UNITED NATIONS

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UNEP/FAO/RC/CRC.2/13/Add.1

United Nations Environment Programme

Food and Agriculture Organization of the United Nations

Distr.: General
1 December 2005

English only

Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade
Chemical Review Committee
Second meeting
Geneva, 13–17 February 2006
Item 5 (b) 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: DBCP

DBCP: supporting documentation provided by Canada

Note by the secretariat

The annex to the present note contains the supporting documentation provided by Canada in support of its final regulatory action on DBCP.

* UNEP/FAO/RC/CRC.2/1.

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Annex

List of supporting documentation on DBCP from Canada

- Focused summary
- CCHOS webpage: HSDB 1,2-DIBROMO-3-CHLOROPROPANE.htm
- letter dated Sept 06, 1977: DBCP.correspondence.06 Sept77.pdf
- letter dated Sept 23, 1977: DBCP.correspondence.23 Sept77.pdf

Focussed Summary for DBCP (Canada)

Introduction

a) The events that led to the final regulatory action;

Concerns for potential occupational exposure and fertility effects as well as the suspected carcinogenicity of DBCP (dibromochloropropane) were raised in Canada. The registrant ceased all formulation and distribution of DBCP products and informed customers of possible dangers.

b) The significance of the regulatory action, e.g., one use or many uses, level or degree of exposure;

All pest control uses and formulations of DBCP are prohibited as of January 01, 1978. Unless registered under the Canadian Pest Control Products Act, pesticides may not be imported, sold or used in Canada. DBCP is not registered for pest control use in Canada.

c) An overview of the regulatory system of the notifying country, if relevant;

At the time the regulatory decision was taken, the Department of Agriculture was the federal department responsible for the regulation of pest control products in Canada. The Department of Agriculture, the Department of Health and Welfare, the Department of Environment, the Department of Natural Resources and the Department of Fisheries and Oceans provided advice to the Minister of Agriculture with regard to the health, environmental and value assessments required by the *Pest Control Products Act*.

Since 1995, Health Canada's Pest Management Regulatory Agency (PMRA) is the federal agency responsible for the regulation of pest control products in Canada and undertakes review of all aspects of pesticide pre and post market assessment, including health, environment and value assessments.

Before a pesticide is considered for registration in Canada, it must undergo extensive testing to determine the potential risks posed to human health and the environment and the pesticide's value. New pest control products cannot be marketed unless the risks to health and the environment associated with their use, and the product's value, are acceptable. Their continued acceptability over many years on the market must be ensured through re-evaluation and special review.

d) The scope of the regulatory action: a precise description of the chemicals subject to the regulatory action.

All pest control uses and formulations of DBCP are prohibited. Unless registered under the Canadian Pest Control Products Act, pesticides may not be imported, sold or used in Canada. DBCP is not registered for pest control use in Canada.

Risk evaluation

a) Key findings of the national risk evaluation;

DBCP was suspected to induce reproductive effects in men (i.e., sterility) through occupational exposure and suspected to be a carcinogen.

b) Key data reviews consulted together with a brief description;

Not Available.

Attached letter dated Sept 7, 1977, from the Department of Health and Welfare, Canada, refer to incidents of sterility in workers, and upcoming studies highlighting risk of carcinogenicity.

c) Reference to national studies, e.g. toxicological and ecotoxicity studies;

Not Available.
Attached letter dated Sept 7, 1977, the Department of Health and Welfare, Canada, refer to incidents of sterility in workers, and upcoming studies highlighting risk of carcinogenicity.

d) A summary of actual or potential human exposure and/or environmental fate.

DBCP is a volatile chemical and inhalation could be hazardous. There is a potential of occupational risk to workers using DBCP as a fumigant, and at formulating plants.

Risk reduction and relevance to other States

a) Estimates of the quantity of chemicals used, or imported/exported, at the time of the regulatory action and, if possible, information on ongoing trade;

Information on quantity of chemicals used, imported/exported at the time of the regulatory action is not currently available.

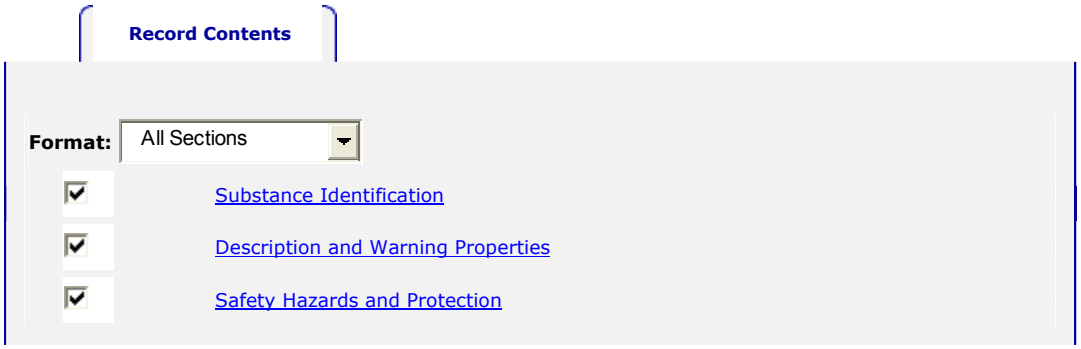
All pest control uses and formulations of DBCP are prohibited in Canada.

b) Relevance of the control action to other States, i.e., those with similar conditions of use;

DBCP is a volatile chemical and inhalation could be hazardous. There is a potential of occupational risk to workers using DBCP as a fumigant, and at formulating plants. Such conditions may occur in other States.

c) Comments on the typical use of the chemical in the notifying country, with comments on possible misuse if appropriate.

DBCP was used in Canada as a soil sterilant for the control of nematodes.
Risks from occupational exposure were associated with normal production and application practices.



- Fire and Reactivity
- Protective Equipment and Controls
- Storage, Cleanup and Disposal
- Health Hazards and Toxic Effects
- Emergency Treatment
- Metabolism and Pharmacology
- Environmental Fate and Exposure Potential
- Sources and Concentrations
- Human Environmental Exposure
- Standards and Regulations
- Monitoring and Analysis Methods
- Manufacturing and Use Information
- Chemical and Physical Properties
- References

REFRESH RECORD

SUBSTANCE IDENTIFICATION

HSDB Chemical Name 1,2-DIBROMO-3-CHLOROPROPANE
HSDB Number 1629
Last Revision Date 2003/08/29
Last Review Date Reviewed by SRP on 1/23/1997
CAS Registry Number 96-12-8
Synonyms

AI3-18445; BBC 12; BBCP [REF-1, p.464]; Caswell No 287; 1-CHLORO-2,3-DIBROMOPROPANE [REF-2, p.240]; 3-CHLORO-1,2-DIBROMOPROPANE; DBCP; DIBROMCHLORPROPAN (GERMAN); 1,2-DIBROM-3-CHLOR-PROPAN (GERMAN) [REF-3]; DIBROMOCHLOROPROPANE; 1,2-Dibromo-3-chloropropane (DBCP)-EM [REF-4]; 1,2-DIBROMO-3-CLORO-PROPANO (ITALIAN); 1,2-DIBROOM-3-CHLOORPROPAAN (DUTCH); Nematocide EM 12.1 [REF-4]; Nematocide EM 15.1 [REF-4]; EPA Pesticide Chemical Code 011301; FUMAGON; Fumazon 86 [REF-5, p.V-261]; FUMAZONE [REF-6, p.267]; Fumazone 86E [REF-5, p.V-261]; NCI-C00500; NEMABROM; NEMAFUME; NEMAGON [REF-6, p.267]; NEMAGON 20; NEMAGON 90; NEMAGON 206 [REF-3]; NEMAGON 20G; NEMAGON SOIL FUMIGANT; NEMANAX; Nemanex; NEMAPAZ; NEMASET; Durham Nematicode EM 17.1 [REF-4]; NEMAZON; OS1897 [REF-7, p.438]; OXY DBCP; PROPANE, 1-CHLORO-2,3-DIBROMO-; PROPANE, 1,2-DIBROMO-3-CHLORO-; SD 1897; Nematocide Solution EM 17.1 [REF-4]; Gro-Tone Nematode Granular [REF-4]

Molecular Formula C3-H5-Br2-Cl [REF-8, p.873]
Shipping Number/Name

UN 2872; Dibromochloropropane IMO 6.1; Dibromochloropropane

DESCRIPTION AND WARNING PROPERTIES

Color/Form
Colorless liquid when pure [REF-20, p.369]

Odor
PUNGENT ODOR [REF-21, p.512] Pungent odor at high concentrations. [REF-22, p.92]

Taste
The threshold for taste ... was reported to be 0.01 mg/l. [REF-23, p.I-3]

Odor Threshold
Low odor threshold= 0.0965 mg/cu m; High odor threshold= 0.2895 mg/cu m; Irritating concn= 1.93 mg/cu m [REF-35]

Skin, Eye, And Respiratory Irritations
MAY BE IRRITATING TO SKIN, MUCOUS MEMBRANES. [REF-7, p.438]

SAFETY HAZARDS AND PROTECTION

DOT Emergency Guidelines

- Health: Inhalation of vapors or dust is extremely irritating. May cause burning of eyes and flow of tears. May cause coughing, difficult breathing and nausea. Brief exposure effects last only a few minutes. Exposure in an enclosed area may be very harmful. Fire will produce irritating, corrosive and/or toxic gases. Runoff from fire control or dilution water may cause pollution. [QR] [REF-32, p.G-159]

- Fire or explosion: Some of these materials may burn, but none ignite readily. Containers may explode when heated. [QR] [REF-32, p.G-159]

- Public safety: CALL Emergency Response Telephone Number. ... Isolate spill or leak area immediately for at least 25 to 50 meters (80 to 160 feet) in all directions. Keep unauthorized personnel away. Stay upwind. Keep out of low areas. Ventilate closed spaces before entering. [QR] [REF-32, p.G-159]

- Protective clothing: Wear positive pressure self-contained breathing apparatus (SCBA). Wear chemical protective clothing which is specifically recommended by the manufacturer. It may provide little or no thermal protection. Structural firefighters' protective clothing provides limited protection in fire situations ONLY; it is not effective in spill situations. [QR] [REF-32, p.G-159]

- Evacuation: ... Fire: If tank, rail car or tank truck is involved in a fire, ISOLATE for 800 meters (1/2 mile) in all directions; also, consider initial evacuation for 800 meters (1/2 mile) in all directions. [QR] [REF-32, p.G-159]

- Fire: Small fires: Dry chemical, CO2, water spray or regular foam. Large fires: Water spray, fog or regular foam. Move containers from fire area if you can do it without risk. Dike fire control water for later disposal; do not scatter the material. Fire involving tanks or car/trailer loads: Fight fire from maximum distance or use unmanned hose holders or monitor nozzles. Do not get water inside containers. Cool containers with flooding quantities of water until well after fire is out. Withdraw immediately in case of rising sound from venting safety devices or discoloration of tank. ALWAYS stay away from tanks engulfed in fire. For massive fire, use unmanned hose holders or monitor nozzles; if this is impossible, withdraw from area and let fire burn. [QR] [REF-32, p.G-159]

- Spill or leak: Do not touch or walk through spilled material. Stop leak if you can do it without risk. Fully encapsulating, vapor protective clothing should be worn for spills and leaks with no fire. Small spills: Take up with sand or other noncombustible absorbent material and place into containers for later disposal. Large spills: Dike far ahead of liquid spill for later disposal. Prevent

entry into waterways, sewers, basements or confined areas. [QR] [REF-32, p.G-159]

- First aid: Move victim to fresh air. Call 911 or emergency medical service. Apply artificial respiration if victim is not breathing. Do not use mouth-to-mouth method if victim ingested or inhaled the substance; induce artificial respiration with the aid of a pocket mask equipped with a one-way valve or other proper respiratory medical device. Administer oxygen if breathing is difficult. Remove and isolate contaminated clothing and shoes. In case of contact with substance, immediately flush skin or eyes with running water for at least 20 minutes. For minor skin contact, avoid spreading material on unaffected skin. Keep victim warm and quiet. Effects should disappear after individual has been exposed to fresh air for approximately 10 minutes. Ensure that medical personnel are aware of the material(s) involved, and take precautions to protect themselves. [QR] [REF-32, p.G-159]

FIRE AND REACTIVITY

Fire Potential

- 1,2-Dibromo-3-chloropropane (DBCP) itself is classified in the USA as a combustible liq in class IIIA; formulations of DBCP incl kerosene or other flammable solvents fall into the flammable range (class IB for formulations made with kerosene). [REF-24, p.622]

Flash Point

170 DEG F (OPEN CUP) [REF-33]

Reactivities and Incompatibilities

- Chemically-active metals such as aluminum, magnesium & tin alloys [QR] [REF-34, p.92]

Decomposition

- 195.5 deg C at 760 mm Hg, with decomp [REF-24, p.621]

PROTECTIVE EQUIPMENT AND CONTROLS

Protective Equipment and Clothing

- Protective clothing shall be resistant to the penetration & to the chemical action of dibromochloropropane. Additional protection, incl gloves, bib-type aprons, boots & overshoes, shall be provided for, & worn by, each employee during any operation that may cause direct contact with liq. ... [REF-36, p.309]

- Unless eye protection is afforded by a respirator hood or facepeice, protective goggles (splash-proof safety goggles (cup-cover type dust & splash safety goggles)) ... or a face shield (8-in minimum) shall be worn at operations where there is danger of contact of the eyes with liquid dibromochloropropane because of spills or splashes. [REF-36, p.308]

- PRECAUTIONS FOR "CARCINOGENS": ... dispensers of liq detergent /should be available./ ... Safety pipettes should be used for all pipetting. ... In animal laboratory, personnel should ... wear protective suits (preferably disposable, one-piece & close-fitting at ankles and wrists), gloves, hair covering & overshoes. ... In chemical laboratory, gloves & gowns should always be worn ... however, gloves should not be assumed to provide full protection. Carefully fitted masks or respirators may be necessary when working with particulates or gases, & disposable plastic aprons might provide addnl protection. ... gowns ... /should be/ of distinctive color, this is a reminder that they are not to be worn outside the laboratory. /Chemical Carcinogens/ [REF-37, p.8]

- Vendor recommendations concerning the protective qualities of materials to minimize potential exposure to 1,2-dibromo-3-chloropropane are as follows: Nitrile and polyvinyl chloride received fair or poor ratings from three or more vendors; Polyethylene and chlorinated polyethylene received fair or poor ratings from less than three vendors. [REF-38, p.78]

- Wear appropriate personal protective clothing to prevent skin contact. [QR] [REF-34, p.93]

- Wear appropriate eye protection to prevent eye contact. [QR] [REF-34, p.93]

- Eyewash fountains should be provided in areas where there is any possibility that workers could be exposed to the substance; this is irrespective of the recommendation involving the wearing of eye protection. [QR] [REF-34, p.93]

- Facilities for quickly drenching the body should be provided within the immediate work area for emergency use where there is a possibility of exposure. [QR] [REF-34, p.93]

- Recommendations for respirator selection. Condition: At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration: Respirator Class(es): Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode. Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained breathing apparatus operated in pressure-demand or other positive-pressure mode. [QR] [REF-34, p.93]

- Recommendations for respirator selection. Condition: Escape from suddenly occurring respiratory hazards: Respirator Class(es): Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister having a high-efficiency particulate filter. Any appropriate escape-type, self-contained breathing apparatus. [QR] [REF-34, p.93]

Other Preventative Measures

- Contact lenses should not be worn when working with this chemical. [QR] [REF-34, p.93]

- SRP: The scientific literature for the use of contact lenses in industry is conflicting. The benefit or detrimental effects of wearing contact lenses depend not only upon the substance, but also on factors including the form of the substance, characteristics and duration of the exposure, the uses of other eye protection equipment, and the hygiene of the lenses. However, there may be individual substances whose irritating or corrosive properties are such that the wearing of contact lenses would be harmful to the eye. In those specific cases, contact lenses should not be worn. In any event, the usual eye protection equipment should be worn even when contact lenses are in place.

- Transfers of 1,2-dibromo-3-chloropropane (DBCP) from one container to another should be made through closed systems, with venting back to the original container or through charcoal or other absorptive or destructive arrangement that will prevent escape of DBCP into the occupational environment. No acceptable chem decontamination for DBCP is known; destruction by incineration requires dilution with a flammable solvent and passage of the products of burning through scrubbers to remove the hydrogen chloride and hydrogen bromide produced. [REF-24, p.623]

- Protective clothing or gear that becomes contaminated should be washed at once with soap or water or discarded. If the odor of 1,2-dibromo-3-chloropropane persists on clothing or protective gear after washing & aeration, the clothing or gear should not be worn. [REF-24, p.623]

- The material must not be allowed to remain on the skin. [REF-6, p.268]

- PRECAUTIONS FOR "CARCINOGENS": Smoking, drinking, eating, storage of food or of food & beverage containers or utensils, & the application of cosmetics should be prohibited in any laboratory. All personnel should remove gloves, if worn, after completion of procedures in which carcinogens have been used. They should ... wash ... hands, preferably using dispensers of liq detergent, & rinse ... thoroughly. Consideration should be given to appropriate methods for cleaning the skin, depending on nature of the contaminant. No standard procedure can be recommended, but the use of organic solvents should be avoided. Safety pipettes should be used for all pipetting. /Chemical Carcinogens/ [REF-37, p.8]

- PRECAUTIONS FOR "CARCINOGENS": ... Operations connected with synth & purification ... should be carried out under well-ventilated hood. Analytical procedures ... should be carried out with care & vapors evolved during ... procedures should be removed. ... Expert advice should be obtained before existing fume cupboards are used ... & when new fume cupboards are installed. It is desirable that there be means for decreasing the rate of air extraction, so that carcinogenic powders can be handled without ... powder being blown around the hood. Glove boxes should be kept under negative air pressure. Air changes should be adequate, so that concn of vapors of volatile carcinogens will not occur. /Chemical Carcinogens/ [REF-37, p.8]

- PRECAUTIONS FOR "CARCINOGENS": Vertical laminar-flow biological safety cabinets may be used for containment of in vitro procedures ... provided that the exhaust air flow is sufficient to provide an inward air flow at the face opening of the cabinet, & contaminated air plenums that are under positive pressure are leak-tight. Horizontal laminar-flow hoods or safety cabinets, where filtered air is blown across the working area towards the operator, should never be used ... Each cabinet or fume cupboard to be used ... should be tested before work is begun (eg, with fume bomb) & label fixed to it, giving date of test & avg air-flow measured. This test should be repeated periodically & after any structural changes. /Chemical Carcinogens/ [REF-37, p.9]

- PRECAUTIONS FOR "CARCINOGENS": Principles that apply to chem or biochem lab also apply to microbiological & cell-culture labs ... Special consideration should be given to route of admin. ... Safest method of administering volatile carcinogen is by injection of a soln. Admin by topical application, gavage, or intratracheal instillation should be performed under hood. If chem will be exhaled, animals should be kept under hood during this period. Inhalation exposure requires special equipment. ... unless specifically required, routes of admin other than in the diet should be used. Mixing of carcinogen in diet should be carried out in sealed mixers under fume hood, from which the exhaust is fitted with an efficient particulate filter. Techniques for cleaning mixer & hood should be devised before expt begun. When mixing diets, special protective clothing &, possibly, respirators may be required. /Chemical Carcinogens/ [REF-37, p.9]

- PRECAUTIONS FOR "CARCINOGENS": When ... admin in diet or applied to skin, animals should be kept in cages with solid bottoms & sides & fitted with a filter top. When volatile carcinogens are given, filter tops should not be used. Cages which have been used to house animals that received carcinogens should be decontaminated. Cage-cleaning facilities should be

installed in area in which carcinogens are being used, to avoid moving of ... contaminated /cages/. It is difficult to ensure that cages are decontaminated, & monitoring methods are necessary. Situations may exist in which the use of disposable cages should be recommended, depending on type & amt of carcinogen & efficiency with which it can be removed. /Chemical Carcinogens/ [REF-37, p.10]

- PRECAUTIONS FOR "CARCINOGENS": To eliminate risk that ... contamination in lab could build up during conduct of expt, periodic checks should be carried out on lab atmospheres, surfaces, such as walls, floors & benches, & ... interior of fume hoods & airducts. As well as regular monitoring, check must be carried out after cleaning-up of spillage. Sensitive methods are required when testing lab atmospheres. ... Methods ... should ... where possible, be simple & sensitive. ... /Chemical Carcinogens/ [REF-37, p.10]

- PRECAUTIONS FOR "CARCINOGENS": Rooms in which obvious contamination has occurred, such as spillage, should be decontaminated by lab personnel engaged in expt. Design of expt should ... avoid contamination of permanent equipment. ... Procedures should ensure that maintenance workers are not exposed to carcinogens. ... Particular care should be taken to avoid contamination of drains or ventilation ducts. In cleaning labs, procedures should be used which do not produce aerosols or dispersal of dust, ie, wet mop or vacuum cleaner equipped with high-efficiency particulate filter on exhaust, which are avail commercially, should be used. Sweeping, brushing & use of dry dusters or mops should be prohibited. Grossly contaminated cleaning materials should not be re-used ... If gowns or towels are contaminated, they should not be sent to laundry, but ... decontaminated or burnt, to avoid any hazard to laundry personnel. /Chemical Carcinogens/ [REF-37, p.10]

- PRECAUTIONS FOR "CARCINOGENS": Doors leading into areas where carcinogens are used ... should be marked distinctively with appropriate labels. Access ... limited to persons involved in expt. ... A prominently displayed notice should give the name of the Scientific Investigator or other person who can advise in an emergency & who can inform others (such as firemen) on the handling of carcinogenic substances. /Chemical Carcinogens/ [REF-37, p.11]

- SRP: Contaminated protective clothing should be segregated in such a manner so that there is no direct personal contact by personnel who handle, dispose, or clean the clothing. Quality assurance to ascertain the completeness of the cleaning procedures should be implemented before the decontaminated protective clothing is returned for reuse by the workers.

- PRECAUTIONS FOR "CARCINOGENS": In animal laboratory, personnel should remove their outdoor clothes & wear protective suits (preferably disposable, one-piece & close-fitting at ankles & wrists), gloves, hair covering & overshoes. ... clothing should be changed daily but ... discarded immediately if obvious contamination occurs ... /also,/ workers should shower immediately. In chemical laboratory, gloves & gowns should always be worn ... however, gloves should not be assumed to provide full protection. Carefully fitted masks or respirators may be necessary when working with particulates or gases, & disposable plastic aprons might provide addnl protection. If gowns are of distinctive color, this is a reminder that they should not be worn outside of lab. /Chemical Carcinogens/ [REF-37, p.8]

- The worker should immediately wash the skin when it becomes contaminated. [QR] [REF-34, p.93]

- The worker should wash daily at the end of each work shift. [QR] [REF-34,

p.93]

- Work clothing that becomes wet or significantly contaminated should be removed and replaced. [QR] [REF-34, p.93]

- Workers whose clothing may have become contaminated should change into uncontaminated clothing before leaving the work premises. [QR] [REF-34, p.93]

STORAGE, CLEANUP AND DISPOSAL

Cleanup Methods

- PRECAUTIONS FOR "CARCINOGENS": A high-efficiency particulate arrestor (HEPA) or charcoal filters can be used to minimize amt of carcinogen in exhausted air ventilated safety cabinets, lab hoods, glove boxes or animal rooms ... Filter housing that is designed so that used filters can be transferred into plastic bag without contaminating maintenance staff is avail commercially. Filters should be placed in plastic bags immediately after removal ... The plastic bag should be sealed immediately ... The sealed bag should be labelled properly ... Waste liquids ... should be placed or collected in proper containers for disposal. The lid should be secured & the bottles properly labelled. Once filled, bottles should be placed in plastic bag, so that outer surface ... is not contaminated ... The plastic bag should also be sealed & labelled. ... Broken glassware ... should be decontaminated by solvent extraction, by chemical destruction, or in specially designed incinerators. /Chemical Carcinogens/ [REF-37, p.15]

Disposal Methods

- Generators of waste (equal to or greater than 100 kg/mo) containing this contaminant, EPA hazardous waste number U066, must conform with USEPA regulations in storage, transportation, treatment and disposal of waste. [REF-42]

- No acceptable chem decontamination for 1,2-dibromo-3-chloropropane is known; destruction by incineration requires dilution with a flammable solvent and passage of the products of burning through scrubbers to remove the hydrogen chloride and hydrogen bromide produced. [REF-24, p.623]

- Dibromochloropropane is reported to be stable to neutral and acid media. It is hydrolyzed by alkali to 2-bromoallyl alcohol. Controlled incineration with adequate scrubbing and ash disposal facilities. The Manufacturing Chemists Association suggest the following disposal procedures for bromine-containing compounds: - pour onto vermiculite, sodium bicarbonate or a sand-soda ash mixture (90-10). Mix and shovel into paper boxes. Place in an open incinerator. Cover with scrap wood and paper. Ignite with an excelsior train; stay on upwind side or dump into a closed incinerator with afterburner. - Dissolve in a flammable solvent. Spray into the firebox of an incinerator equipped with afterburner and scrubber (alkali). Recommendable methods: Adsorption & incineration. Peer review: Dilute well with hydrocarbon fuel. Adsorb on vermiculite or sodium carbonate. Incinerate with excess non halogenated waste. (Peer-review conclusions of an IRPTC expert consultation (May 1985)) [REF-43, p.267]

- PRECAUTIONS FOR "CARCINOGENS": There is no universal method of disposal that has been proved satisfactory for all carcinogenic compounds & specific methods of chem destruction ... published have not been tested on all kinds of carcinogen-containing waste. ... Summary of avail methods & recommendations ... /given/ must be treated as

guide only. /Chemical Carcinogens/ [REF-37, p.14]

- PRECAUTIONS FOR "CARCINOGENS": ... Incineration may be only feasible method for disposal of contaminated laboratory waste from biological expt. However, not all incinerators are suitable for this purpose. The most efficient type ... is probably the gas-fired type, in which a first-stage combustion with a less than stoichiometric air:fuel ratio is followed by a second stage with excess air. Some ... are designed to accept ... aqueous & organic-solvent solutions, otherwise it is necessary ... to absorb soln onto suitable combustible material, such as sawdust. Alternatively, chem destruction may be used, esp when small quantities ... are to be destroyed in laboratory. /Chemical Carcinogens/ [REF-37, p.15]

- PRECAUTIONS FOR "CARCINOGENS": High-efficiency particulate arrestor filters ... can be disposed of by incineration. For spent charcoal filters, the adsorbed material can be stripped off at high temp & carcinogenic wastes generated by this treatment conducted to & burned in an incinerator. ... LIQUID WASTE: ... Disposal should be carried out by incineration at temp that ... ensure complete combustion. SOLID WASTE: Carcasses of lab animals, cage litter & misc solid wastes ... should be disposed of by incineration at temp high enough to ensure destruction of chem carcinogens or their metabolites. /Chemical Carcinogens/ [REF-37, p.15]

- PRECAUTIONS FOR "CARCINOGENS": ... Small quantities of ... some carcinogens can be destroyed using chem reactions ... but no general rules can be given. ... As a general technique ... treatment with sodium dichromate in strong sulfuric acid can be used. The time necessary for destruction ... is seldom known ... but 1-2 days is generally considered sufficient when freshly prepd reagent is used. ... Carcinogens that are easily oxidizable can be destroyed with milder oxidative agents, such as saturated soln of potassium permanganate in acetone, which appears to be a suitable agent for destruction of hydrazines or of compounds containing isolated carbon-carbon double bonds. Concn or 50% aqueous sodium hypochlorite can also be used as an oxidizing agent. /Chemical Carcinogens/ [REF-37, p.16]

- PRECAUTIONS FOR "CARCINOGENS": Carcinogens that are alkylating, arylating or acylating agents per se can be destroyed by reaction with appropriate nucleophiles, such as water, hydroxyl ions, ammonia, thiols & thiosulfate. The reactivity of various alkylating agents varies greatly ... & is also influenced by sol of agent in the reaction medium. To facilitate the complete reaction, it is suggested that the agents be dissolved in ethanol or similar solvents. ... No method should be applied ... until it has been thoroughly tested for its effectiveness & safety on material to be inactivated. For example, in case of destruction of alkylating agents, it is possible to detect residual compounds by reaction with 4(4-nitrobenzyl)-pyridine. /Chemical Carcinogens/ [REF-37, p.17]

- A potential candidate for liquid injection incineration at a temperature range of 650 to 1,600 deg C and a residence time of 0.1 to 2 seconds. A potential candidate for fluidized bed incineration at a temperature range of 450 to 980 deg C and residence times of seconds for liquids and gases, and longer for solids. A potential candidate for rotary kiln incineration at a temperature range of 820 to 1,600 deg C and residence times of seconds for liquids and gases, and hours for solids. [REF-44, p.3-12]

- Group I Containers: Combustible containers from organic or metallo-organic pesticides (except organic mercury, lead, cadmium, or arsenic compounds) should be disposed of in pesticide incinerators or in specified landfill sites. /Organic or metallo-organic pesticides/ [REF-45]

- Group II Containers: Non-combustible containers from organic or metallo-organic pesticides (except organic mercury, lead, cadmium, or arsenic compounds) must first be triple-rinsed. Containers that are in good condition may be returned to the manufacturer or formulator of the pesticide product, or to a drum reconditioner for reuse with the same type of pesticide product, if such reuse is legal under Department of Transportation regulations (eg 49 CFR 173.28). Containers that are not to be reused should be punctured ... and transported to a scrap metal facility for recycling, disposal or burial in a designated landfill. /Organic or metallo-organic pesticides/ [REF-45]

- The following wastewater treatment technology have been investigated for 1,2-dibromo-3-chloropropane: Resin absorption. [REF-46, p.E-195]

HEALTH HAZARDS AND TOXIC EFFECTS

Non-Human Toxicity Values

LD50 Rabbit (male) oral 100 mg/kg [REF-84, p.V-2]
LC50 Rat (Long-Evans male and female) 1,480 mg/cu m/hr [REF-84, p.V-2]
LD50 Rabbit (albino) dermal 1,400 mg/kg /95-8% purity/ [REF-84, p.V-2]
LD50 Mouse ip 123 mg/kg />99% purity/ [REF-85, p.V-3]
LD50 Mouse (female) oral 260 mg/kg /95-8% purity/ [REF-86, p.V-2]
LD50 Rat (male) oral 170 mg/kg /95-8% purity/ [REF-84, p.V-2]
LD50 Guinea pig (male) oral 210 mg/kg /95-8% purity/ [REF-87, p.V-2]

Human Toxicity Excerpts

Sperm count were determined for 36 workers potentially exposed to 1,2-dibromo-3-chloropropane (DBCP) (the extent of exposure to other pesticides is not clear). Of these, 11 were found to be vasectomized. Of the remaining 25, 3 had sperm counts between 10 & 30 million/ml; 11 who had normal counts (> 40 million/ml) had had a short duration of exposure ([REF-50]

ANALYSES OF SEMEN SAMPLES TAKEN FROM EXPOSED & NON-EXPOSED 1,2-DIBROMO-3-CHLOROPROPANE (DBCP) WORKERS REVEALED THAT AVG YFF (Y-CHROMOSOME NONDISJUNCTION) FREQUENCY WAS 3.8% IN EXPOSED & 1.2% IN NON-EXPOSED. AVG Y-CHROMOSOME FREQUENCY WAS 41.8% IN EXPOSED & 41.5% IN NON-EXPOSED. THE AVG LENGTH OF EXPOSURE WAS APPROX 15.2 MO. [REF-51]

SIX WORKERS IN 1,2-DIBROMO-3-CHLOROPROPANE FACTORY WERE EXAMINED. AZOOSPERMIA DIAGNOSED IN EACH. THE PRESENTING SYMPTOM IN 2 PATIENTS WAS INFERTILITY, & A DECR LIBIDO OR IMPOTENCE IN THE OTHER PATIENTS. ELEVATED PLASMA FOLLICLE-STIMULATING HORMONE LEVELS WERE DEMONSTRATED. [REF-52]

A study summarizes a four year follow-up of 20 production workers with 1,2-dibromo-3-chloropropane induced testicular dysfunction. It is suggested that the gonadotoxic effect of 1,2-dibromo-3-chloropropane (DBCP) in human males is reversible, being inversely related to previous exposure time and being most likely to occur in the presence of normal follicle stimulating hormone values. The further incr in plasma follicle stimulating hormone and luteinizing hormone & the moderate decr in the mean testosterone level in non-recovered workers may suggest a delayed toxic effect of DBCP on Sertoli and Leydig cell function during the four yr follow-up period. [REF-53]

A group of 22 factory workers who were exposed to dibromochloropropane (DBCP) during its production were reassessed 8 years after being diagnosed as azoospermic (15) or oligozoospermic (7) when initially evaluated in 1977. A follow-up study after 4 yr had indicated that the gonadotoxic effects of DBCP might be reversible. The objective of the eight yr reassessment was to confirm this reversible effect as well as to assess the outcome of pregnancies among wives of DBCP exposed workers. It was observed that recovery of spermatogenesis occurred in four oligozoospermic and three azoospermic men whose plasma follicle stimulating hormone concentration was

normal during the whole period. A marked increase in this hormone and luteinizing hormone levels above the upper limit of normal was found in azoospermic men who did not recover. No significant changes in follicle stimulating hormone levels were detected in both recovered and non-recovered oligozoospermic workers. It was also concluded that paternal exposure to DBCP was not associated with an increased risk of fetal malformations or spontaneous abortions. There were 44 conceptions; 22 occurred during paternal exposure to DBCP and 22 during the recovery period. These 44 conceptions resulted in 36 live births (and one ongoing uncomplicated pregnancy). The spontaneous abortion rate did not differ from the frequency found in the pre-exposed or non-exposed pregnancies. The three induced abortions were not related to paternal DBCP exposure. [REF-54]

... Study of 62 agricultural workers in Israel suggests that spontaneous abortions may have been more frequent in wives of 1,2-dibromo-3-chloropropane-exposed workers (19% of 121 pregnancies) than in wives of unexposed workers (6.6% of 76 pregnancies). [REF-55, p.316]

In man ... /it/ produces moderate depression of the CNS and pulmonary congestion after exposure by inhalation, and ... /causes/ acute gastrointestinal distress and pulmonary edema after ingestion. [REF-56, p.1643]

BLOOD & SEMEN SAMPLES WERE ANALYZED FROM 73 AGRICULTURAL WORKERS FROM 6 DIFFERENT STATES. SPERM COUNTS DECR IN ORDER OF RESEARCHERS & SALESMEN, FARMERS, FORMULATORS & CUSTOM APPLICATORS. DATA SHOW VARIATION OF EFFECT IN EXPOSURE TO DIFFERENT AMT OF 1,2-DIBROMO-3-CHLOROPROPANE. [REF-57]

... Twenty-four pesticide applicators who were exposed to 1,2-dibromo-3-chloropropane (DBCP) for 2 mo or more during the yr in which they were studied had a mean sperm count of 22 million/ml. Thirty-one applicators ... exposed for less than 2 mo but more than 2 wk had a mean sperm count of 39 million/ml, while the mean count for 19 men exposed for less than 2 wk was 46 million/ml. Twenty-two applicators who reported no exposure to ... /DBCP/ had a mean count of 62 million/ml. This trend was statistically significant (p= 0.018); however, only the men exposed for 2 mo or more had counts which were significantly lower (p [REF-58]

A historical prospective mortality study was conducted on 3579 white male workers employed between 1935 and 1976 with potential exposures to brominated cmpd incl 1,2-dibromo-3-chloropropane (DBCP). Workers were classified by their work areas or departments in order to estimate their potential exposures. A significant mortality excess due to diseases of the circulatory system was observed among workers potentially exposed to DBCP. [REF-59]

A group of some 3500 workers classified as having had exposure ... to several cmpd incl 1,3-dibromo-3-chloropropane (DBCP), was studied in 4 facilities in the USA. Among the 1034 workers ever exposed to ... /DBCP/, a slightly incr, statistically nonsignificant mortality rate from cancer was observed. Nine respiratory cancers were observed, whereas 5.0 would have been expected; of these, 7 were due to lung cancer (4.8 expected). Among 238 workers exposed on a routine basis, no cancer death was observed (Wong et al, 1984). In view of the number & the lack of control of confounding factors, the studies were considered to be inadequate /by the working group/. [REF-60, p.S7 191]

SYMPTOMATOLOGY: 1. (A) Inhalation, high vapor concn: gasping, refusal to breathe, coughing, substernal pain, and extreme respiratory distress at vapor concn over 1500 ppm. Irritation of eyes and upper respiratory mucosa appears promptly after exposure to concentrated vapors. Lacrimation and headache are prominent. Coma may occur rapidly. (B) Inhalation, low, vapor concn, central nervous depression and moderate irritation of respiratory system. Headache is frequent. 2. Dermal: severe skin irritation with marked inflammatory response of epidermis and underlying tissues. 3. Oral: acute gastrointestinal distress with pulmonary congestion and edema. Central nervous depression, perhaps even in the absence of impaired oxygen uptake. 4. By any route, possible late injuries to liver, kidneys and heart. 5. After inhalation exposure, malaise, headache, chest and abdominal discomfort and

irritability have been reported to persist for several weeks and perhaps for several years. /Dichloropropenes/ [REF-5, p.III-142]

MARKED IMPAIRMENT OF SPERMATOGENESIS WAS NOTED IN GROUP OF MEN EXPOSED TO 1,2-DIBROMO-3-CHLOROPROPANE IN A PLANT, AS DEMONSTRATED BY SEMEN ANALYSES, TESTICULAR BIOPSIES, & HORMONE STUDIES. CONSIDERATION IS GIVEN TO POSSIBLE EFFECTS RESIDUAL LEVELS COULD PRODUCE IN CONSUMERS. [REF-61]

The effects of exposure to 1,2-dibromo-3-chloropropane (DBCP) for 1-7 yr on testicular physiology were evaluated in men by measuring the circulating levels of follicle-stimulating hormone, luteinizing hormone, androstenedione, testosterone, and dihydrotestosterone every 4 hr throughout a 24 hr period, and correlating this data with semen analysis & testicular biopsy. Above-normal concn of plasma follicle-stimulating hormone in 29 of 30 samples & plasma luteinizing hormone in 25 of 30 samples were observed. Androstenedione levels were lower than normal. DBCP caused profound damage of the germinal epithelium. The observed elevated levels of luteinizing hormone in the face of normal testosterone concn suggest damage to the Leydig cells, with the chronic overstimulation of those cells by luteinizing hormone being necessary to maintain essentially normal testosterone concn. Histologic evidence of Leydig cell hyperplasia support this interpretation. [REF-62]

At this point, DBCP appears to be the chemical agent with the most recognizable effect on the testis of any chemical studied in regard to occupational exposure. The impact dibromocloropropane has upon the testis is gross in character, as manifested by markedly decreased sperm counts. With the discovery of new sensitive laboratory analytical techniques and the use of sophisticated epidemiological methods, new studies will help define the impact of occupational exposures to chemical and physical agents on the reproductive potential of man. [REF-63]

44 Men whose exposure to dibromochloropropane in a formulation plant was first described in 1977. Five to 8 yr after the initial effects of dibromochloropropane exposure were discovered and all exposures terminated, there appeared to be no major changes in testicular function of most of the exposed men as measured by sperm concn or serum FSH levels. Recovery of sperm production in two of eight originally azoospermic workers was observed, and no increase in sperm production could be detected in men who had low sperm counts in 1977. [REF-64, p.705]

The mortality experience of a cohort of 548 employees at the Michigan Division of Dow Chemical Company who had potential exposure to 1,2-dibromo-3-chloropropane (DBCP) was updated through 1989. There were 68 total deaths in this cohort compared to 72.1 expected. There were 19 deaths from all malignancies compared to 19.0 expected. There were no deaths from stomach, liver, kidney, testes, or nasal cavity cancers. There were seven deaths from cancer of the lung compared to 6.6 expected. The findings do not suggest an incr risk for all malignant neoplasm mortality among 548 DBCP production and formulation male workers. Among the 81 workers who were in an exposure subgroup defined as direct with 1 or more years of experience, there were three lung cancer deaths observed to the 0.9 expected; however, smoking was a confounding factor. /Results indicate/ that even though this ... study nearly doubled the number of person years from the original study performed in 1984, the conclusions remain limited by the size of the cohort and the duration of the follow up period. [REF-65]

Non-Human Toxicity Excerpts

1,2-Dibromo-3-chloropropane ... tested on animal eyes both undiluted and as a 1% solution in propylene glycol caused slight pain and signs of irritation that lasted for one to two days, but no damage to the cornea. [REF-66, p.316]

IN 90 DAY FEEDING TRIALS THE LOWEST DOSE LEVEL CAUSING A DECR IN GROWTH RATE WAS: FOR FEMALE RATS 150 MG/KG, FOR MALE RATS 450 MG/KG. [REF-13, p.164]

DAILY ORAL ADMIN OF 70 MG/KG BODY WT (20% OF ACUTE LD50) TO RATS WAS LETHAL AFTER 3 WK OF DOSING. DEGENERATIVE EFFECTS WERE NOTED IN VASCULAR SYSTEM & IN ALL INTERNAL ORGANS. 1,2-DIBROMO-3-CHLOROPROPANE

(97% PURE) WAS GIVEN BY GAVAGE TO 190 RATS EITHER IN A DOSE OF 100 MG/KG BODY WT (SINGLE DOSE), OR IN REPEATED DOSES OF 10 MG/KG BODY WT FOR 5 MO. AFTER THE SINGLE DOSE, THE ANIMALS DEVELOPED ... NERVOUS SYSTEM DEPRESSION & WT LOSS. FOLLOWING REPEATED TREATMENT, AN EFFECT ON SPERMATOGENESIS WAS OBSERVED IN MALES, & NUMBER & VIABILITY OF SPERMATOZOA WERE DECR, ESTRUS WAS INHIBITED IN FEMALES. ... INHALATION OF CONCN OF OVER 600 MG/CU M (60 PPM) IN AIR CAUSED IRRITATION OF ... MUCOUS MEMBRANES & RESPIRATORY TRACT, HEPATIC DEGENERATION, NEUROTOXICITY, & NEPHROTOXICITY IN RATS. [REF-11, p.V20 90]

TWO GROUPS OF 50 MALE AND 50 FEMALE B6C3F1 HYBRID MICE 5-6 WK OLD WERE FED TECHNICAL-GRADE 1,2-DIBROMO-3-CHLOROPROPANE (MIN 90% PURITY) IN CORN OIL BY GAVAGE ON 5 CONSECUTIVE DAYS/WK. APPROX TIME-WEIGHTED AVG DOSES WERE 114 & 219 MG/KG FOR MALES AND 110 AND 209 MG/KG FOR FEMALES. TWO GROUPS, EACH OF 20 MALES & 20 FEMALES, WERE USED AS VEHICLE-TREATED & UNTREATED CONTROLS. LOW-DOSE ANIMALS & VEHICLE CONTROLS ... KILLED @ 60 & 78 WK & HIGH-DOSE ANIMALS AT 47 WK BECAUSE OF HIGH MORTALITY RELATED TO TUMORS. ... IN MALES, 40/50 OF HIGH-DOSE GROUP HAS DIED BY END OF WK 47, & 42/50 OF LOW-DOSE GROUP HAD DIED BY WK 59. IN FEMALES, 30/50 OF HIGH-DOSE GROUP HAD DIED BY END OF WK 47, & 41/50 OF LOW-DOSE GROUP ... BY WK 60. SQUAMOUS CELL CARCINOMAS OF FORESTOMACH OCCURRED IN 43/46 LOW-DOSE MALES, 47/49 HIGH-DOSE MALES, 50/50 LOW-DOSE FEMALES, AND 47/48 HIGH-DOSE FEMALES. THIS LESION OCCURRED WITH FREQUENT METASTASES TO ABDOMINAL VISCERA & LUNG. NO GASTRIC NEOPLASMS OCCURRED IN EITHER VEHICLE OR UNTREATED CONTROLS (NCI, 1978). [REF-11, p.V20 87]

TWO GROUPS OF 50 MALE AND 50 FEMALE OSBORNE-MENDEL RATS, 6-7 WK OLD WERE FED 1,2-DIBROMO-3-CHLOROPROPANE (MIN 90% PURE) IN CORN OIL BY GAVAGE AT APPROX TIME-WEIGHTED AVG DOSAGES OF 15 & 29 MG/KG BODY WT ON 5 CONSECUTIVE DAYS/WK. TWO GROUPS, EACH OF 20 MALES & 20 FEMALES, WERE USED AS ... CONTROLS. LOW- & HIGH-DOSE FEMALES WERE TREATED FOR 73 & 64 WK, RESPECTIVELY, & THEN KILLED ... HIGH-DOSE MALES ... TREATED FOR 64 WK & THEN KILLED; LOW-DOSE MALES WERE TREATED FOR 78 WK & THEN KILLED @ 83 WK. ... SQUAMOUS-CELL CARCINOMAS OF FORESTOMACH OCCURRED IN 47/50 BOTH LOW- AND HIGH-DOSE MALES, 38/50 LOW-DOSE FEMALES, & 29/49 HIGH-DOSE FEMALES. THESE LESIONS OCCURRED WITH FREQUENT METASTASES TO ABDOMINAL VISCERA & LUNGS. NO GASTRIC CARCINOMAS OCCURRED IN ... CONTROLS. IN FEMALES, ADENOCARCINOMAS OF THE MAMMARY GLAND OCCURRED IN 24/50 OF THE LOW-DOSE GROUP, IN 31/50 OF THE HIGH-DOSE GROUP, IN 2/20 UNTREATED CONTROLS AND IN NONE OF THE VEHICLE CONTROLS (NCI, 1978). [REF-11, p.V20 89]

1,2-DIBROMO-3-CHLOROPROPANE WAS MUTAGENIC IN SALMONELLA TYPHIMURIUM TA100, TA1530 & TA1535, BUT NOT IN TA1538, BOTH IN PRESENCE & ABSENCE OF LIVER MICROSOMAL ACTIVATION SYSTEM. [REF-11, p.V20 90]

AFTER CHRONIC ADMIN OF 1,2-DIBROMO-3-CHLOROPROPANE BY 1 OR MORE ROUTES TO HA:ICR SWISS MICE, IT WAS ACTIVE AS SKIN TUMOR INITIATOR IN THE TWO-STAGE CARCINOGENESIS ASSAYS; PHORBOL MYRISTATE ACETATE WAS USED AS A PROMOTER. IT ALSO INDUCED LUNG &/OR STOMACH TUMORS BY REPEATED SKIN APPLICATION. [REF-67]

1,2-DIBROMO-3-CHLOROPROPANE WAS MOST ACTIVE OF 4 RELATED 3-CARBON HALOGENATED & OXYGENATED CMPD WHEN TESTED FOR MUTAGENIC ACTIVITY BY AMES TEST (SALMONELLA TYPHIMURIUM, STRAIN TA-100), BUT REQUIRED ENZYMIC CONVERSION BY S9 MICROSOMAL PREPARATION TO ACTIVE MUTAGEN WHICH WAS DOSE-RELATED. [REF-68]

1,2-DIBROMO-3-CHLOROPROPANE INDUCED DOMINANT LETHALS IN RATS IN POST-MEIOTIC STAGE OF SPERMATOGENESIS, ESPECIALLY IN EARLY SPERMATID STAGE. IT DID NOT CAUSE DOMINANT LETHALS IN MICE. [REF-69]

... UP TO 50 MG/KG /1,2-DIBROMO-3-CHLOROPROPANE WAS ADMIN/ DAILY TO

RATS BY GAVAGE ON DAYS 6-15 OF GESTATION. SOME MATERNAL TOXICITY, FETAL WT DECR, & DECREASED FETAL VIABILITY WAS FOUND BUT NO INCREASE IN MALFORMATION. [REF-70, p.189]

... SINGLE INTRAPERITONEAL 100 MG/KG INJECTION OF 1,2-DIBROMO-3-CHLOROPROPANE TO PREPUBERTAL MALE MICE INDUCED SIGNIFICANT UNSCHEDULED DNA SYNTHESIS (DNA REPAIR) IN PREMEIOTIC GERM CELLS BUT NOT IN SPERMATOZOA. [REF-55, p.323]

RABBITS EXPOSED TO 1,2-DIBROMO-3-CHLOROPROPANE (10 PPM) BY INHALATION FOR 14 WK HAD NEARLY COMPLETE TESTICULAR ATROPHY BY 8TH WK. ALL STAGES OF SPERMATOGENESIS WERE ABSENT; LIPIDS WITHIN LEYDIG CELLS WERE INCR. RATS, SIMILARLY EXPOSED SHOWED 50% DECR IN TESTICULAR WT & PATCHY DECR IN SPERMATOGENESIS. [REF-71]

MALE RATS (AGE 14 WK) WERE EXPOSED CONTINUOUSLY TO 0.3-10 PPM OF 1,2-DIBROMO-3-CHLOROPROPANE. HYPERTROPHY OF ADRENALS & MARKED WT REDUCTION OF EPIDIDYMIS, TESTES & SEMINAL VESICLES WERE OBSERVED. REDUCTION IN NUMBER OF SPERMATOZOA IN EPIDIDYMIS, & REDUCTION IN WHITE BLOOD CELLS ALSO OCCURRED. [REF-72]

MALE RABBITS EXPOSED TO 1,2-DIBROMO-3-CHLOROPROPANE (10 PPM) FOR 8 WK BY INHALATION APPEARED INFERTILE WHEN MATED DURING 14TH WK. [REF-73]

... THE MUTAGENICITY OF DBCP /1,2-DIBROMO-3-CHLOROPROPANE/ BY AMES REVERSE MUTATION ASSAY /IN SALMONELLA TYPHIMURIUM, STRAIN TA1535 WAS INVESTIGATED/. ... /IT/ WAS CONCLUDED THAT IN THE ABSENCE OF S9 ACTIVATION IN RATS PRETREATED WITH AROCLOR, THE MUTAGENIC CAPABILITY OF STD DBCP PREPN (0 TO 1600 UG/PLATE) WAS DUE SOLELY TO EPICHLOROHYDRIN, WHICH WAS INCLUDED AS STABILIZER. HOWEVER, AFTER THE ADDN OF S9, TECHNICAL-GRADE & HIGHLY PURIFIED DBCP (20 TO 200 UG/PLATE) WERE EQUALLY MUTAGENIC. ON THE BASIC OF THOSE DATA ... /IT/ WAS CONCLUDED THAT DBCP IS A POTENT INDIRECT MUTAGEN IN BACTERIA. THAT CONCLUSION HAS BEEN CONFIRMED BY RECENT WORK ... /BY INVESTIGATORS/ WHO FOUND DBCP TO BE MUTAGENIC TO SALMONELLA TYPHIMURIUM TA1535 & TA100 & TO ESCHERICHIA COLI WP2 HCR. [REF-55, p.322]

1,2-DIBROMO-3-CHLOROPROPANE HAS BEEN SHOWN TO INDUCE SISTER-CHROMATID EXCHANGE (SCE) & CHROMOSOME ABERRATIONS IN CULTURED CHINESE HAMSTER CELLS OVER A RANGE OF APPLIED DOSES. [REF-55, p.322]

MALE & FEMALE RATS INHALED 0, 0.1, 1, OR 10 PPM 1,2-DIBROMO-3-CHLOROPROPANE (DBCP) VAPOR FOR 6 HR/DAY, 5 DAYS/WK FOR 14 WK FOLLOWED BY RECOVERY PERIODS OF UP TO 32 WK. DBCP DID NOT AFFECT THE ABILITY OF MALES TO IMPREGNATE FEMALES; HOWEVER, A DOMINANT LETHAL EFFECT WAS EVIDENT AT 10 PPM. MODERATE TESTICULAR ATROPHY & FOCAL AGGREGATES OF ALTERED CELLS IN THE ADRENAL CORTEX WERE OBSERVED IN RATS EXPOSED @ 10 PPM FOR 14 WK. LESIONS WERE OBSERVED IN THE ADRENAL CORTEX OF RECOVERY MALES & FEMALES FROM THE 10 PPM EXPOSURE LEVEL; FEMALES EXPOSED TO 1 PPM HAD SLIGHT ADRENAL CORTICAL LESIONS AT THE END OF THE RECOVERY PERIOD. INCR NUMBERS OF OVARIAN CYSTS OCCURRED IN FEMALES FROM THE 10 PPM LEVEL. BRAIN EFFECTS, INCL FOCAL OR MULTIFOCAL MINERALIZED DEPOSITS, WERE PRESENT IN MALES & FEMALES IN THE 10 PPM EXPOSURE GROUP. [REF-74]

1,2-Dibromo-3-chloropropane (DBCP) was evaluated for genotoxicity in the mouse spot test. Male PW mice, homozygous for 5 coat color mutations, were mated with C57BL/6 females. On day 10 of pregnancy, the females received ip injections of 106 mg/kg DBCP dissolved in soybean oil. The offspring were examined for recessive color spots for 14-30 days following birth. Pups from treated animals showed a significantly higher frequency (2.9%) of recessive color spots compared with solvent treated (0.6%) or untreated (0.9%) controls. Most of the spots induced by DBCP were light brown, which suggest that DBCP induced predominately point mutations in the pigment cells. Thus, DBCP is mutagenic in somatic cells of mice in vivo; however,

no teratogenic effects were observed. [REF-75]

1,2-Dibromo-3-chloropropane (DBCP) was evaluated in a specific-locus test for gene-mutation induction in the germ line of male (101 x C3H)F1 mice. A total of 144 males (3 groups) were injected ip with 80 mg/kg DBCP on 5 consecutive days for a total exposure of 400 mg/kg. One group of 12 males was given DBCP as a single dose of 90 mg/kg and another group of 24 males was given a single dose of 110 mg/kg. For treated spermatogonial stem cells, the finding of 2 mutations among 39519 offspring was not remarkable. From treated post stem-cell stages, no mutants were found among 6240 offspring. The fertility of DBCP-treated males was not altered. Thus, DBCP was negative in these tests and the highest ineffective dose tested was 400 mg/kg. [REF-76]

... 0.2 mg/ml concn of 1,2-dibromo-3-chloropropane (DBCP) in 0.01% ethanol or ethanol alone /was fed/ to Canton-S male Drosophila melanogaster for 72 hr then to individual males mated with Basc females. DBCP treatment produced sex-linked recessive mutations in 9.5% of the first brood. In Drosophila it also caused loss of X or Y chromosomes and induced increases in heritable translocations. [REF-55, p.322]

Male & female rats & mice were exposed to 0, 1, 5, or 25 ppm concn of 1,2-dibromo-3-chloropropane (DBCP) by inhalation 6 hr/day, 5 days/wk for 13 wk. The severity & incidence of histopathological changes of nasal cavity were dose related. Changes in all dosage groups in the region of the respiratory turbinates included cytomegaly of basal cells, focal hyperplasia, squamous metaplasia & disorientation of basal & ciliated cells, & loss of cilia. Necrosis & squamous metaplasia of olfactory, tracheal, & bronchial epithelium were present in the animals receiving 25 ppm. [REF-55, p.321]

1,2-Dibromo-3-chloropropane test results for mutagenicity in L5178Y mouse lymphoma cells were positive. [REF-77, p.81]

No toxic effects of 1,2-dibromo-3-chloropropane were observed at 5.0 ppm for Salmo gairdnerii (rainbow trout) or Petromyzon marinus (sea lamprey). [REF-78, p.107]

The effects of 1,2-dibromo-3-chloropropane (DBCP) on epididymal sperm carbohydrate metabolism was studied in Fischer 344 rats to identify the specific site of DBCP-induced inhibition of metabolism. Glucose and lactate metabolism were significantly inhibited by 3.0 mM DBCP. At a concentration of 3 mM DBCP, carbon dioxide production from the tricarboxylic acid cycle intermediates, acetyl CoA, succinate, alpha-ketoglutarate, and citrate was inhibited by 81-98%. To determine if the inhibitory effects of DBCP occurred in the mitochondrial electron transport chain, oxygen consumption resulting from metabolism of TCA cycle intermediates in intact sperm was measured. The presence of 3 mM DBCP inhibited oxidation of endogenous substrate plus alpha-ketoglutarate and malate by 95 and 92%, respectively, but did not inhibit the flavine adenine dinucleotide linked oxidation of succinate. The activities of alpha-ketoglutarate, pyruvate, malate, and lactic dehydrogenase were not inhibited by 3 mM DBCP. [REF-79]

Male Sprague-Dawley rats were treated with 1,2-dibromo-3-chloropropane (DBCP) on alternate days during the first 20 days of life and examined at 76-78 days to study the dose-toxicity relationship of DBCP by assessing alterations in the reproductive system. Four dose levels of DBCP, 1, 5, 10, and 20 mg/kg body weight, were used (5 animals/treatment group). The compound was dissolved in propylene glycol and administered subcutaneously at the back of the neck. In another phase of the study, DBCP (10 mg/kg body weight) was administered to rats on alternate days from either Days 2-10 or Days 12-20 of age. Sexually matured male rats were treated with 5 mg/kg of DBCP on alternate days for a total of 10 doses and all animals were killed at 30 or 75 days after the last injection. A dose-response relationship in testes weights was seen in all 4 dose levels of DBCP with 89-98% reduction in the three highest dose groups when treated the first 20 days. The epididymes and seminal vesicles showed marked reductions (82-90%) at the three highest dose groups but an increase in weight in the lowest dose group. Biochemical studies showed that the androgen production capacity per unit weight of testicular tissue was elevated as a function of the DBCP dose, although when the androgen production rate was expressed on the basis of tests pair weight, it showed a reduction, due to the DBCP-

induced loss in testis weight. Histopathological study showed cellular alterations in the 5 mg/kg DBCP-treated group and a total absence of seminiferous tubules in the 10 mg/kg group. The results of the critical period study showed that DBCP treatment on Days 2-10 had more effect than treatment on Days 12-20. The age-related study showed that sexually matured rats were less susceptible to the reproductive toxicity of DBCP than was the developing rat. [REF-80]

Dibromochloropropane was not teratogenic to rats when given orally on days 6-15 of gestation at levels of 12.5, 25, or 50 mg/kg/day. The two highest levels were toxic, resulting in reduced maternal and fetal weights. Oral doses of DBCP given to rabbits at 15 mg/kg in water and to rats at 15 mg/kg in corn oil did not significantly effect fertility. When male rats were exposed to DBCP vapor at a concentration 10 ppm for 14 wk, they were able to fertilize females, but the proportion of resorptions was increased over control levels, suggesting a dominant lethal effect. Rabbits were more sensitive than rats; male rabbits exposed to 1 or 10 ppm DBCP showed testicular atrophy, loss of spermatogenic cells, and complete infertility at the high exposure level confirmed the reproductive toxicity potential of DBCP at 100 mg/kg/day by gavage in a continuous breeding design in mice. [REF-43, p.703]

The comparative toxicities of 2,3-dichloro-1-propanol (DC1P), 1,3-dichloro-2-propanol (DC2P), alpha-chlorohydrin (ACH), epichlorohydrin (ECH) or 1,2-dibromo-3-chloropropane (DBCP) were investigated in rats. Male Wistar rats were given a single sc injection of 0.34 um/kg body weight DC1P, DC2P, ACH, ECH or DBCP. The rats were /sacrificed/ 6 wk after treatment and the testes and epididymes were removed for analysis. Reproductive system effects were evaluated. Significant reductions in body weight and in testis and epididymis weights were measured for DBCP treated rats. Epididymal weight decr significantly from a control value of 0.0229 g to 0.208 g in the DC1P group. Control sperm count in the body plus tail of the epididymis was 177.4 X 10(6), while counts for DBCP, DC1P and DC2P were 15.5 X 10(6), 138.9 X 10(6), and 153.8 X 10(6), respectively, all of which were significant reductions. Sperm counts were also significantly reduced in the head of the epididymis in the DBCP and ACH groups. The occurrence of sperm without tails incr from a control level of 13.8/1000 sperm to 865.8/1000 sperm in the DBCP treated group. A slight incr in immature sperm from 3.8/1000 to 7.3/1000 was /noted/ in the ACH treated group. Histological examination of the seminiferous tubules of the DBCP group showed reduced diameters and loss of step nine spermatids and pachytene spermatocytes. Only Sertoli cells were seen in some tubules. No pathological changes were observed in other treated groups. /The results indicate/ that DC1P is a more potent testicular toxicant than DC2P, ACH, and ECH, though much weaker than DBCP in the damage studied. [REF-81]

F344 rats & B6C3F1 mice inhaled 0.6 or 3.0 ppm 1,2-dibromo-3-chloropropane (DBCP) for 6 hr/day, 5 days/wk, for 76-103 wk. ... Untreated chamber controls consisted of 50 rats and 50 mice of each sex. ... Under the conditions of this bioassay, DBCP was carcinogenic for male and female F344/N rats, including incr incidences of nasal cavity tumors of the tongue in both sexes, and cortical adenomas in the adrenal glands of females. DBCP was carcinogenic in male and female B6C3F1 mice, including incr incidences of nasal cavity tumors and lung tumors. Levels of Evidence of Carcinogenicity: Male Rats: Positive; Female Rats: Positive; Male Mice: Positive; Female Mice: Positive. [QR] [REF-82]

A bioassay for possible carcinogenicity of technical grade dibromochloropropane (DBCP) was conducted by using Osborne-Mendel Rats and B6C3F1 mice. DBCP in corn oil was admin by gavage 5 days/wk at either two dosages, to groups of 50 male and 50 female animals of each species. ... Under the conditions of this study, DBCP is a stomach carcinogen in rats and mice of both sexes and is carcinogenic to the mammary gland in female rats. Levels of Evidence of Carcinogenicity: Male Rats: Positive; Female Rats: Positive; Male Mice: Positive; Female Mice: Positive. [QR] [REF-83, p.4]

Evidence for Carcinogenicity

Evaluation: There is inadequate evidence in humans for the carcinogenicity of 1,2-dibromo-3-chloropropane. There is sufficient evidence in experimental animals for the carcinogenicity of 1,2-dibromo-3-chloropropane. Overall evaluation: 1,2-Dibromo-3-chloropropane is possibly carcinogenic to humans (Group 2B). [QR] [REF-47, p.V71

494]

National Toxicology Program Reports

F344 rats & B6C3F1 mice inhaled 0.6 or 3.0 ppm 1,2-dibromo-3-chloropropane (DBCP) for 6 hr/day, 5 days/wk, for 76-103 wk. Early deaths of high-dose rats & mice were assoc with resp tract tumors. Untreated chamber controls consisted of 50 rats and 50 mice of each sex. ... Under the conditions of this bioassay, DBCP was carcinogenic for male and female F344/N rats, including incr incidences of nasal cavity tumors of the tongue in both sexes, and cortical adenomas in the adrenal glands of females. DBCP was carcinogenic in male and female B6C3F1 mice, including incr incidences of nasal cavity tumors and lung tumors. Levels of Evidence of Carcinogenicity: Male Rats: Positive; Female Rats: Positive; Male Mice: Positive; Female Mice: Positive. [QR] [REF-82]

A bioassay for possible carcinogenicity of technical grade dibromochloropropane (DBCP) was conducted by using Osborne-Mendel Rats and B6C3F1 mice. DBCP in corn oil was admin by gavage 5 days/wk at either two dosages, to groups of 50 male and 50 female animals of each species. ... The time weighted avg dosages of DBCP in the chronic study were 29 mg/kg/day for the high dose rats of both sexes, and 15 mg/kg/day for the low dose rats of both sexes. The time weighted avg concn for the high dose male and female mice were 219 and 209 mg/kg/day, respectively. The time weighted avg for the low dose male and female mice were 114 and 110 mg/kg/day, respectively. For each species, 20 animals of each sex were placed on test as controls. These animals were intubated with corn oil at the same time that dosed animals were intubated with DBCP mixtures. Twenty animals of each sex were placed on test as untreated controls for each species. These animals received no gavage treatments. ... Under the conditions of this study, DBCP is a stomach carcinogen in rats and mice of both sexes and is carcinogenic to the mammary gland in female rats. Levels of Evidence of Carcinogenicity: Male Rats: Positive; Female Rats: Positive; Male Mice: Positive; Female Mice: Positive. [QR] [REF-83, p.4]

Dibromochloropropane (DBCP) ... was tested because of the known toxicity in rats & relative paucity of data in mice. DBCP was an early RACB study using Swiss CD-1 mice. Data on food & water consumption's, body weights, & clinical signs during a 2 wk dose-range-finding study (Task 1) were used to set exposure concns for the Task 2 continuous cohabitation study at 25.0, 50.0, & 100.0 mg/kg by gavage in corn oil. In the F0 animals, 4 females, 2 females, 2 females, & 3 females & a male died in the control through high dose groups, respectively. The deaths were not attributed to DBCP exposure. In the low & high dose groups, there was a 10% & 8%, respectively, decr in the number of litters/pair. However, there was no change in the number of pups/litter, pup viability, or pup weight adjusted for litter size. There were no treatment-related reductions in F0 mouse body weight. In the absence of a change in pup parameters, no Task 3 was conducted, & the control & high dose mice were reared for second generation evaluation. Body weights between mice in these 2 groups were not different at weaning or at cohabitation. In the Task 4 F1 mating trial, controls & high dose DBCP mice delivered the same number of litters/group, pups/litter, & proportion viable pups; adjusted pup body weight was not affected by DBCP. After the F2 litters were delivered & evaluated, the F1 adults were killed & necropsied. In the high dose treated males, there was a 16% incr in relative liver weight, & a decr of 8% & 20% in relative epididymis & prostate weights, respectively. There were no differences between the groups in sperm endpoints. DBCP treatment increased female relative liver weight by 6%; vaginal cytology was not performed. This study found that DBCP produced minor effects (fewer litters/F0 pair, & reduced epididymis & prostate weights in F1 mice) concomitant with minor increases in liver weight & no change in body weight. These changes are relatively small, compared to effects seen in rats, & probably represent a significant species difference in response. [QR] [REF-89]

TSCA Test Submissions

1,2-Dibromo-3-chloropropane (CAS# 96-12-8) was evaluated for carcinogenicity. The test substance was administered in the diet of male and female Charles River CD-1 mice (number of animals not reported) at dose levels of 0, 0.3, 1.6, and 4.8 mg/kg bw (after adjustments in actual feed consumption, fortification, and evaporation) for 78-weeks. Survival rates in the control group were 74% (females) and 60% (males); and in the high dose group 80% (females) and 54% (males). The predominant tumor was squamous cell carcinoma of the non-glandular stomach in males (52%) and

females (38%). There was one kidney tumor and stomach tumor in one male; and single cases of lung, liver, and uterine tumors accompanied with a stomach tumor in females. Mammary tumors were present in two females with one female having a stomach tumor also. None of the controls had any tumors. [UR] [REF-90]

1,2-Dibromo-3-chloropropane (CAS# 96-12-8) was evaluated for carcinogenicity. The test substance was administered in the diet of male and female Charles River and Sprague Dawley rats (50/sex/group) at dose levels of 0.24, 0.80, and 2.39 mg/kg bw (after adjustments for fortification and evaporation) for two-years. There was a dose-related increase in non-neoplastic tissue changes in the liver (peliosis hepatitis), kidney (renal tubule hyperplasia and megalocytic cells lining renal tubules), and stomach (acanthosis, hyperkeratosis, and basal cell activity). Tumor incidence in males at 2.39 mg/kg was 20/48 (stomach), 20/48 (kidney), and 6/48 (stomach). In females at 2.39 mg/kg, tumor incidence was 11/48 (stomach), 13/48 (kidney), and 2/48 (stomach). [UR] [REF-90]

1,2-Dibromo-3-chloropropane (CAS# 96-12-8) was evaluated for mutagenicity. The test substance was positive in the Ames assay. No further information was provided. [UR] [REF-91]

1,2-Dibromo-3-chloropropane (CAS# 96-12-8) was evaluated for mutagenicity. The test substance was positive in the mouse lymphoma assay using the TK Locus and L5178Y cells. No further information was provided. [UR] [REF-91]

EMERGENCY TREATMENT

Medical Surveillance

Medical supervision should incl a pre-exposure physical exam, with an assessment of the employee's ability to wear a respirator for a prolonged period of time, and an assessment of fertility for male workers. The assessment of fertility for all male employees other than those with known azoospermia should be repeated after each period of 30 days of working with 1,2-dibromo-3-chloropropane (DBCP) or as requested by the responsible physician. Detailed records of the dates and hours during which each employee worked with DBCP should be incl in the employee's medical record along with any records of environmental monitoring performed in the employee's work station. [REF-24, p.623]

... Periodic examinations containing the elements of the preplacement or initial examination shall be made available on at least an annual basis. Examination of current employees shall be made available as soon as practicable after the promulgation of a standard for 1,2-dibromo-3-chloropropane (DBCP). Medical surveillance shall be made available to any worker suspected of having been exposed to DBCP. Pertinent medical records shall be maintained for all employees subject to exposure to DBCP in the workplace. Such records shall be maintained for 30 yr and shall be avail to medical representatives of the USA Government, the employer, and the employee. [REF-36, p.308]

Sperm count distributions among exposed and control groups at a 1,2-dibromo-3-chloropropane manufacturing plant were remarkably similar. Yet reproductive histories from 60 exposed men indicated that fertility had been reduced during exposure. Wherever there is concern about the potential for adverse reproductive effects in the workplace, data suitable for fertility analyses should be collected during annual medical exam. [REF-48]

The YFF sperm assay, which is a quantification of the incidence of sperm with 2 fluorescent bodies (YFF= two fluorescent bodies), was performed on human subjects exposed to 1,2-dibromo-3-chloropropane. They showed a statistically significant incr in the incidence of double Y chromosomes. This test should be considered for inclusion as part of a battery of medical tests for monitoring indust populations. [REF-49]

PRECAUTIONS FOR "CARCINOGENS": Whenever medical surveillance is

indicated, in particular when exposure to a carcinogen has occurred, ad hoc decisions should be taken concerning ... /cytogenetic and/or other/ tests that might become useful or mandatory. /Chemical Carcinogens/ [REF-37, p.23]

METABOLISM AND PHARMACOLOGY

Absorption, Distribution, and Excretion

CAN BE ABSORBED PERCUTANEOUSLY IN TOXIC AMT. [REF-5, p.II-268]

MALE WISTAR RATS WERE GIVEN ORALLY 20-400 MG/KG (14)C-LABELED 1,2-DIBROMO-3-CHLOROPROPANE. MAJOR SITES OF RADIOACTIVITY WERE FOUND IN THE LIVER & KIDNEY. IT IS SUGGESTED THAT THE MACROMOLECULAR BINDING IN VIVO IS CAUSED BY AN ACTIVATED METABOLIC INTERMEDIATE FORMED ON MICROSOME. [REF-92]

When a dose of 20 mg/kg 1,2-dibromo-3-chloropropane-3-(14)C was given orally ... /to/ male rats ... only traces (0.04%) of the (14)C were excreted in the expired air as unchanged 1,2-dibromo-3-chloropropane. Essentially all (98.8%) was absorbed from the gut and 90% of the activity was excreted in 3 days. During the first 24 hr, 49, 14, and 16.5% ... was excreted in the urine, feces, and expired air ... . [REF-25, p.3536]

Metabolism/Metabolites

Following intraperitoneal admin of 50 mg/kg of 1,2-dibromo-3-chloropropane (DBCP) to rats in propylene glycol, S,S'-(2-hydroxypropane-1,3-diyl)bismercapturic acid & S-(2,3-dihydroxypropyl)mercapturic acid were found as metabolites in urine. The metabolic pathway for DBCP incl oxidation & hydrolysis to a series of epoxide metabolites, and formation of male anti-fertility agents alpha-chlorohydrin & alpha-bromohydrin from epoxides. Subsequent oxidative metabolism of these latter two cmpd to oxalic acid presumably causes liver damage. [REF-93]

Rats treated orally with 1,2-dibromo-3-chloropropane (DBCP) excrete small amt of 2-bromoacrylic acid. Rabbit liver microsomal oxidases also yield 2-bromoacrylic acid from DBCP. The conversion involves initial enzymic sulfoxidation or hydroxylation at methyl chloride moiety (-CH2Cl) substituents and then facile nonenzymic reactions to liberate 2-haloacroleins which are further oxidized to the 2-haloacrylic acids. 2-Haloacroleins as potent mutagens and intermediary metabolites may contribute to the adverse toxicologic properties of DBCP. [REF-94]

Mechanism of Action

ADMIN OF A SINGLE ORAL DOSE OF 1,2-DIBROMO-3-CHLOROPROPANE (DBCP) TO MALE RATS DECR HEPATIC MICROSOMAL CYTOCHROME P450 & B5 TO 45 AND 65% OF CONTROLS AFTER 48 HR. INCORPORATION OF DELTA-AMINOLEVULINIC ACID INTO PROTEIN, MICROSOMES & PROTEASE-TREATED MICROSOMES WAS DECR 88, 65, AND 70% OF RESPECTIVE CONTROL VALUE IN ANIMALS TREATED FOR 12 HR. ACTIVITY OF ALA-DEHYDRATASE ALSO DECR TO 75 AND 90% OF CONTROLS AT 24 AND 48 HR. THESE DATA SUGGEST AN INHIBITION OF HEME SYNTH OR AN ALTERATION IN HEME DEGRADATION MAY PLAY A ROLE IN DECR OF THE MICROSOMAL CYTOCHROMES FOLLOWING TREATMENT WITH DBCP. [REF-95]

Challenge of male rats with a single dose of 1,2-dibromo-3-chloropropane resulted in significant decr in cytochrome p450 in microsomes isolated from liver, kidney, testis, lung, & small intestine mucosa 48 hr after treatment. Lipid peroxidation was not found in hepatic microsomes. In liver tissue, treatment resulted in a decr in cytochrome p450 in both rough & smooth microsomal fractions and nuclei, but not in mitochondrial fractions. Mixed-function oxidase activities in hepatic microsomes decr in parallel with cytochrome p450 content. Thus, treatment with alkyl halides may preferentially affect isozymes of cytochrome p450. [REF-96]

The potential for 1,2-dibromo-3-chloropropane (DBCP) to reduce male fertility by acting at a site in the genital tract beyond the testis was evaluated in male rats. Doses of 10, 20, or 40 mg/kg DBCP given sc once daily for 7 days caused a dose-dependent redn in the metab of glucose to carbon dioxide by epididymal sperm, as measured in vitro. Conversion of glucose to lactate was not reduced, indicating inhibition of energy metab at a step postglycolysis. The direct addn of DBCP to epididymal sperm being incubated in vitro also inhibited the metab of glucose to CO2.

Thus, DBCP may cause a nearly immediate infertility via a direct effect on posttesticular sperm. A possible mechanism of the infertility is inhibition by DBCP of glucose metab in the ejaculated sperm. [REF-97]

Subcutaneous administration of the nematocide, 1,2-dibromo-3-chloropropane (DBCP), to adult, male, fischer 344 rats transiently depleted hepatic and caput (head) epididymal nonprotein sulfhydryl contents. NPS concentrations in the testis and kidney were not lowered by DBCP. Liver, kidney and testis all exhibited increases in tissue nonprotein sulfhydryl concentrations 48 hr after treatment; the effects were most prominent in the outer medullary section of the kidney 24 hr after treatment with 80 mg/kg of DBCP. The glutathione depleting agent diethyl maleate transiently lowered hepatic, renal and caput epididymal nonprotein sulfhydryl concentrationsin a dose and time dependent manner. Renal and caput epididymal nonprotein sulfhydryl contents were increased relative to control 24 hr after diethyl maleate treatment. Single sc injections of DBCP produced dose dependent lesions in the kidney, testis, caput epididymis and liver. Diethyl maleate treatment 90 min before DBCP treatment enhanced the nephrotoxic potency of DBCP as indicated by greater elevations of blood urea nitrogen and serum creatinine concentrations and by more severe renal tubular necrosis in diethyl maleate pretreated thanin vehicle controls, as determined 48 hr after DBCP exposure. Seminiferous tubular degeneration, as determined 48 hr post-DBCP treatment, was greater in rats pretreated with 600 mg/kg of diethyl maleate than in nonpretreated controls. When examined 16 days after DBCP treatment, however, the severity of testicular atrophy was virtually the same in rats pretreated with a lower dose of diethyl maleate (400 mg/kg) as in nonpretreated rats. These results indicate that DBCP is a depletor of hepatic and caput epididymal NPS in the acutely toxic dose range. Inasmuch as NPS concentrations were not lowered in two of the major target organs, kidney and testis, acute DBCP injury would not appear to be dependent on local glutathione depletion. However, the greater susceptibility of kidney and testis to DBCP injury after diethyl maleate pretreatment suggests an important role for nonprotein sulfhydryl, particularly those in the liver, in modulating DBCP toxicities. [REF-98]

Interactions

Single subcutaneous injection of 1,2-dibromo-3-chloropropane (DBCP) produced dose-dependent injury to kidney, testis, epididymis, & liver in male rats. Pretreatment with enzyme inducer phenobarbital reduced the nephrotoxicity & hepatotoxicity of DBCP, & resulting serum creatinine and urea nitrogen concn. Cobaltous chloride pretreatment enhanced the necrogenic effect of DBCP on the kidney & potentiated DBCP-induced elevations of serum creatinine and urea nitrogen concn. The gonadotoxicity of DBCP was enhanced by cobaltous chloride and reduced by phenobarbital. The modulating effects of cobaltous chloride and phenobarbital could not be ascribed simply to changes in tissue concn of the protective conjugation substrate glutathione, since cobaltous chloride incr and phenobarbital did not alter renal & hepatic nonprotein sulfhydryl concn. A complex role of metab is indicated in determining dose-dependent toxic response to DBCP admin. [REF-99]

ENVIRONMENTAL FATE AND EXPOSURE POTENTIAL

Environmental Fate/Exposure Summary

Due to the restrictions on the use of 1,2-dibromo-3-chloropropane as a nematocide and soil fumigant, little release of 1,2-dibromo-3-chloropropane presently occurs. The use of 1,2-dibromo-3-chloropropane as a laboratory reactant is not expected to result in large quantities being released to the environment. If released to the atmosphere, 1,2-dibromo-3-chloropropane will exist solely in the vapor phase in the ambient atmosphere, based on a measured vapor pressure of 0.58 mm Hg at 20 deg C. Vapor-phase 1,2-dibromo-3-chloropropane is degraded in the atmosphere by reaction with photochemically-produced hydroxyl radicals with an estimated half-life of about 37 days. Products of 1,2-dibromopropanol, chlorobromopropanol, and 1-bromo-3-chloro-2-propanone are formed during this process. 1,2-Dibromo-3-chloropropane released to soil will likely volatilize or leach. In alkaline, but not neutral or acidic soils, hydrolysis may be significant. Biodegradation is possible but is expected to be slow relative to volatilization and leaching. In water, 1,2-dibromo-3-chloropropane is expected to volatilize. It may also slowly hydrolyze (half-life= 38 years, neutral pH, at 25 deg C). Estimated volatilization half-lives for a model river and model lake are

14 hours and 9 days, respectively. In groundwater, 1,2-dibromo-3-chloropropane is expected to persist due to its low estimated rate of hydrolysis (half-life= 141 years, neutral pH, at 15 deg C). In surface waters, biodegradation may occur, but is expected to be slow relative to the rate of volatilization. Photodegradation is not expected to be an important fate process for this compound. Sorption to sediments and bioconcentration are not expected to be important fate processes based on measured Koc values of 40-149 and measured BCF values of 3.6-19, respectively. Human exposure is expected to result primarily from ingestion of drinking water, particularly from groundwater sources, containing 1,2-dibromo-3-chloropropane. Occupational exposure to 1,2-dibromo-3-chloropropane is likely via inhalation and dermal contact with vapors, water, and products containing 1,2-dibromo-3-chloro-propane. (SRC)

Ecotoxicity Values

- LD50 ANAS PLATYRHYNCHOS (MALLARD) 3-5 MO FEMALES ORAL 66.8 MG/KG (95% CONFIDENCE LIMIT 48.2-92.6 MG/KG) /95% ACTIVE INGREDIENT/ [REF-88, p.58]

- LD50 PHASIANUS COLCHICUS (RING-NECKED PHEASANT) 3-4 MO FEMALES ORAL 156 MG/KG (95% CONFIDENCE LIMIT 89.3-271 MG/KG) /95% ACTIVE INGREDIENT/ [REF-88, p.54]

Environmental Fate

- TERRESTRIAL FATE: 1,2-Dibromo-3-chloropropane has been applied to various types of agricultural soils in CA by injection, flooding & sprinkling. The chemical was still present 40 wk after application; and its distribution in soil was proportional to size of soil particles, with greatest distribution found in sandy soils & lowest in clay. In field experiments, 1,2-dibromo-3-chloropropane was detected in soil at levels in the mean range of 0.008-1.64 mg/kg from 1 day to 16 wk after application at the rate of 13.75 kg/ha. Volatilization is expected to be the primary fate of DBCP near the soil surface. Leaching to groundwater is also anticipated based on the demonstrated weak adsorption of DBCP to several soils. Hydrolysis in acidic and neutral soils is not expected to be significant, but may be so in alkaline soils. Although biodegradation may also be significant, it is expected to be a slow process relative to leaching and volatilization. [REF-60, p.V20 86]

- TERRESTRIAL FATE: Based on a recommended classification scheme(1), measured soil Koc values ranging from 40(2)-149(3) indicate that 1,2-dibromo-3-chloropropane will have very high to high mobility in soil(SRC). Clay and silt soils adsorb more 1,2-dibromo-3-chloropropane than sands; however, downward migration of this compound was observed regardless of the soil type(4). 1,2-Dibromo-3-chloropropane has been reported in well water samples(5) indicating that this compound does leach to groundwater. Koc values from 305-355 were measured for aquifer solids(6) suggesting that this compound will have moderate mobility in an aquifer system(6,SRC). Hydrolysis in acidic and neutral soils is not expected to be significant based on an estimated aqueous half-life of 38 years at pH 7(7), but may be so in alkaline soils(8,SRC). 1,2-Dibromo-3-chloropropane volatilized rapidly from soil surfaces where it had been applied in irrigation water; at least 85% of this compound was lost over 42 days in experiments using cyclic water applications meant to mimic citrus irrigation practices(9). However, air levels of this compound above shank injection-treated soil rarely exceeded 1 ppb beyond 1 day post treatment(10). [REF-101]

- TERRESTRIAL FATE: Although biodegradation may be an important fate process in soil, it is expected to be a slow process relative to leaching and volatilization(SRC). Persistence of 1,2-dibromo-3-chloropropane was much greater when injected into soils than when applied to soils in irrigation water(1). The most rapid rate of dehalogenation (20% in 1 week) was obtained with pH 8 soil suspensions; the maximum observed dehalogenation was 63% after 4 weeks under unspecified conditions(2). Biodegradation of 1,2-dibromo-3-chloropropane in aerobic soil columns gave half-lives of 6.6, 13.0, and 1130 days for natural, nutrient-enriched, and sterile conditions,

respectively(3). In other experiments however, 1,2-dibromo-3-chloropropane was not aerobically degraded in soil over a period of time ranging up to several months(4,5). Soil samples, maintained under anaerobic conditions, transformed 1,2-dibromo-3-chloropropane, at 10 and 100 mg/kg suspension, with 5.6 and 11.6% conversion, respectively, in 28 days(4) [REF-102]

- AQUATIC FATE: Based on a recommended classification scheme(1), measured Koc values from 40(2)-149(3) indicate that 1,2-dibromo-3- chloropropane should not adsorb to suspended solids and sediment in water(SRC). Due to the low measured hydrolysis rate at neutral pH (estimated half-life= 38 years at 25 deg C and pH 7)(4), volatilization is expected to be the predominant fate of aqueous 1,2-dibromo-3-chloropropane (1,2-dibromo-3-chloropropane) under neutral conditions. In basic solution, however, hydrolysis is expected to compete with volatilization, forming 2-bromoallyl alcohol(5). 1,2-Dibromo-3-chloropropane should volatilize from water surfaces(1,SRC) based on an estimated Henry's Law constant of 1.5X10-4 atm-cu m/mole(SRC), calculated from experimental values for vapor pressure(6) and water solubility(6). Estimated volatilization half-lives for a model river and model lake are 14 hours and 9 days, respectively(1,SRC). Photodegradation is not expected to be a major fate process for this compound in water based on experimental results in natural water(7). [REF-103]

- AQUATIC FATE: According to a classification scheme(1), BCF values ranging from 3.6 to 19(2), measured in carp, suggest that bioconcentration in aquatic organisms is low(SRC). Data suggest that 1,2-dibromo-3-chloropropane may biodegrade under some environmental conditions(SRC). In soil samples, the most rapid rate of dehalogenation (20% in 1 week) was obtained with pH 8 soil suspensions; the maximum observed dehalogenation was 63% after 4 weeks under unspecified conditions(3). Four subsoil materials and groundwater samples, and a sewage sample were aerobically incubated in the presence of 0.05 to 500 mg 1,2-dibromo-3-chloropropane/l water. No transformation was noted, by formation of inorganic halide or organic products or by the production of CO2, over 60 days(4). Groundwater and aquifer samples incubated under anaerobic conditions were unable to convert 1,2-dibromo-3-chloropropane over a 4 month period(4) . However, continuous-flow fixed-film columns, used to mimic anoxic groundwater conditions, were run under methanogenic (acclimation period of 9-12 weeks), sulfate-respiring (acclimation period 99%, 82-98%, and 14-23% removal, respectively, of 1,2-dibromo-3-chloropropane(5). [REF-104]

- ATMOSPHERIC FATE: According to a model of gas/particle partitioning of semivolatile organic compounds in the atmosphere(1), 1,2-dibromo-3-chloropropane, which has a measured vapor pressure of 0.58 mm Hg at 20 deg C(2,SRC), will exist solely as a vapor in the ambient atmosphere. Vapor-phase 1,2-dibromo-3-chloropropane is degraded in the atmosphere by reaction with photochemically-produced hydroxyl radicals(SRC) giving products of 1,2-dibromopropanol, chlorobromopropanol, and 1-bromo-3-chloro-2-propanone(4); the half-life for this reaction in air is estimated to be about 37 days(3,SRC). An upper limit to the ozone reaction rate constant of [REF-105]

Biodegradation

- A mixed culture of soil microorganisms containing primarily Pseudomonas and Flavobacteria dehalogenated 1,2-dibromo-3-chloropropane to n-propanol(1). The most rapid rate of dehalogenation (20% in 1 week) was obtained with pH 8 soil suspensions; the maximum observed dehalogenation was 63% after 4 weeks under unspecified conditions(2). Biodegradation of 1,2-dibromo-3-chloropropane was measured in soil columns; half-lives of 6.6, 13.0, and 1130 days were obtained for natural, nutrient-enriched, and sterile conditions, respectively(3). Two soil samples, four subsoil materials and groundwater samples, and a sewage sample were incubated in the presence of 0.05 to 500 mg 1,2-dibromo-3-chloropropane/kg soil, soil suspension, or water. No transformation was noted, by formation of inorganic halide or organic products or by the production of CO2, over 60 days(4). Soil samples,

maintained under anaerobic conditions, transformed 1,2-dibromo-3-chloropropane, at 10 and 100 mg/kg suspension, with 5.6 and 11.6% conversion, respectively, in 28 days(4). Groundwater and aquifer samples incubated under similar, anaerobic conditions were unable to convert 1,2-dibromo-3-chloropropane over a 4 month period(4). Alkyl reductive dehalogenation was reported as a transformation mechanism for the biodegradation of 1,2-dibromo-3-chloropropane in anaerobic soil(5). [REF-106]

- Continuous-flow fixed-film columns, seeded with sewage and run under denitrifying, sulfate respiring, or methanogenic conditions, were used to simulate the biodegradation of 1,2-dibromo-3-chloropropane in anoxic groundwater(1). Under methanogenic conditions and following an acclimation period of 9-12 weeks, >99% removal of 1,2-dibromo-3-chloropropane at an initial concentration of 17 ug/l was measured(1). 98% of the added 1,2-dibromo-3-chloropropane (at 12 ug/l initially) was removed following a [REF-107]

- Following 182 days incubation, 0.2 and 0.8% mineralization was reported for 1,2-dibromo-3-chloropropane in uncontaminated soil and soil contaminated with isodrin, dieldrin, and p-chlorophenylmethylsulfoxide, respectively(1). Biodegradation rates were faster in top soils collected from Hawaii than in soils obtained from greater depths; rates of 0.00016, 0.00014, and 0.00006/hour were measured at soil depths of 45 cm, 90 cm, and lower depths, respectively(2). 1,2-Dibromo-3-chloropropane at 1 mg/l was not degraded in soil columns filled with a sandy soil (0.087% organic carbon) and subjected to 14 cm water/day(3). 68% of the added 1,2-dibromo-3-chloropropane was not accounted for by either volatilization or adsorption following addition of municipal wastewater to soil columns filled with a Lincoln fine sand (used to simulate rapid infiltration treatment of municipal wastewater); this loss may have been due to biodegradation(4). [REF-108]

Abiotic Degradation

- Kinetic data on the hydrolysis of 1,2-dibromo-3-chloropropane in water was collected in the range of 40-97 deg C(1). An Arrhenius plot of these data yielded estimated half-lives of 38 and 141 years at 25 and 15 deg C, respectively, at pH 7(1). Under alkaline conditions, 1,2-dibromo-3-chloropropane is hydrolyzed to 2-bromoallyl alcohol(2). A half-life of 6.1 years, due mainly to hydrolysis, was calculated in a study examining the fate of 1,2-dibromo-3-chloropropane in both groundwater and groundwater/aquifer solids(4). Laboratory studies in phosphate buffer solutions indicate that 1,2-dibromo-3-chloropropane dehydrohalogenation to 2-bromo-3-chloro-1-propene (95%) and 2,3-dibromo-1-propene (5%) occurs followed by hydrolysis to the corresponding allyl alcohols; dehydrohalogenation is relatively slow when compared to the hydrolysis of this compound(4). Irradiation of an aqueous solution of 1,2-dibromo-3-chloropropane in pyrex tubes, using a mercury vapor UV lamp, resulted in negligible photodegradation(5). The addition of hydrogen peroxide to the solution increased the rate of photodegradation noticeably, suggesting that this compound may be degraded in natural waters containing a high concentration of hydroxyl radicals(5). [REF-109]

- The dominant removal process of 1,2-dibromo-3-chloropropane in the atmosphere is hydroxyl abstraction; 1,2-dibromopropanol, chlorobromopropanol, and 1-bromo-3-chloro-2-propanone are formed as products during this process(1). The rate constant for the vapor-phase reaction of 1,2-dibromo-3-chloropropane with photochemically-produced hydroxyl radicals has been measured as 4.4X10-13 cu cm/molecule-sec at 25 deg C(2). This corresponds to an atmospheric half-life of about 37 days at an atmospheric concentration of 5X10+5 hydroxyl radicals per cu cm(2,SRC). An upper limit of [REF-110]

Bioconcentration

- A bioconcentration factor for 1,2-dibromo-3-chloropropane of 11 was estimated

from a measured water solubility of 1,230 ppm(1). [REF-111]

- BCF values of 3.6-17 and 4.0-19 were measured at concentrations of 0.3 and 0.03 mg/l 1,2-dibromo-3-chloropropane, respectively, in carp(1). According to a classification scheme(2), these BCF values indicate that bioconcentration of this compound in aquatic organisms is low(SRC). [REF-112]

Soil Adsorption/Mobility

- The Kd for the adsorption of 1,2-dibromo-3-chloropropane onto Panoche clay loam is 0.20 cu cm/g for a 1,2-dibromo-3-chloropropane concentration range of 0.5-95 ug/ml(1). A Kd value of 0.286 L/kg was measured in Hanford sandy loam soil columns(2). Values of 40 (Koc value)(3) and 128 (Kom value)(4) were measured for 1,2-dibromo-3-chloropropane in unspecified soils. Koc values of 129 and 149 were measured in a silt loam and in a fine sand soil, respectively(5). Koc values of 305 and 355 were measured for aquifer solids from the Fresno aquifer (pH 7.3-7.7, mass fraction of organic carbon=0.0002); a calculated Rf value from these results indicates that only about 10% of the 1,2-dibromo-3-chloropropane is sorbed to the aquifer material(6). Koc values for 3 soils ranged from 70 to 126 (pH 7.6-8.1, mass fraction of organic carbon=0.0052-0.0544)(6). According to a recommended classification scheme(7), these measured Koc values suggest that 1,2-dibromo-3-chloropropane has moderate to very high mobility in soil(SRC). [REF-113]

- Modeling predicts that 1,2-dibromo-3-chloropropane will adsorb so weakly that it will co-migrate with water through low organic content soil(1). Clay and silt soils adsorb 1,2-dibromo-3-chloropropane more strongly than sand soils, but downward vertical migration of this compound was observed regardless of soil type(2). The retardation factor (defined as the ratio of the interstitial water velocity to the velocity of the chemical) of 1,2-dibromo-3-chloropropane in Lincoln fine sand columns (organic carbon= 0.87%) was measured as 2.1(3) and [REF-114]

Volatilization from Water/Soil

- The Henry's Law constant for 1,2-dibromo-3-chloropropane is estimated as 1.5X10-4 atm-cu m/mole(SRC) from its experimental values for vapor pressure, 0.58 mm Hg(1), and water solubility, 1230 mg/l(1). This value indicates that 1,2-dibromo-3-chloropropane will volatilize from water surfaces(2,SRC). Based on this Henry's Law constant, the volatilization half-life from a model river (1 m deep, flowing 1 m/sec, wind velocity of 3 m/sec) is estimated as approximately 14 hours(2,SRC). The volatilization half-life from a model lake (1 m deep, flowing 0.05 m/sec, wind velocity of 0.5 m/sec) is estimated as approximately 9 days(2,SRC). 1,2-Dibromo-3-chloropropane's values for vapor pressure(1) and Henry's Law constant(1,SRC) indicate that volatilization from dry and moist soil surfaces may occur(SRC). [REF-115]

- The volatilization half-life of 1,2-dibromo-3-chloropropane was estimated to be 1.2 days in a model soil assumed to contain 1,2-dibromo-3-chloropropane evenly distributed within the first 10 cm(1). Volatilization rates of 1,2-dibromo-3-chloropropane were higher from sand (0.8% organic matter, pH= 7.2) and silt loam(0.5% organic matter, pH= 8.4) than from clay loam(1.6% organic matter, pH= 7.8), possibly due to decreased adsorption processes(2). Volatilization losses to the atmosphere accounted for at least 85% of the 1,2-dibromo-3-chloropropane lost over 42 days during experiments meant to mimic citrus irrigation practices(water applications were performed cyclically)(3). Losses of 1,2-dibromo-3-chloropropane due to volatilization were significantly reduced by the application of water immediately following the introduction of this compound to soil(3). In other experiments, air levels of 1,2-dibromo-3-chloropropane 4 feet above shank-injection-treated soil rarely exceeded 1 ppb beyond 1 day post treatment(4). During water-run treatments, air concentrations 4 feet above the surface did not exceed 300 ppb for more than a few hours during application(4). [REF-116]

SOURCES AND CONCENTRATIONS

Natural Occurring Sources

- 1,2-Dibromo-3-chloropropane is not known to occur as a natural product. [REF-11, p.V20 86]

Artificial Sources

- 1,2-Dibromo-3-chloropropane's former production and use(1) as a soil fumigant and a nematocide(2) resulted in the direct release of this compound to the environment(SRC). Its production and use as an intermediate in organic synthesis(2) may result in its release to the environment through various waste streams(SRC). [REF-100]

Water Concentrations

- During 1979-80, 236 water samples were collected from 205 sites in SC. Well water, surface water (lakes, ponds, & rivers), & municipal water were sampled. DBCP levels ranged from non-detectable to 0.05 ug/l in an area of non-use (background). In the area of high use, 37% of the surface water samples exceeded the background level, but none exceeded 0.4 ug/l. Twenty-seven percent of the well water samples from the high-use area exceeded the background level. [REF-117]

- SURFACE WATER: South Carolina - not detected (0.008 ppb) to 3.5 ppb in areas where 1,2-dibromo-3-chloropropane was extensively used, and not detected to 0.05 ppb in non-use areas(1). Detected, but not quantified in Magnolia, AK(2). [REF-118]

- DRINKING WATER: Two drinking water wells in California contained 68 and 95 ppb 1,2-dibromo-3-chloropropane; one well in Arizona contained 137 ppb 1,2-dibromo-3-chloropropane(1). Finished water samples from 280 random sites in the US serving less than 10,000 persons were 0.4% positive (one sample) with a maximum concentration of 5.5 ug/l (detection limit= 5.0 ug/l)(2). South Carolina municipal water- ND(0.008 ppb)-0.05 ppb in areas of non- and high use(3). South Carolina well water- ND(0.008 ppb)- >1.0 ppb (high use areas); ND-0.05 ppb (non-use areas)(3). [REF-119]

- GROUNDWATER: Groundwater samples from AZ, CA, HI, MD and SC contained 0.02-137 ug/l 1,2-dibromo-3-chloropropane(1). Several CA sites (orchards or vineyards): not detected-22 ug/l (5 ng/l detection limit)(2). South Carolina well water: not detected(0.008 ppb)- >1.0 ppb (high use areas); not detected-0.05 ppb (non-use areas)(3). Two drinking water wells in California contained 68 and 95 ppb 1,2-dibromo-3-chloropropane and one well in Arizona contained 137 ppb 1,2-dibromo-3-chloropropane(4). Groundwater wells in Mililani, Kunia and Waipahu, Hawaii were contaminated with 1,2-dibromo-3-chloropropane in 1981 at concentrations of 26-97 ng/l(5,6). 1,2-Dibromo-3-chloropropane was monitored in 20,545 wells in AZ, CA, FL, HI, IN, MD, SC, VA, and WA from 1978 to 1991; 1,829 wells were positive for this compound with concentrations ranging from 0.001 to 8000 ug/l(7). [REF-120]

- GROUNDWATER: 94 of 262 domestic, municipal, and irrigation wells monitored in California during 1979 contained 1,2-dibromo-3-chloropropane at concentrations ranging from 0.1 to 39 ppb(1). In the California Department of Pesticide Regulation database (data collected from 1975-1991), 1,2-dibromo-3-chloropropane was present in 2480 California wells at a maximum concentration of 60 ug/l(2). In public drinking water wells alone, 1,2-dibromo-3-chloropropane was detected in 275 wells at a maximum concentration of 7.4 ug/l(2). Although 1,2-dibromo-3-chloropropane was banned in California in 1979, increasing concentrations were being detected in well water as of 1984(3). By 1984, 1,473 wells in California contained 1,2-dibromo-3-chloropropane at concentrations above 1 ppb(3). About half of the well water samples

collected in the San Joaquin Valley contained 1,2-dibromo-3-chloropropane at an average concentration of 5 ug/l; wells less than 30 m deep were more likely to be contaminated(4). Groundwater from beneath the Rocky Mountain Arsenal contained 1,2-dibromo-3-chloropropane at unreported concentrations, most likely from a pesticide manufacturer located on site(5). In a random survey of wells serving fewer than 10,000 persons or more than 10,000 persons, 1 well (at a concentration of 5.5 ug/l, quantitation limit= 5.0 ug/l) and 0 wells, respectively, contained 1,2-dibromo-3-chloropropane(6). [REF-121]

Effluents Concentrations

- Spent chlorination liquor from the bleaching of sulphite pulp contained 1,2-dibromo-3-chloropropane at concentrations of 0.2 to 0.9 g/ton pulp(1). 1,2-Dibromo-3-chloropropane was measured in the emissions of a small-scale combustor burning pulverized coal at a maximum concentration of 4.274X10-7 lb/10+6 Btu(2). [REF-122]

Sediment/Soil Concentrations

- IN FIELD EXPT, 1,2-DIBROMO-3-CHLOROPROPANE WAS DETECTED IN SOIL AT LEVELS IN MEAN RANGE OF 0.008-1.64 MG/KG FROM DAY 1 TO 16 WK AFTER APPLICATION AT RATE OF 13.75 KG/HA. [REF-11, p.V20 86]

- Detected but not quantified in Arkansas sediments and soil(2). Soil samples taken from 0-18 m in or near orchards and vineyards in which 1,2-dibromo-3-chloropropane had been used were ND-9 ppb in 1,2-dibromo-3-chloropropane with the higher 1,2-dibromo-3-chloropropane levels being found in the upper and middle regions(1). 32 fields in California, treated with 1,2-dibromo-3-chloropropane 2 to 4 years previously, contained this compound in the topsoil at about 2 to 5 ug/kg(3). 1,2-Dibromo-3-chloropropane was measured in topsoil, subsoil, and groundwater; topsoils contained ug/kg amounts of this compound, subsoils contained 1,2-dibromo-3-chloropropane at ug/kg amounts, especially in clay and silt layers, at depths as great as 15 meters(3). Groundwater from the same sites contained 1,2-dibromo-3-chloropropane at 1.2 to 12 ug/l(3). By 1986, 1,2-dibromo-3-chloropropane was detected in California soils at depths >120 m(3). [REF-123]

- Soil samples collected from a peach orchard near a well containing 1 mg/kg 1,2-dibromo-3-chloropropane (1,2-dibromo-3-chloropropane) (contaminated) & from a peach orchard with a well containing 0.1 mg/kg 1,2-dibromo-3-chloropropane (uncontaminated) contained less than 0.1 and 0.5 mg/kg 1,2-dibromo-3-chloropropane, respectively; both orchards had been fumigated with 1,2-dibromo-3-chloropropane via shank injection methods(1). Soil samples taken at the site of a possible spill contained high concn of 1,2-dibromo-3-chloropropane in the upper 1 m & at 6.1 m where the water table was encountered(1). Soil collected from an orchard in California contained 1,2-dibromo-3-chloropropane in the first meter, then had no detectable concentrations of this compound until 9 m depth where clays and silts were encountered; peak concentrations were reached in the clay and silt soil then decreased with increasing depth until the water table was reached at 16 m. Groundwater at the surface of the water table had 12 ug/l 1,2-dibromo-3-chloropropane(2). In a vineyard soil, 1,2-dibromo-3-chloropropane was detected in the topsoil and again in silt and sand lenses at 2 and 4.5 m before detection in a perched water table at 0.54 ug/l(2). [REF-124]

Atmospheric Concentrations

- In a trial in California of shank injection in a vineyard, a concn of 11 ppb was determined at the level of the driver's seat on the tractor moving the injecting rig and of 3 ppb at the middle of the vineyard at 5 ft above the ground. Higher airborne concn were measured in citrus groves and a vineyard treated by irrigation. In another trial, in which 1,2-dibromo-3-

chloropropane was applied by shank injection into a fallow field ... the workers at the loading site met airborne concn of 7-131 ppb. [REF-24, p.622]

- Magnolia, AK: 1,688 to 6,653 ng/cu m, 7/77 to 8/77; El Dorado, AK: not detected to 1.87 ng/cu m(1). 1,2-Dibromo-3-chloropropane was detected in 3 samples of source-dominated air at an average daily concentration of 0.001 ppbv(2). An unspecified urban location in the US had air concentrations of 0.01 ug 1,2-dibromo-3-chloropropane/cu m (1 positive, 2 negative detections total)(3). [REF-125]

Food Survey Values

- /1,2-Dibromo-3-chloropropane (DBCP)/ was detected in carrot peel and pulp in concn of 0.339 and 0.607 mg/kg, respectively. After unpeeled carrots were boiled for 5 min, they still contained 0.251 mg/kg DBCP. [REF-11, p.V20 87]

- 1,2-Dibromo-3-chloropropane residues were measured in peaches harvested from trees growing in fall-fumigated or nonfumigated soil(1). No 1,2-dibromo-3-chloropropane residues were detected in peaches from trees growing on nonfumigated soil or in soil fumigated at or below the previously recommended rate of 46.8 l/ha. An average application rate of 58 and 115 L/treated ha resulted in residues of 0.19 ppb and 0.43 ppb of 1,2-dibromo-3-chloropropane, respectively(1). Foods sampled from the FDA market basket collection contained a mean concentration of 81 and 85 ng/g 1,2-dibromo-3-chloropropane for fatty and non-fatty foods, respectively (out of 5 determinations)(2). [REF-126]

Plant Concentrations

- 1,2-Dibromo-3-chloropropane (DBCP) residues were measured in peaches from trees growing in fall-fumigated or nonfumigated soil. No DBCP residue was detected in peaches from trees growing on nonfumigated soil or in soil fumigated at or below the previously recommended rate of 46.8 l/ha. An avg application rate of 58 l/ha resulted in residues of 0.19 ppb of DBCP, whereas 115 l/ha gave residues of 0.43 ppb DBCP. [REF-127]

- ... /1,2-DIBROMO-3-CHLOROPROPANE/ WAS DETECTED IN CARROTS IN THE RANGE OF 0.009-1.5 MG/KG & IN RADISHES IN THE RANGE OF 0.03-0.194 MG/KG AFTER APPLICATION OF 13.75 KG/HA TO SOIL. IN THE SAME STUDY, THE CMPD WAS DETECTED IN CARROT PEEL & PULP IN CONCN OF 0.339 & 0.607 MG/KG, RESPECTIVELY. AFTER UNPEELED CARROTS WERE BOILED FOR 5 MIN, THEY STILL CONTAINED 0.251 MG/KG DBCP. [REF-11, p.V20 87]

Other Environmental Concentrations

- IT IS PRESENT AT LEVELS OF 0.002 OR 0.05% IN FLAME RETARDANT TRIS(2,3-DIBROMOPROPYL) PHOSPHATE (1977). [REF-11, p.V20 86]

- Commercially available sodium humate contained 1,2-dibromo-3-chloropropane in the range of 15 to 25 ppb(1). [REF-128]

HUMAN ENVIRONMENTAL EXPOSURE

Probable Routes Of Human Exposure

- OCCUPATIONAL EXPOSURE TO 1,2-DIBROMO-3-CHLOROPROPANE IN PRODUCTION OR FORMULATION PLANTS AT LEVELS WHICH CAUSED PHYSIOLOGICAL CHANGES HAS BEEN REPORTED FOR: 1) 41 EMPLOYEES IN CA; 2) 86 ... IN AR; & 3) TOTAL OF 50 EMPLOYEES IN CO & AL. 1 USA MANUFACTURER ... EST THAT EMPLOYEES EXPOSURE RANGED FROM LESS THAN 1-6 MG/CU M (100-600 PPB) OVER 3 YR. THE USA OSHA HAS EST THAT 2000-3000 EMPLOYEES HAVE RECENTLY BEEN

OR MAY CURRENTLY BE EXPOSED DURING THE MANUFACTURE & FORMULATION OF 1,2-DIBROMO-3-CHLOROPROPANE. ... AN AVG OF 4 MG/CU M (0.4 PPM) ... OVER AN 8-HR DAY /WAS DETECTED IN AN UNSPECIFIED/ MANUFACTURING PLANT. IN ANOTHER FACTORY, LEVELS OF 1-6 MG/CU M (0.1-0.6 PPM) HAVE BEEN ESTIMATED ... [REF-11, p.V20 87]

- 1,2-Dibromo-3-chloropropane (DBCP) is used as a nematocide in Hawaii. Occupational exposures of Hawaiian agricultural workers to airborne DBCP are mainly in the range of parts per billion. [REF-129]

- 1,2-Dibromo-3-chloropropane has not been used as a pesticide in the US since 1979(3). Occupational exposure to 1,2-dibromo-3-chloropropane would have been mainly due to vapors regardless of the route of entry to air(2). 1,2-Dibromo-3-chloropropane is (was) used as a nematocide in Hawaii. Occupational exposures of Hawaiian agricultural workers to airborne 1,2-dibromo-3-chloropropane were mainly in the range of parts per billion(1). The general population will be exposed to 1,2-dibromo-3-chloropropane via inhalation of contaminated air, ingestion of food and drinking water (particularly well water), and dermal contact with vapors, food, and water containing 1,2-dibromo-3-chloro-propane(SRC). [REF-130]

Average Daily Intake

- FOOD: 2.21-61.0X10-6 mg/kg/day (USEPA estimate)(1). WATER INTAKE: (assume 5.5 ug/l, 11 ug per person. Insufficient air and food monitoring data were available to estimate an average daily intake(1). An upper-bound estimate of the lifetime inhalation pathway dose of 1,2-dibromo-3-chloropropane attributable to a unit concentration in water supplies (mg/kg d)/(mg/l) was 0.11(2); this represents the amount of compound inhaled due to exchange between household water and air. [REF-131]

Body Burdens

- PERSONAL AIR: Breath samples collected from subjects in Greensboro, NC and Devils Lake, ND did not contain measurable concentrations of 1,2-dibromo-3-chloropropane (detection limit= 1 ug/cu m)(1). [REF-132, p.289-315]

STANDARDS AND REGULATIONS

Immediately Dangerous to Life or Health (IDLH)

- NIOSH considers 1,2-dibromo-3-chloropropane to be a potential occupational carcinogen. [QR] [REF-34, p.92]

OSHA Standards

- Inhalation. The employer shall assure that no employee is exposed to an airborne concentration of DBCP in excess of 1 part DBCP per billion parts of air (ppb) as an 8-hour time-weighted average. [QR] [REF-133]

- Dermal and eye exposure. The employer shall assure that no employee is exposed to eye or skin contact with DBCP. [QR] [REF-133]

Niosh Recommendations

- NIOSH considers 1,2-dibromo-3-chloro-propane to be a potential occupational carcinogen. [QR] [REF-34, p.92]

- NIOSH usually recommends that occupational exposures to carcinogens be limited to the lowest feasible concentration. [QR] [REF-34, p.92]

Atmospheric Standards

- Listed as a hazardous air pollutant (HAP) generally known or suspected to cause serious health problems. The Clean Air Act, as amended in 1990,

directs EPA to set standards requiring major sources to sharply reduce routine emissions of toxic pollutants. EPA is required to establish and phase in specific performance based standards for all air emission sources that emit one or more of the listed pollutants. 1,2-Dibromo-3-chloropropane is included on this list. [QR] [REF-134]

Federal Drinking Water Standards

- EPA 0.2 ug/l [QR] [REF-135]

State Drinking Water Standards

- (CA) CALIFORNIA 0.2 ug/l [QR] [REF-135]
- (HI) HAWAII 0.04 ug/l [QR] [REF-135]

State Drinking Water Guidelines

- (AZ) ARIZONA 0.025 ug/l [QR] [REF-135]
- (ME) MAINE 0.25 ug/l [QR] [REF-135]
- (NC) NORTH CAROLINA 0.025 ug/l [QR] [REF-135]

Transport Methods and Regulations

- No person may /transport,/ offer or accept a hazardous material for transportation in commerce unless that person is registered in conformance ... and the hazardous material is properly classed, described, packaged, marked, labeled, and in condition for shipment as required or authorized by ... /the hazardous materials regulations (49 CFR 171-177)./ [QR] [REF-39]
- The International Air Transport Association (IATA) Dangerous Goods Regulations are published by the IATA Dangerous Goods Board pursuant to IATA Resolutions 618 and 619 and constitute a manual of industry carrier regulations to be followed by all IATA Member airlines when transporting hazardous materials. [QR] [REF-40, p.135]
- The International Maritime Dangerous Goods Code lays down basic principles for transporting hazardous chemicals. Detailed recommendations for individual substances and a number of recommendations for good practice are included in the classes dealing with such substances. A general index of technical names has also been compiled. This index should always be consulted when attempting to locate the appropriate procedures to be used when shipping any substance or article. [QR] [REF-41, IMDG; International Maritime Dangerous Goods Code; International Maritime Organization p.3097-1, 6193, 6194, 6195]
- PRECAUTIONS FOR "CARCINOGENS": Procurement ... of unduly large amt ... should be avoided. To avoid spilling, carcinogens should be transported in securely sealed glass bottles or ampoules, which should themselves be placed inside strong screw-cap or snap-top container that will not open when dropped & will resist attack from the carcinogen. Both bottle & the outside container should be appropriately labelled. ... National post offices, railway companies, road haulage companies & airlines have regulations governing transport of hazardous materials. These authorities should be consulted before ... material is shipped. /Chemical Carcinogens/ [QR] [REF-37, p.13]
- PRECAUTIONS FOR "CARCINOGENS": When no regulations exist, the following procedure must be adopted. The carcinogen should be enclosed in a securely sealed, watertight container (primary container), which should be enclosed in a second, unbreakable, leakproof container that will withstand chem attack from the carcinogen (secondary container). The space between primary & secondary container should be filled with absorbent material, which would withstand chem attack from the carcinogen & is sufficient to absorb the entire contents of the primary container in the event of breakage or leakage. Each secondary container should then be enclosed in a strong outer box. The space between the secondary container & the outer box should be filled with an

appropriate quantity of shock-absorbent material. Sender should use fastest & most secure form of transport & notify recipient of its departure. If parcel is not received when expected, carrier should be informed so that immediate effort can be made to find it. Traffic schedules should be consulted to avoid ... arrival on weekend or holiday ... /Chemical Carcinogens/ [QR] [REF-37, p.13]

CERCLA Reportable Quantities

- Persons in charge of vessels or facilities are required to notify the National Response Center (NRC) immediately when there is a release of this designated hazardous substance, in an amount equal to or greater than its reportable quantity of 1 lb or 0.454 kg. The toll free number of the NRC is (800) 424-8802; In the Washington D.C. metropolitan area (202) 426-2675. The rule for determining when notification is required is stated in 40 CFR 302.6 (section IV. D.3.b). [REF-136]

RCRA Requirements

- U066; As stipulated in 40 CFR 261.33, when 1,2-dibromo-3-chloropropane, as a commercial chemical product or manufacturing chemical intermediate or an off-specification commercial chemical product or a manufacturing chemical intermediate, becomes a waste, it must be managed according to Federal and/or State hazardous waste regulations. Also defined as a hazardous waste is any residue, contaminated soil, water, or other debris resulting from the cleanup of a spill, into water or on dry land, of this waste. Generators of small quantities of this waste may qualify for partial exclusion from hazardous waste regulations (40 CFR 261.5). [REF-137]

MONITORING AND ANALYSIS METHODS

Analytic Laboratory Methods

- A Varian 3700 gas chromatograph equipped with electron capture detector & CDS-111 integrator was used for quantitative analysis of drinking water samples. The mean % recovery of 1,2-dibromo-3-chloropropane in water samples was 95.9%. [REF-138]

- Retention ratio data compiled by the FDA in its Pesticide Anal Manual using packed gas chromatography columns were examined for usage when capillary gas chromatography was applied for residue anal of materials incl 1,2-dibromo-3-chloropropane. [REF-139]

- Sample: air; detection: polarography; detection limit: 7 mg/cu m. Sample: soil; detection: polarography; detection limit: 0.1 mg/kg. Sample: food; detection: gas chromatography/electron capture detection; limit of detection: 2 ug/kg. [REF-11, p.V20 88]

- AOAC Method 993.15. 1,2-Dibromoethane and 1,2-Dibromo-3-chloropropane in Water by Microextraction Gas Chromatographic Method. [REF-140]

- APHA Method 6210-C. Volatile Organics in Water by Gas Chromatograph/Mass Spectrometric Purge and Trap Packed-Column Technique. [REF-140]

- APHA Method 6210-D. Volatile Organics in Water by Gas Chromatograph/Mass Spectrometric Purge and Trap Capillary-Column Technique. [REF-140]

- APHA Method 6230-C. Volatile Halocarbons in Water by Purge and Trap Packed-Column Gas Chromatography. OMDL= 0.050 ug/l. [REF-140]

- APHA Method 6230-D. Volatile Halocarbons in Water by Purge and Trap Capillary Gas Chromatography. [REF-140]

- APHA Method 6231-B. 1,2-Dibromoethane (EDB) and 1,2-Dibromo-3-Chloropropane (DBCP) in Water by Liquid-Liquid Extraction and Gas

Chromatography. MDL= 0.010 ug/l. [REF-140]

- CLP Method LC_VOA. Analysis of Water for Low Concentration Volatile Organic Compounds by Gas Chromatography/Mass Spectrometry. CRQL= 1.0 ug/l. [REF-140]
- EAD Method 1625. Semivolatile Organic Compounds by Isotope Dilution GCMS. ML= 10 ug/l. [REF-140]
- EMSLC Method 502.2. Volatile Organic Compounds in Water by Purge and Trap Capillary Column Gas Chromatography with Photoionization and Electrolytic Conductivity Detectors in Series. Revision 2.0. MDL= 3.0 ug/l. [REF-140]
- EMSLC Method 504. 1,2-Dibromoethane (EDB) and 1,2-Dibromo-3-chloropropane (DBCP) in Water by Microextraction and Gas Chromatography. Revision 2.0. MDL= 0.010 ug/l. [REF-140]
- EMSLC Method 504.1. 1,2-Dibromoethane (EDB), 1,2-Dibromo-3-chloropropane (DBCP) and 1,2,3-Trichloropropane (123TCP) in Water by Microextraction and Gas Chromatography. MDL= 0.010 ug/l. [REF-140]
- EMSLC Method 524.1. Measurement of Purgeable Organic Compounds in Water by Packed Column Gas Chromatography and Mass Spectrometry. Revision 3.0. MDL= 2.0 ug/l. [REF-140]
- EMSLC Method 524.2. Measurement of Purgeable Organic Compounds in Water by Capillary Column Gas Chromatography/Mass Spectrometry. Revision 4.0. MDL= 0.26 ug/l. [REF-140]
- EMSLC Method 551. Determination of Chlorination Disinfection Byproducts and Chlorinated Solvents in Drinking Water by Liquid-Liquid Extraction and Gas Chromatography with Electron-Capture Detection. MDL= 0.0090 ug/l. [REF-140]
- EMSLC Method 608.1. The Determination of Organochlorine Pesticides in Industrial and Municipal Wastewater by Gas Chromatography with Electron Capture Detection. EMDL= 0.040 ug/l. [REF-140]
- OSW Method 8011. 1,2-Dibromoethane and 1,2-Dibromo-2-chloropropane by Microextraction and Gas Chromatography. MDL= 0.010 ug/l. [REF-141]
- OSW Method 8081. Organochlorine Pesticides and PCBs. Analysis by capillary GC/ECD. [REF-141]
- OSW Method 8270C. Semivolatile Organic Compounds by Gas Chromatography/Mass Spectrometry (GC/MS): Capillary Column Technique. [REF-141]
- OSW Method 5021. Volatile Organic Comounds in Soils and Other Solid Matrices Using Equilibrium Headspace Analysis. [REF-141]
- EAD Method 1656. Organo-Halide Pesticides in Municipal and Industrial Wastewater by Gas Chromatography. [REF-140]
- OSW Method 8010B. Determination of Halogenated Volatile Organics by Gas Chromatography. MDL= 0.030 ug/l. [REF-141]
- OSW Method 8021A. Analysis of Halogenated and Aromatic Volatiles by Gas Chromatography Using Electrolytic Conductivity and Photoionization Detectors in Series: Capillary Column Technique. MDL= 3.0 ug/l. [REF-141]
- OSW Method 8260A. Determination of Volatile Organic Compounds by Gas Chromatography/Mass Spectrometry (GC/MS): Capillary Column Technique.

MDL= 0.26 ug/l. [REF-141]

- SFSAS Method SFSAS_29. Extraction and Analysis of Organics in Biological Tissue. Analysis by capillary GC/MS. LOQ= 0.050 mg/kg. [REF-140]

Clinical Laboratory Methods

- Recoveries of 1,2-dibromo-3-chloropropane (DBCP) from whole rat blood were 92.6-102.4% and the mean % recovery was 96.7%. A Varian 3700 gas chromatograph equipped with electron capture detector & CDS-111 integrator was used for quantitative analysis. [REF-138]

MANUFACTURING AND USE INFORMATION

Methods of Manufacturing

- ... BY THE LIQUID PHASE ADDITION OF BROMINE TO ALLYL CHLORIDE. [REF-9, p.VA17 129]

Impurities

- Technical grade DBCP has been shown to contain up to 10% impurities, incl epichlorohydrin and allyl chloride. ... Epichlorohydrin is added intentionally as a stabilizer. [REF-10, p.210]

Formulations/Preparations

- FUMAZONE 86E: 1,2-DIBROMO-3-CHLOROPROPANE AND RELATED HALOGENATED C3 HYDROCARBONS, 84.0%, INERT INGREDIENTS 16.0%, (PETROLEUM SOLVENT 9%). FUMAZONE 86: 1,2-DIBROMO-3-CHLOROPROPANE & RELATED HALOGENATED C3 ALIPHATICS 85.5%, PETROLEUM SOLVENT 14.5%. [REF-5, p.V-261]

- 1,2-DIBROMO-3-CHLOROPROPANE IS AVAIL IN USA AS TECHNICAL GRADE CONTAINING NOT LESS THAN 95% OF PURE CHEM, AS EMULSIFIABLE CONCENTRATES CONTAINING 70.7-87.8%, AS SOLN CONTAINING 47.2%, AS GRANULES CONTAINING 5.25-34%, & IN FERTILIZER MIXT CONTAINING 0.6-5%. [REF-11, p.V20 84]

- Gro-Tone Nematode Granular; granular, 17.3% Dibromo-3-chloropropane [REF-4]

- Durham Nematocode EM 17.1, Nematocide Solution 17.1, soluble concn, 97% Dibromo-3-chloropropane [REF-4]

- Nematocide EM 12.1, soluble concn, 85% Dibromo-3-chloropropane [REF-4]

- Nematocide EM 15.1, soluble concn, 94% Dibromo-3-chloropropane [REF-4]

- 1,2-Dibromo-3-chloropropane (DBCP)-EC, emulsifiable concn, 80% Dibromo-3-chloropropane [REF-4]

Other Manufacturing Information

- MANY PERENNIAL PLANTS TOLERATE HIGH CONCN BUT OTHERS, EG TOBACCO, POTATO, ARE SENSITIVE AND LONG AERATION PERIOD PRIOR TO PLANTING MAY BE NECESSARY. [REF-12, p.180]

- 1,2-DIBROMO-3-CHLOROPROPANE IS ... EFFECTIVE AGAINST A WIDE RANGE OF NEMATODES, INCLUDING ROOT-KNOT NEMATODES, AT 10-125 KG/HA. SOIL TEMP AT 15 CM DEPTH SHOULD BE 21-27 DEG C FOR BEST RESULTS. [REF-13, p.164]

- 1,2-Dibromo-3-chloropropane was first produced commercially in the US in 1955. [REF-14, p.V20 84]

- All US usage of 1,2-dibromo-3-chloropropane was cancelled in 1979. [REF-15, p.V14 580]
- Manufacturers: Shell (formerly); Dow (formerly); Amvac. [REF-9, p.VA6 538]

Major Uses

- Cancellation of all registrations of end use products except for the use on pineapples in Hawaii /as soil fumigant/ (3/31/81) [REF-16, p.3]
- Intermediate in organic synthesis; LV (low in volatiles) commercial preparation for the flame retardant tris(2,3-dibromopropyl)phosphate [REF-1, p.464]
- Unclassified nematocide used for soil fumigation of cucumbers, summer squash, cabbage, cauliflower, carrots, snap beans, okra, aster, shasta daisy, ornamental turf (lawns), bermuda grass, centipede grass, St Augustine grass, zoysia grass, ardisia, azalea, camellia, forsythia, gardenia, hibiscus, roses, and arborvitae. /Gro-Tone Nematode Granular/ /Former uses/ [REF-4]
- Fumigation of pineapple in Hawaii. /Nematocide EM 12.1, Nematocide EM 15.1/ [REF-4]
- Restricted use against plant-parasitic nematodes in soil fumigation of pineapple. /Nematocide Solution 17.1/ [REF-4]
- Nematicidal soil sterilant used on berries, citrus, grapes, deciduous fruit, nuts, peanuts, cotton, soya beans, turf, vegetables, and ornamentals. /Former use/ [REF-17, p.A132]

Consumption Patterns

In 1977, 831,000 pounds of 1,2-dibromo-3-chloropropane (DBCP) was used in CA alone, mainly on grapes and tomatoes. In 1974, USA farmers applied 9.8 million pounds of DBCP on crops. [REF-18, p.77]

U.S. Production

(1977) PROBABLY GREATER THAN 4.54X10+6 G [REF-19]
(1982) PROBABLY GREATER THAN 2.27X10+6 G [REF-19]

CHEMICAL AND PHYSICAL PROPERTIES

Molecular Weight	236.36 [REF-21, p.512]
Melting Point	5 deg C [REF-25, p.3532]
Boiling Point	164.5 deg C at 300 mm Hg [REF-24, p.621]
Density/Specific Gravity	2.08 AT 20 DEG C/20 DEG C [REF-1, p.464]
Vapor Density	2.09 at 14 deg C [REF-31]
Vapor Pressure	0.58 mm Hg at 20 deg C [REF-28]
Corrosivity	CORRODES ALUMINUM, MAGNESIUM, TIN & ALLOYS CONTAINING THESE METALS; ATTACKS RUBBER MATERIAL & COATINGS [REF-11, p.V20 84]; Will not corrode steel or copper alloys unless it contains more than 0.02% of water. [REF-26, p.160]

Octanol/Water Partition Coefficient

log Kow= 2.96 [REF-27]

Solubilities

- MISCIBLE IN ALIPHATIC AND AROMATIC HYDROCARBONS [REF-24, p.621]
- MISCIBLE WITH OILS, DICHLOROPROPANE, ISOPROPYL ALCOHOL [REF-21, p.512]
- 0.1% wt/wt in water [REF-12, p.180]

- Miscible with acetone [REF-24, p.621]
- In water= 1230 mg/l at 20 deg C [REF-28]

Spectral Properties

- INDEX OF REFRACTION: 1.553 AT 14 DEG C/D [REF-21, p.512]
- MASS: 4575 (National Bureau of Standards EPA-NIH Mass Spectra Data Base, NSRDS-NBS-63) [REF-29, p.V2 144]
- Intense mass spectral peaks: 157 m/z (100%), 75 m/z (88%), 155 m/z (85%), 49 m/z (38%) [REF-30, p.3]

Other Chemical/Physical Properties

- Percent in saturated air: 0.13 @ 25 deg C; 1 mg/l= 103.4 ppm and 1 ppm= 9.71 mg/cu m @ 25 deg C, 760 mm Hg [REF-25, p.3533]
- Conversion factors: 1 ppm= 9.67 mg/cu m; 1 mg/cu m= 0.103 ppm [REF-23, p.II-2]
- AMBER TO DARK BROWN LIQUID /TECHNICAL GRADE/ [REF-1, p.464]
- Dense yellow liquid; may also appear in granular form /Technical Grade/ [REF-2, p.240]
- Stable in neutral and acidic media; hydrolyzed by alkali to 2-bromoallyl alcohol. [REF-14, p.V20 84]
- Dense yellow or amber liquid (Note: A solid below 43 degrees F). [REF-22, p.92]

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atmosphere by reaction with photochemically-produced hydroxyl radicals(SRC) giving products of 1,2-dibromopropanol, chlorobromopropanol, and 1-bromo-3-chloro-2-propanone(4); the half-life for this reaction in air is estimated to be about 37 days(3,SRC). An upper limit to the ozone reaction rate constant of

- REF - 106: (1) Castro CE; Environ Health Persp 21: 279-83 (1977) (2) Castro CA, Belser NO; Environ Sci Technol 2: 779-83 (1968) (3) Litton GM, Guymon GL; J Environ Qual 22: 311-25 (1993) (4) Bloom RA, Alexander M; J Environ Qual 19: 722-26 (1990) (5) Mohn WW, Teidje JM; Microbiol Rev 56: 482-507 (1992)

- REF - 107: Continuous-flow fixed-film columns, seeded with sewage and run under denitrifying, sulfate respiring, or methanogenic conditions, were used to simulate the biodegradation of 1,2-dibromo-3-chloropropane in anoxic groundwater(1). Under methanogenic conditions and following an acclimation period of 9-12 weeks, >99% removal of 1,2-dibromo-3-chloropropane at an initial concentration of 17 ug/l was measured(1). 98% of the added 1,2-dibromo-3-chloropropane (at 12 ug/l initially) was removed following a

- REF - 108: (1) Williams RT et al; Installation Restoration Program Environmental Technology Development. Biodegradation of DIMP, Dieldrin, Isodrin, DBCP, and PCPMSO in Rocky Mountain Arsenal Soils. Wesford (RF), West Chester, PA. Contract Daak11-85-D-007. NTIS/AD-A245852/9 (1989) (2) Liu CCK et al; Toxic Assess 2: 239-52 (1987) (3) Wilson JT et al; J Environ Qual 10: 501-6 (1981) (4) Piwoni MD et al; Hazard Waste Hazard Materials 3: 43-55 (1986)

- REF - 109: (1) Burlinson NE et al; Environ Sci Technol 16: 627-32 (1982) (2) IARC; Some Halogenated Hydrocarbons 20: 83-96 (1979) (3) Meylan WM, Howard PH; Chemosphere 26: 2293-99 (1993) (4) Deeley GM et al; J Environ Qual 20: 547-56 (1991) (5) Milano JC et al; Wat Res 24: 557-64 (1990)

- REF - 110: The dominant removal process of 1,2-dibromo-3-chloropropane in the atmosphere is hydroxyl abstraction; 1,2-dibromopropanol, chlorobromopropanol, and 1-bromo-3-chloro-2-propanone are formed as products during this process(1). The rate constant for the vapor-phase reaction of 1,2-dibromo-3-chloropropane with photochemically-produced hydroxyl radicals has been measured as 4.4X10-13 cu cm/molecule-sec at 25 deg C(2). This corresponds to an atmospheric half-life of about 37 days at an atmospheric concentration of 5X10+5 hydroxyl radicals per cu cm(2,SRC). An upper limit of

- REF - 111: (1) Kenaga EE; Ecotox Env Safety 4: 26-38 (1980)

- REF - 112: (1) Chemicals Inspection and Testing Institute; Biodegradation and Bioaccumulation Data of Existing Chemicals Based on the CSCL Japan. Japan Chemical Industry Ecology-Toxicology and Information Center. ISBN #4-89074-101-1 (1992) (2) Franke C et al; Chemosphere 29: 1501-14 (1994)

- REF - 113: (1) Biggar JW et al; Environ Geol 5: 127-31 (1984) (2) Litton GM, Guymon GL; J Environ Qual 22: 311-25 (1993) (3) Bomberger DC et al; ACS Symp Ser 225: 197-214 (1983) (4) Sabjlic A; J Agric Food Chem 32: 243-6 (1984) (5) Cohen SZ et al; in ACS Symp Ser. Garner WY et al (ed.). Washington, DC 315(Eval Pestic Ground Water): 170-96 (1986) (6) Deeley GM et al; J Environ Qual 20: 547-56 (1991) (7) Swann RL et al; Res Rev 85: 23 (1983)

- REF - 114: Modeling predicts that 1,2-dibromo-3-chloropropane will adsorb so weakly that it will co-migrate with water through low organic content soil(1). Clay and silt soils adsorb 1,2-dibromo-3-chloropropane more strongly than sand soils, but downward vertical migration of this compound was observed regardless of soil type(2). The retardation factor (defined as the ratio of the interstitial water velocity to the velocity of the chemical) of 1,2-dibromo-3-

chloropropane in Lincoln fine sand columns (organic carbon= 0.87%) was measured as 2.1(3) and

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- REF - 117: Carter GE Jr, Riley MB; Pestic Monit J 15 (3): 139-42 (1981)

- REF - 118: (1) Carter GE, Riley MB; Pest Monit J 15: 138-42 (1981) (2) Pellizzari ED et al; Environmental Monitoring Near Industrial Sites: Brominated Chemicals Part 1 Office of Toxic Substances USEAPA Washington DC (1978)

- REF - 119: (1) Burmaster DE; Environ 24: 6-13 (1982) (2) Westrick JJ et al; J Amer Water Works Assoc 76: 52-9 (1984) (3) Carter GE, Riley MB; Pest Monit J 15: 138-42 (1981)

- REF - 120: (1) Rao PSC et al; Soil Crop Sci Soc Fl Proc 44: 1-8 (1985) (2) Nelson SJ et al; Studies Environ Sci 17: 169-74 (1981) (3) Carter GE, Riley MB; Pest Monit J 15: 138-42 (1981) (4) Burmaster DE; Environ 24: 6-13 (1982) (5) Lau LS, Mink JF; J Am Wat Works Assoc 79: 37-42 (1987) (6) Oki DS, Giambelluca TW; Ground Water 25: 693-702 (1987) (7) USEPA; Pesticides in Groundwater Database. A Compilation of Monitoring Studies: 1971-1991. National Summary. USEPA Off Pest Programs. Prevention Pesticides and Toxic Substances (H7507C) USEPA-734-12-92-001 (1992) (8) Peoples SA et al; Bull Environ Contam Toxicol 24: 611-18 (1980) (9) Westrick JJ et al; J Amer Water Works Assoc 76: 52-9 (1984)

- REF - 121: (1) Peoples SA et al; Bull Environ Contam Toxicol 24: 611-18 (1980) (2) Lam RHF et al; pp. 15-44 in Water Contamination and Health, Wang, RGM (ed), NY,NY: Marcel Dekker, Inc (1994) (3) Berteau PE, Spath DP; pp. 423-35 in ACS Symp Ser 315(Evaluation Pestic Groundwater) (1986) (4) Aharonson N et al; Pure Appl Chem 59: 1419-46 (1987) (5) Burrows WD; pp.80-2 in JT Conf Sens Environ Pollut Conf Proc 4th, 1977. ACS, Washington, DC (1978) (6) Westrick JJ et al; J Amer Water Works Assoc 76: 52-9 (1984)

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(2) Daft JL; J Agric Food Chem 37: 560-64 (1989)

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- REF - 128: (1) Gabbita KV; Toxicol Environ Chem 11: 203-13 (1986)
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- REF - 134: Clean Air Act as amended in 1990, Sect. 112 (b) (1) Public Law 101-549 Nov. 15, 1990
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- REF - 136: 40 CFR 302.4 (7/1/95)
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END OF RECORD

Health and Welfare Canada
Santé et Bien-être social Canada

Health Protection Branch
Direction générale de la protection de la santé

OTTAWA, K1A 0L2

Your file Votre référence

September 6, 1977

Our file Notre référence

Mr. M. J. Heney,
Assistant Deputy Minister,
Production and Marketing Branch,
Agriculture Canada,
Sir John Carling Building,
OTTAWA, Ontario.
K1A 0C5

Dear Mr. Heney:

Recent reports have implied that the fumigant dibromochloropropane (DBCP) is the agent which has induced sterility in 10 out of 15 workers at the Occidental Chemical Company's formulating plant in California, and in 12 men who work at the Dow Chemical plant in Magnolia, Arkansas. Dibromochloropropane is a volatile chemical and inhalation of it could be hazardous if suitable respirators are not worn at all times when it is handled.

In Canada, a granular product containing DBCP is formulated by Shell Canada at Simcoe, Ontario, and the liquid product is formulated at Toronto. I understand that production for this year was completed some three weeks ago. Apparently five men are involved in the processing which occupies less than five working days per year. Shell Canada will be conducting medical examinations on these employees.

In addition to the effects on reproduction mentioned above, DBCP is also suspected to be carcinogenic; the results of studies conducted by the National Cancer Institute and the Dow Chemical Plant of the U.S.A. are expected to be available soon.

The potential occupational hazards of DBCP lead me to recommend to you that registration of DBCP be temporarily cancelled. No further sales at any level (to Shell Canada, to distributors, to applicators, etc.) or formulation should be allowed in Canada until the results of

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the various studies (including medical reports, reproduction studies and carcinogenicity studies) have been made available to toxicologists of the Health Protection Branch for evaluation.

I trust that you will agree that this action is necessary to protect the health of Canadians who may be exposed to this chemical.

Yours sincerely,

A. B. Morrison, Ph.D.,
Assistant Deputy Minister,
Health Protection Branch.

Agriculture Canada
Production and Marketing Branch
Direction de la Production et de la Commercialisation
O t t a w a , K1A 0C5

FILE

September 23, 1977

Your file Votre référence 8342DCP

Our file Notre référence

Dr. A. B. Morrison
Assistant Deputy Minister
Health Protection Branch
Health and Welfare Canada
Tunney's Pasture
Ottawa, Ontario
K1A 0L2

Dear Dr. Morrison:

Thank you for your letter of September 6, 1977 in which you express concern regarding dibromochloropropane (DBCP). Regulatory officials in Agriculture Canada have been closely following developments in respect to this pest control product in anticipation of a need to take regulatory action under the Pest Control Products Act.

However, Shell Canada Ltd., the only formulator/registrant of DBCP products in Canada reacted quickly and in a responsible manner. They informed the Department by letter that they were ceasing all formulation and distribution of DBCP products. Subsequently they also informed their customers of possible dangers associated with the use of the products and took action to withdraw material from the distributor/user levels of trade.

These commendable actions satisfied the company's own concerns for safety and met the immediate intent of the P.C.P. Act relative to the protection of the health of Canadians. A final regulatory decision must await completion and evaluation of the NCI and Dupont studies and other medical reports. Nevertheless, a temporary suspension notice is being issued on the DBCP products for the purposes of the Act thus confirming the actions already taken by Shell Canada Ltd.

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Through regular channels responsible officials of Health and Welfare Canada will receive copies of the regulatory directive consistent with usual practice.

Yours sincerely,

F. E. Payne
A/Assistant Deputy Minister
Production and Marketing