauge the potential effects. Exceedance of the RfD does not imply that an adverse health effect would necessarily occur. As the amount and frequency of exposures exceeding the RfD increase, the probability of adverse health effects also increases.

[c] The $1/ED_{10}$ value is a measure of the carcinogenic potency of a chemical. The value reported here has been proposed in the hazard ranking of hazardous air pollutants in EPA's proposed rulemaking (Section 112(g) of the Clean Air Act, April 1994).

Please Note: The main sources of information for this fact sheet are EPA's Integrated Risk Information System (IRIS), which contains information on oral chronic toxicity of carbon tetrachloride and the RfD, and the carcinogenic effects of carbon tetrachloride including the unit cancer risk for inhalation exposure,

and the Agency for Toxic Substances and Disease Registry's (ATSDR's) *Toxicological Profile for Carbon Tetrachloride*. Other secondary sources include the Hazardous Substances Data Bank (HSDB), a database of summaries of peer-reviewed literature, and the Registry of Toxic Effects of Chemical Substances (RTECS), a database of toxic effects that are not peer reviewed.

Environmental/Occupational Exposure

- Individuals may be exposed to carbon tetrachloride in the air from accidental releases from production and uses, and from its disposal in landfills. (1)
- Carbon tetrachloride is also a common contaminant of indoor air; the sources of exposure appear to be building materials or products, such as cleaning agents, used in the home. (1)
- Workers involved in the manufacture or use of carbon tetrachloride are most likely to have significant exposures to carbon tetrachloride. (1)
- Individuals may also be exposed to carbon tetrachloride by drinking contaminated water. (1,2)
- In the past, ingestion of bread or other products made with carbon tetrachloride-fumigated grain may have contributed to dietary exposure, but this route of exposure is no longer believed to be of significance. (2)

Assessing Personal Exposure

- Measurement of carbon tetrachloride in exhaled breath has been the most convenient medium to determine exposure; measurements in blood, fat, or other tissues have also been used as indicators of exposure. However, these tests are not routinely available and cannot be used to predict whether any health effects will result. (1)

Health Hazard Information

Acute Effects:

- Acute (short-term) inhalation and oral exposures to carbon tetrachloride have been observed primarily to damage the liver and kidneys of humans. Depression of the central nervous system has also been reported. Symptoms of acute exposure in humans include headache, weakness, lethargy, nausea, and vomiting. (1-6)
- Delayed pulmonary edema has been observed in humans exposed to carbon tetrachloride by inhalation and ingestion, but this is believed to be due to injury to the kidney rather than direct action of carbon tetrachloride on the lung. (1)
- Acute animal exposure tests, such as the LC_{50} and LD_{50} tests in rats, mice, rabbits, and guinea pigs, have demonstrated carbon tetrachloride to have low toxicity from inhalation exposure, low-to-moderate toxicity from ingestion, and moderate toxicity from dermal exposure. (7)

Chronic Effects (Noncancer):

- Chronic (long-term) inhalation or oral exposure to carbon tetrachloride produces liver and kidney damage in humans and animals. (1,3,6,8)
- EPA has not established an RfC for carbon tetrachloride. (9)
- The RfD for carbon tetrachloride is 0.0007 mg/kg/d based on liver lesions in rats. (9)
- EPA has high confidence in the principal study on which the RfD was based because the study was well conducted and good dose-response was observed in the liver, which is the target organ for carbon

tetrachloride toxicity; medium confidence in the database because four additional subchronic studies support the RfD, but reproductive and teratology endpoints are not well investigated; and, consequently, medium confidence in the RfD.

Reproductive/Developmental Effects:

- No information is available on the reproductive or developmental effects of carbon tetrachloride in humans.
- Decreased fertility in rats, decreased sperm production in male rats, degenerative changes in the testes, and a decreased survival rate of newborns have been observed in animals exposed to carbon tetrachloride orally and by inhalation. (1,6)
- Birth defects have not been observed in animals exposed to carbon tetrachloride by inhalation or ingestion. (1,2,8)

Cancer Risk:

- Occasional reports have noted the occurrence of liver cancer in workers who had been exposed to carbon tetrachloride by inhalation exposure; however, the data are not sufficient to establish a cause-and-effect relationship. (1,6,8-10)
- Liver tumors have developed in animals exposed to carbon tetrachloride by gavage (experimentally placing the chemical in their stomachs). (1-4,6,8-11)
- EPA has classified carbon tetrachloride as a Group B2, probable human carcinogen. (8,9)
- EPA uses mathematical models, based on human and animal studies, to estimate the probability of a person developing cancer from breathing air containing a specified concentration of a chemical. EPA calculated an inhalation unit risk of 1.5×10^{-5} $(\mu g/m^3)^{-1}$. EPA estimates that, if an individual were to breathe air containing carbon tetrachloride at 0.07 $\mu g/m^3$[(1)] over his or her entire lifetime, that person would theoretically have no more than a one-in-a-million increased chance of developing cancer as a direct result of breathing air containing this chemical. Similarly, EPA estimates that breathing air containing 0.7 $\mu g/m^3$ would result in not greater than a one-in-a-hundred thousand increased chance of developing cancer, and air containing 7.0 $\mu g/m^3$ would result in not greater than a one-in-a-ten thousand increased chance of developing cancer. (9)
- EPA's Office of Air Quality Planning and Standards, for a hazard ranking under Section 112(g) of the Clean Air Act Amendments, has ranked carbon tetrachloride in the nonthreshold category. The $1/ED_{10}$ value is 0.34 per (mg/kg)/d and this would place it in the low category under Superfund's ranking for carcinogenic hazard. (12)

Physical Properties

- The chemical formula for carbon tetrachloride is CCl_4, and its molecular weight is 153.8 g/mol. (1,2)
- Carbon tetrachloride is a clear, nonflammable liquid which is almost insoluble in water. (1)
- Carbon tetrachloride has a sweet characteristic odor, with an odor threshold above 10 ppm. (1)
- The vapor pressure for carbon tetrachloride is 91.3 mm Hg at 20 C, and its log octanol/water partition coefficient (log K_{ow}) is 2.64. (1)

Uses

- Carbon tetrachloride has been produced in large quantities to make refrigerants and propellants for

aerosol cans; production of fluorocarbon propellants is being phased out due to their effect on the ozone layer and this use of carbon tetrachloride is currently declining. (1)

- Carbon tetrachloride is used as a solvent for oils, fats, lacquers, varnishes, rubber waxes, and resins and as a starting material in the manufacture of organic compounds. (5,12)
- Carbon tetrachloride was formerly used as a dry cleaning agent, fire extinguisher, grain fumigant, and pesticide. (1,5,12)

Conversion Factors:

To convert from ppm to mg/m^3: mg/m^3 = (ppm) × (molecular weight of the compound)/(24.45). For carbon tetrachloride: 1 ppm = 6.3 mg/m^3.

Health Data from Inhalation Exposure

Concentration (mg/m^3)	Health numbers[a]	Regulatory, advisory numbers[b]	Reference
100,000.0			
-- -- -- -- 10,000.0	• LC_{50} (mice) (59,938 mg/m^3) • LC_{50} (rats) (50,336 mg/m^3)		7 7
-- -- -- -- 100.0			
-- -- -- -- 10.0		• MSHA standard (63 mg/m^3) • ACGIH TLV (31 mg/m^3) • OSHA PEL and NIOSH REL (12.6 mg/m^3)	7 7 7
-- -- -- -- 1.0			
-- -- -- -- 0.1			
-- -- --			

-- 0.01			
-- -- -- -- 0.001			
-- -- -- -- 0.0001			
-- -- -- -- 0.00001	• EPA Cancer Risk Level (1-in-a-million excess lifetime risk)[c] (7×10^{-5} mg/m^3)		9

See notes on following page.

ACGIH TLV--American Conference of Governmental and Industrial Hygienists' threshold limit value expressed as a time-weighted average; the concentration of a substance to which most workers can be exposed without adverse effects.

LC_{50} (Lethal Concentration$_{50}$)--A calculated concentration of a chemical in air to which exposure for a specific length of time is expected to cause death in 50% of a defined experimental animal population.

MSHA--Mine Safety and Health Administration.

NIOSH REL--National Institute of Occupational Safety and Health's recommended exposure limit; NIOSH-recommended exposure limit for an 8- or 10-h time-weighted-average exposure and/or ceiling.

OSHA PEL--Occupational Safety and Health Administration's permissible exposure limit expressed as a time-weighted average; the concentration of a substance to which most workers can be exposed without adverse effect averaged over a normal 8-h workday or a 40-h workweek.

[a] Health numbers are toxicological numbers from animal testing or risk assessment values developed by EPA.

[b] Regulatory numbers are values that have been incorporated in Government regulations, while advisory numbers are nonregulatory values provided by the Government or other groups as advice.

[c] These cancer risk estimates were derived from oral data and converted to provide the estimated inhalation risk.

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1. *Micrograms per cubic meter is the unit of measurement for chemicals in air.
