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Operation of the interim Prior Informed Consent procedure banned or severely restricted chemicals in international trade

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Decision Guidance Document

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Ethylene dichloride

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Interim Secretariat for the Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade

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Interim Secretariat for the Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade

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Rome - Geneva, February 2001

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Mandate

The Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade was adopted at the Conference of Plenipotentiaries held in Rotterdam on 10 and 11 of September 1998. The same Conference also adopted a Resolution on interim arrangements in order to operate an interim PIC procedure between the time of the adoption of the Convention and its entry into force, and to prepare for its effective operation once it enters into force.

Paragraph 7 of this Resolution decided that all chemicals that have been identified for inclusion in the PIC procedure under the original PIC procedure but for which Decision Guidance Documents have not yet been circulated before the date on which the Convention is opened for signature will become subject to the interim PIC procedure as soon as the relevant decision guidance documents have been adopted by the Intergovernmental Negotiating Committee (INC).

At its 67th session, held in RomeGeneva on 12-16 July 199930 October to 3 November 2000, the INC thus adopted decision guidance documents for binapacryl and toxapheneethylene dichloride and ethylene oxide (Decision INC-67/23) with the effect that these chemicals became subject to the interim PIC procedure.

The present decision guidance documents for ethylene dichloride was communicated to the Designated National Authorities on 1 September 1999February 2001 with the request that they submit a response concerning the future import of the chemical to the Secretariat in line with Article 10, paragraph 2 of the Rotterdam Convention.

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Disclaimer

The use of trade names in this document is primarily intended to facilitate the correct identification of the chemical. It is not intended to imply any approval or disapproval of any particular company. As it is not possible to include all trade names presently in use, only a number of commonly used and published trade names have been included in this document.

While the information provided is believed to be accurate according to data available at the time of preparation of this Decision Guidance Document, the Food and Agriculture Organization of the United Nations (FAO) and the United Nations Environment Programme (UNEP) disclaim any responsibility for omissions or any consequences that may flow therefrom. Neither FAO or UNEP shall be liable for any injury, loss, damage or prejudice of any kind that may be suffered as a result of importing or prohibiting the import of this chemical.

The designations employed and the presentation of material in this publication do not imply the expression of any opinion whatsoever on the part of FAO or UNEP concerning the legal status of any country, territory, city or area or of its authorities or concerning the delimitation of its frontiers or boundaries.

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ABBREVIATIONS WHICH MAY BE USED IN THIS DOCUMENT

(N.B. Chemical elements and pesticides are not included in this list)

<	less than
≤	less than or equal to
<<	much less than
>	greater than
≥	greater than or equal to
µg	Microgram
a.i.	active ingredient
ACGIH	American Conference of Governmental Industrial Hygienists
ADI	acceptable daily intake
ADP	adenosine diphosphate
ATP	adenosine triphosphate
BBA	Biologische Bundesanstalt für Land- und Forstwirtschaft
b.p.	boiling point
Bw	body weight
°C	degree Celsius (centigrade)
CA	Chemicals Association
CCPR	Codex Committee on Pesticide Residues
CHO	Chinese hamster ovary
D	Dust
EC	Emulsifiable concentrates
EC50	Effect concentration, 50%
ED50	Effect dose, 50%
EHC	Environmental Health Criteria
ERL	Extraneous residue limit
EU	European Union
FAO	Food and Agriculture Organization of the United Nations
g	Gram
GAP	Good agricultural practice

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ABBREVIATIONS WHICH MAY BE USED IN THIS DOCUMENT

GL	Guideline level
GR	Granules
ha	Hectare
i.m.	Intramuscular
i.p.	Intraperitoneal
IARC	International Agency for Research on Cancer
IC50	Inhibition concentration, 50%;
IPCS	International Programme on Chemical Safety
IRPTC	International Register of Potentially Toxic Chemicals
IUPAC	International Union of Pure and Applied Chemistry
JMPR	Joint FAO/WHO Meeting on Pesticide Residues (Joint Meeting of the FAO Panel of Experts on Pesticide Residues in Food and the Environment and a WHO Expert Group on Pesticide Residues)
k	Kilo- (x 1000)
kg	Kilogram
Koc	Organic carbon-water partition coefficient
l	Litre
LC_{50}	Lethal concentration, 50%
LD_{50}	Lethal dose, 50%
LOAEL	Lowest observed adverse effect level
LD_{LO}	Lowest lethal dose
LOEL	lowest observed effect level
m	Metre
m.p.	melting point
mg	Milligram
ml	Millilitre
mPa	MilliPascal
MRL	maximum residue limit
MTD	maximum tolerated dose
NCI	National Cancer Institute
ng	Nanogram
NIOSH	National Institute of Occupational Safety and Health

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ABBREVIATIONS WHICH MAY BE USED IN THIS DOCUMENT

NOAEL	no-observed-adverse-effect level
NOEL	no-observed-effect level
OP	organophosphorus pesticide
PHI	pre-harvest interval
PIC	prior informed consent
Pow	octanol-water partition coefficient
POP	persistent organic pollutant
ppm	parts per million (used only with reference to the concentration of a pesticide in an experimental diet. In all other contexts the terms mg/kg or mg/l are used).
RfD	reference dose for chronic oral exposure
SBC	secretariat for the Basel Convention
SC	Soluble concentrate
SG	water soluble granules
SL	soluble concentrate
SMR	standardized mortality ratio
STEL	short term exposure limit
TADI	temporary acceptable daily intake
TLV	threshold limit value
TMDI	theoretical maximum daily intake
TMRL	temporary maximum residue limit
TWA	time weighted average
UNEP	United Nations Environment Programme
USEPA	United States Environmental Protection Agency
UV	Ultraviolet
VOC	volatile organic compound
WHO	World Health Organization
WP	wettable powder
Wt	Weight

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PIC - Decision guidance document for a banned or severely restricted chemi

Ethylene dichloride

Published: February 2001

Common name	Ethylene dichloride (ISO)
Other names/ Synonyms	1,2-Dichloroethane (IUPAC, CA); alpha,beta-dichloroethane; 1,2-bichloroe ethane dichloride; ethane, 1,2-dichloro-; ethylene chloride; EDC; 1,2-et dichloride; sym-(metric)-dichlorethane.
CAS No.	107-06-2
Use category	Pesticide
Use	Ethylene dichloride is reported used as both a pesticide and an industrial chemica
	Pesticide use: A small fraction of the total production (approximately 0.1% in th in 1977) was used for pesticide solvent and as an insecticidal fumigant, mainly in products. When used as a fumigant, ethylene dichloride is usually mixed with tetrachloride to reduce the fire hazard, and small portions of other fumigants r added *(WHO, 1987)*. It was also used as a rodenticide.
	Industrial use: The major industrial use of the compound is in the synthesis c chloride (approximately 90% of the total production in Japan and approximately 8 total production in the USA). Other chemicals produced from ethylene dichlori 1,1,1-trichloroethane, ethyleneamines, vinylidene chloride, trichloroetl tetrachloroethylene and ethylene glycol. In 1977, 2 - 4% of the total produc ethylene dichloride in the USA was used for the synthesis of each of these che Another 2% was used in the USA as a lead scavenger in gasoline *(WHO, 198* also used as laboratory solvent, as a drying agent in glues and for the fusion of p
Trade names	Borer-Sol, Brocide, Destruxol, Dichlor-emulsion, Dichlor-mulsion, Dutch Liquid, Oil, ENT 1656, Gaze Olefiant.
Formulation types	Liquid
Basic manufacturers	Dow Chemicals USA; Vulcan Materials Company, USA

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Reasons for inclusion in the PIC procedure

Ethylene dichloride is included in the PIC procedure based on reported bans and severe restrictions use as a pesticide[1]. No control actions have been reported relating to its industrial uses. Inclusi recommended at the eighth meeting of the FAO/UNEP Joint Group of Experts on Prior Informed C following detailed discussions during the sixth and seventh meetings.

Deleted: . *It is included in the procedure on the basis of the control actions reported by a number of Governments*

[1] Users of the DGD should be aware that the term "pesticides" may have different meanings in different jurisdicti

Summary of control actions (see Annex 2 for details)

Control actions were reported by 6 countries and the European Union. In 5 countries (Austria, Canada, Slovenia and the United Kingdom) and in the European Union, ethylene dichloride was re as banned for use as an agricultural pesticide. No remaining uses in agriculture were reported. TI reported that ethylene dichloride was totally banned for the fumigation of stored products. Concerr the carcinogenic properties of ethylene dichloride on human health is reported as a primary reason control actions.

Hazard classification by organization

WHO	Gaseous or volatile fumigant not classified under the WHO recommended classifica pesticides by hazard *(IPCS , 1998-1999)*.
EPA	Group B2 (probable human carcinogen). *(USEPA, 1991).*
EU	F; R11|carc. Cat. 2; R45|Xn; R 22|Xi; R 36/37/38 (classification in accordanc Directive 67/548/EEC on the approximation of the laws, regulations and adminis provisions relating to the classification, packaging and labelling of dangerous subst 12th ATP, 1991).
IARC	Group 2B (possibly carcinogenic to humans). *(IARC, 1999).*

Protective measures that have been applied concerning the chemical

Measures to reduce exposure

For the health and welfare of workers and the general public, the handling and application substance should be entrusted only to competently supervised and well-trained applicators wh follow adequate safety measures and use the chemical according to good application practices. Re exposed workers should receive appropriate monitoring and health evaluations. Protective cloth indicated in the *FAO Guidelines for Personal Protection when Working with Pesticides in Tropical Cl* (1990) is required.

In view of the volatility of ethylene dichloride, particular attention should be given to control inh exposure.

Packaging and labelling

Follow the *FAO Revised Guidelines on Good Labelling Practice for Pesticides (1995)* and the *Gui for the Packaging and Storage of Pesticides* (1985). Unbreakable packaging required; put bre packaging into closed unbreakable container. Do not transport with food and feed stuff.

The United Nations Committee of Experts on the Transportation of Dangerous Goods classifi chemical in:

Hazard class: 3

Packing group: II

Alternatives

Only Austria reported that many alternatives for designated purposes were available. No alternative reported by other notifying countries.

It is essential that before a country considers substituting any of the reported alternatives, it ensur the use is relevant to their national needs.

Waste Disposal

Waste should be disposed of in accordance with the provisions of the Basel Convention on the Co Transboundary Movements of Hazardous Wastes and Their Disposal, any guidelines thereunder *1994)* and any other relevant regional agreements.

See the *FAO Guidelines on Prevention of Accumulation of Obsolete Pesticide Stocks (1995),* ar *Pesticide Storage and Stock Control Manual* (1996).

Wear protective clothing and respiratory equipment suitable for hazardous materials. Sweep, scoop up spilled material. Vacuuming or wet sweeping may be used to avoid dust dispersal. Do not f surface water or sanitary sewer system. Dispose of empty containers in a sanitary landfill incineration.

Waste must never be discharged into sewers or surface waters. Contaminated porous surfaces vermiculite, etc) should be disposed of at a waste management facility. Recovered liquids m reprocessed, incinerated or treated at a waste management facility (*Environment Canada, 1992*).

It should be noted that the methods recommended in the literature are often not suitable in a s country. High temperature incinerators may not be available. Consideration should be given to the alternative destruction technologies.

Exposure limits

	Type of limit	Value
Food	MRL's (Maximum Residue Limits in mg/kg) in specified products *(FAO/WHO, 1999).*	No MRL allocated.
	JMPR ADI (Acceptable Daily Intake) in mg/kg diet *(WHO, 1992).*	No ADI allocated.
Workplace	USA TLV-TWA (Threshold Limit Value; Time-Weighted Average)*(ACGIH, 1999)*.	10 ppm (40 mg/m

First aid

First aid: Move victim to fresh air. Call emergency medical care. Apply artificial respiration if victim breathing. Administer oxygen if breathing is difficult. Remove and isolate contaminated clothing and In case of contact with substance, immediately flush skin or eyes with running water for at le minutes. Wash skin with soap and water. Keep victim warm and quiet. Effects of exposure (inha ingestion or skin contact) to substance may be delayed. Ensure that medical personnel are aware material(s) involved, and take precautions to protect themselves (*U.S. Department of Transpo 1996*).

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Deleted: Precautions for "carcinogens": There is no universal method for disposal that has been proved satisfactory for all carcinogenic compounds. Ethylene dichloride is a candidate for liquid injection incineration, with a temperature of 650 to 1600 °C and a residence time of 0.1 to 2 seconds. *(USEPA, 1987).*

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Deleted: Persons who have been poisoned (accidentally or otherwise) should be transported immediately to a hospital and put under surveillance of properly trained medical staff. ¶
Eyes: Immediately flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower lids. Seek medical attention immediately.¶
Skin: Flush skin with plenty of soap and water for at least 15 minutes before removing contaminated clothing and shoes.¶
Ingestion: Do not induce vomiting. Have the victim rinse his or her mouth and then drink 2-4 cupfuls of water, and seek medical advice.¶
Inhalation: Remove from exposure into fresh air immediately.

Annexes

Annex 1 - Further information on the substance

1 Chemical and physical properties

1.1	**Identity**	Clear colourless liquid; chloroform-like odour; sweet taste *(Tomlin, 1994)*
1.2	**Formula**	$C_2H_4Cl_2$
	Chemical name	1,2-dichloroethane (CA).
1.3	**Solubility**	5-10 mg/ml at 19°C in water
	logPow	1.76
1.4	**Vapour pressure**	8.53 kPa (64 mmHg), 20 °C, highly volatile.
1.5	**Melting point**	-36°C
1.6	**Boiling point**	83.5°C
1.7	**Flammability**	It is flammable. The flash point is 13°C
1.8	**Reactivity**	This compound is incompatible with strong alkalis, strong caustics, ox materials, active metals such as aluminium, magnesium, sodium or pota It reacts violently with nitrogen tetraoxide, dimethylaminopropylamine o ammonia. A vigorous reaction also occurs when a mixture of this com propylene dichloride and o-dichlorobenzene comes into contac aluminium. It can corrode iron, zinc and aluminium in the presence of m *(Sax, 1986)*. Mixtures with nitric acid easily deteriorate *(Bretherick, 198*

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Deleted: 8.69 g/litre at 20 °C, miscible with alcohol, chloroform, ether *(IARC, 1979)*.
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2 Toxicity

2.1 General

2.1.1	**Mode of action**	Although only limited quantitative data are available, inhaled etl dichloride is likely to be adsorbed by the lungs in humans and experi animals, based on its high vapour pressure and serum/air partition coe *(WHO, 1994)*.
2.1.2	**Uptake**	Ethylene dichloride can be found in the blood of rodents, almost imme after dermal, oral or inhalation exposure. Peak blood level in rat during exposure for 24 hours is 135 mg/l *(Morton, 1991 in Richardson, 1993)*.
2.1.3	**Metabolism**	Ethylene dichloride is metabolised in rat and mouse by two com pathways, both of which involve glutathione (GSH). Oxidation chloroacetaldehyde which is detoxified by GSH; it also reacts with G form S-(2-chloroethyl)glutathione *(D'sruza, 1988 in Richardson, 1993)*.
		Following intraperitoneal injection of mouse, the alkyl purines oxoethyl)guanine and 7-[S-(2-cysteinyl)ethyl]guanine were found in hydrolizates and in the urine. Chloroacetaldehyde and chloroethyl)glutathione were found in haemoglobin *(Svensson, 19 Richardson, 1993)*.
		Following intraperitoneal injection of 50-170 mg/kg ^{14}C-ethylene dichlo mice, 10-42% was expired unchanged and 12-15% as carbon dioxide. M

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the remainder was excreted in the urine, primarily as chloroacetic ac chloroacetaldehyde), S-(carboxymethyl)cysteine and thiodiacetic acid *(1971 in Richardson, 1993)*.

Little dechlorination of ethylene dichloride was found to occur in rat and liver preparations in vitro *(Rannug, 1978 in Richardson, 1993)*.

Metabolism of ethylene dichloride appears to have a significant role manifestation of the toxic, carcinogenic and mutagenic effects c chemical.

2.2 Known effects on human health

2.2.1 Acute toxicity

Symptoms of poisoning

Breathing ethylene dichloride can irritate the nose, throat and lungs ca coughing, shortness of breath and difficulty in breathing. Higher leve cause a build-up of fluid in the lungs (pulmonary oedema). This can death. Exposure can cause nausea, vomiting, headaches, incr drowsiness and then loss of consciousness. Over-exposure can also liver and kidney damage, and irritate the eyes. Contact can irritate th causing redness and a rash, and irritate the eyes *(USEPA, 1987)*.

The lethal oral dose of ethylene dichloride in humans has been estima be between 20 and 50 ml *(WHO, 1994)*.

2.2.2 Short and long term exposure

Cancer Hazard: Ethylene dichloride may be a carcinogen in humans s has been shown to cause stomach, lung, breast and other types of can animals.

Other long term effects: Ethylene dichloride can irritate the lungs. Rep exposure may cause bronchitis to develop with cough, phlegm shortness of breath. Repeated, prolonged contact can chronically irrita skin causing dryness, redness and a rash. Repeated, prolonged exp can cause loss of appetite, nausea and vomiting, trembling and low sugar (with weakness). It may damage the liver and kidneys *(USEPA,*

2.2.3 Epidemiological studies

Significant excess of deaths due to pancreatic cancer was found in a of 278 men working in the chlorohydrin unit of a chemical productior between 1941 and 1967 *(Benson & Teta 1993 in WHO, 1995)*.

No significant difference was found compared with control in a case-c study on 21 employees at a petrochemical plant in USA *(WHO, 1994)*.

In a cohort study of 6588 workers at the same plant, no significant exc malignant brain tumours was observed *(Austin & Schnatter, 1983 in 1995)*.

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No association between ethylene dichloride spill and leukaemia in chil was found in a small case-control study *(Deschamps & Band, 1993 in 1995)*.

A statistically significant increase in colon and rectal cancer was obser men aged ≥ 55 years and whose drinking water contained ≥ 0. ethylene dichloride, even if the authors did not suggest an asso between ethylene dichloride and cancer but underlined the higher cancer incidence in populations consuming chlorinated water *(Isacson in WHO, 1995)*.

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Higher prevalence of subjective symptoms was observed in 10 male w in an oil refinery exposed to 250-800 mg/m^3 than in those exposed to

concentrations. However there was a co-exposure to benzene *(Cetnar 1959 in WHO, 1995).*

An increased morbidity for all disease categories was observed in a period (1951-55) in a group of workers at an aircraft factory exposed f 30% of the working time to 80-150 mg/m³ and to ≤ 5 mg/m³ f remainder *(Kozik, 1957 in WHO, 1995)*.

2.3 Toxicity studies with laboratory animals and *in vitro* systems

2.3.1 Acute toxicity

oral LD_{50} for rats, mice, dogs and rabbits ranged from 413 to 2500 mg/ *(WHO, 1995)*.

Dermal LD_{50} for rabbits ranged from 2800 to 4900 mg/kg bw *(Torkelson & 1981 in WHO, 1995).*

Inhalation LC_{50} for rats exposed for 6 or 7.25 hours ranged from 4000 mg/m³ tc mg/m³ *(WHO, 1995)*.

Irritation Application of ethylene dichloride to the skin of experimental anima resulted in microscopic changes and moderate oedema *(Duprat et al., 1*

2.3.2 Short-term-exposure

Several short-term and subchronic studies in different experimental s indicate that liver and kidneys are the target organs. The documentatic considered inadequate to derive NOELs or LOELs. Some studies morphological changes in the liver in several species following subc exposure to airborne concentrations as low as 800 mg/m³. Liver increase was observed in rats with subchronic oral administration of 4 mg/kg bw. Changes in serum parameters that indicate liver and kidney t were observed in rats exposed to airborne concentrations as low a mg/m³ for 12 months *(WHO, 1995).*

2.3.3 Long-term exposure

Studies on the chronic effects are related to the carcinogenicity substance and do not give sufficient information on non-neoplastic effe the substance. Ethylene dichloride was carcinogenic in mice and rats administered by gavage or dermal application, while no increase incidence of tumours was noted in inhalation or in initiation/pro bioassays *(WHO, 1994)*.

2.3.4 Effects on reproduction

There is no evidence from a limited number of studies that ethylene dicl is teratogenic in experimental animals. There is also little convincing evi that ethylene dichloride induces reproductive or developmental effe doses below those which cause other systemic effects *(WHO, 1995)*.

2.3.5 Mutagenicity

Ethylene dichloride has been consistently positive in *in vitro* mut bioassays in *Salmonella typhimurium*. Response has been greater presence of an exogenous activation system (cytochrome P450 syster in its absence, and mutagenicity was more than doubled in *S. typhin* expressing the human GSTA-1 gene. In cultured mammalian cells, et dichloride forms DNA adducts. It also induces unscheduled DNA synth primary cultures of rodents and human cells and gene mutation in seve lines. Mutation frequency in human cell lines has been correlate differences in glutathione-S-transferase activity. In *in vivo* studies et dichloride induced somatic cell and sex-linked recessive lethal mutati *Drosophila melanogaster* and the compound bound to DNA in all re studies in rats and mice. Although primary DNA damage in liver and

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chromatid exchange has been observed in studies in mice, there has be evidence for micronucleus induction *(WHO, 1995)*.

2.3.6 **Carcinogenicity**

Carcinogenicity of ethylene dichloride was investigated in a few bioassays on experimental animals. Significant increases were not fou any type of tumour in Sprague-Dawley rats or Swiss mice exposed to 607 mg/m^3 for 78 weeks (a high mortality was observed in this study alt it was not related to concentration). No significant increase in the incide mammary gland adenomas and fibroadenomas in Sprague-Dawley fe exposed to 200 mg/m^3 for 2 years *(WHO, 1995)*.

Significant increased incidence of tumours was observed in two s following ingestion; squamous cell carcinomas of the stomach in haemangiosarcomas in both sexes. Fibromas of the subcutaneous tis males, adenocarcinomas and fibroadenomas of the mammary gla females were observed in Osborne-Mendel rats with Time-Weighted A (TWA) daily doses of 45 to 95 mg/kg bw/day for 78 weeks. Similar incr in alveolar/bronchiolar adenomas in males and females, mammary adenocarcinomas in females and endometrial stromal polyp or endo stromal sarcoma combined in females and hepatocellular carcinon males were observed in B6C3F1 mice administered TWA of 97 or 195 bw/day for males and 149 or 299 mg/kg bw/day for females by gavage weeks *(WHO, 1995).*

A significant increase of lung tumours (benign papillomas) was fou female mice following repeated ethylene dichloride application for 440 days. A dose-related increase in the incidence of pulmonary adenoma found in mice following repeated intraperitoneal injection of et dichloride but was not significant. Concomitant exposure to inhaled et dichloride and disulfuram in the diet resulted in an increased incide intrahepatic bile duct cholangiomas and cysts, subcutaneous fibr hepatic neoplastic nodules, interstitial cell tumours in the teste mammary adenocarcinomas in rats compared to rats administered eith compound alone or untreated controls. A further three bioassays did no evident tumour development initiating or promoting properties *(WHO, 19*

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3 Exposure

3.1 **Food**

Very little information is available on ethylene dichloride in food. Et dichloride was found in Germany in milk products with added fruits. In C it was used as an extractant in samples of spice oleoresins. Residue s show that ethylene dichloride can be found in fumigated grain *(WHO, 19*

3.2 **Occupational**

Ethylene dichloride levels of up 150 mg/m^3 and ranging from 40 to 800 were detected in industrial plants using the chemical as a solvent *(1987)*.

Time-weighted averages of 0.1 and 1 mg/m^3, respectively, have reported for two different jobs in an anti-knock agent blending plant USA. The maximum exposure level measured was 8.9 mg/m^3 *(WHO, 19*

3.3 **Environment**

Owing to the limited releases of ethylene dichloride, it is a rare environ contaminant. It has been detected in both surface and groundwater unlike other volatile organic compounds (VOCs), higher levels were re in surface waters. USEPA estimates that 0.3% of all groundwater su contain ethylene dichloride concentrations ranging from 0.5 to 5.0 g/l. percent of surface waters are estimated to have concentrations from 0.5 g/l *(Howard, 1990; USEPA, 1987)*.

Ethylene dichloride commonly occurs in the air of urban and suburban at concentrations less than 0.2 ppb. The greatest source of eth dichloride exposure is from the air. Drinking water is the greatest sou populations with drinking water levels above 6 g/l *(Howard, 1990; U 1987)*.

3.4 **Accidental poisoning**

Acute incidental exposure to ethylene dichloride by inhalation or ingestic resulted in a variety of effects in humans, including effects on the nervous system, liver, kidney, lung and cardiovascular system.

4 Effects on the environment

4.1 Fate

Ethylene dichloride released to the air slowly degrades over a perio few months. Photo-oxidation with hydroxyl radicals, that results production of carbon dioxide and hydrochloric acid, is believed to predominant removal process. It is expected that ethylene dichlor transported over long distances and washed out during rainfall. photolysis is not expected to occur *(Howard, 1990)*.

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Ethylene dichloride released to surface waters will be removed prima evaporation within a few days or weeks. Adsorption to sedimer hydrolysis is not expected.

Releases of ethylene dichloride on to soil will evaporate fairly rapidly. migration to groundwater is expected for sandy soils *(Howard, 1990)*.

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4.1.1 Persistence

Biodegradation is not expected to occur under either aerobic or ana conditions. The photo-oxidation of ethylene dichloride in air is expected a slow process. No significant bioaccumulation is expected to oc aquatic organisms *(Howard, 1990)*.

Deleted: ; USEPA, 1997

4.1.2 Bioconcentration

Ethylene dichloride is not expected to bioconcentrate in fish due to Kow. The measured bioconcentration factor for bluegill sun fish is (*Richardson, 1993*).

4.2 Ecotoxicity

4.2.1 Fish

Acute toxicity studies have been conducted on several species of fresh fish. The most sensitive species was two to three-month old g *(Poecilia reticulata)*, with a nominal 7-day LC_{50} of 106 mg/l et dichloride under static renewal test conditions. In three studies in 30-d fathead minnows *(Pimephales promelas)* over 96-hour LC_{50} values r from 116 to 136 mg/l under flow-through conditions. The only ade acute toxicity study in marine fish involved tidewater silversides *(M beryllina)* in which a nominal 96-hour LC_{50} of 480 mg/l was reported static test conditions *(WHO, 1994)*.

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In a long-term flow-through study of the early life stages of fathead mi
(Pimephales Promelas) a NOEL of 29 mg/l and a LOEL of 59 mg/l (re
larval growth) were identified *(WHO, 1994)*. The EC_{50} for hatchability
27-day LC_{50} for post-hatch survival both of 34 mg/l, resulted fro
ethylene dichloride flow-through assay on embryos and larvae of ra
trout *(Onchorhyncus mykiss)* and the LOEL identified was 3.49 mg/l
reduction in egg hatchability) *(WHO, 1994)*.

After 21 days of continuous exposure to 150 mg/l ethylene dich
mortality of coho salmon *(Onchorhyncus kisutch)* eggs was 46%, w
alevins, 100% mortality occurred 9 days after hatching at 320 mg/l (
1994).

Teratogenic effects were observed in rainbow trout *(Onchorhyncus my*

4.2.2 **Aquatic invertebrates**

Daphnia magna appear to be the invertebrate species most sensit
ethylene dichloride in chronic toxicity studies in freshwater. Under
conditions, the measured 48-hour LC_{50} values for fed and unfed first
Daphnia were 320 and 270 mg/l, respectively; the 48-hour LC_{50} bas
complete immobilization, were 180 and 160 mg/l for fed and
organisms, respectively *(WHO, 1994)*.

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In a 28-day flow-through study on *Daphnia magna* the LOEL and NO
reproductive success were respectively 20.7 and 10.6 mg/l, while the
and NOEL for growth were 71.7 and 41.6 mg/l *(WHO, 1994)*.

With regard to acute toxicity studies in marine invertebrates under stat
conditions, the nominal 24-hour EC_{50} for immobilization of 30-hour pos
larvae of the brine shrimp, *Artemia salina*, was 93.6 mg/l *(WHO, 199*
marine adult shrimp, *Crangon crangon*, the measured 24-hour LC_{50} wa
mg/l, under static test conditions *(WHO, 1994)*.

4.2.3 **Birds**

Significant reduction of the egg weight at 250 mg/kg and reduction o
the number and weight of eggs at 500 mg/kg were observed in a st
which male and female leghorn chickens were fed mash which had
fumigated with ethylene dichloride *(WHO, 1994)*.

4.2.4 **Bees**

There are no adequate studies to permit an assessment of effects on b

4.2.5 **Other**

Aquatic micro-organisms

The IC_{50}s for *Nitrosomonas* and methanogens (29 and 25 mg/l, respec
were considerably lower than for aerobic heterotrophs (470 mg/l). F
bacteria, *Pseudomonas putida*, the nominal 16-hour EC_{50} for the or
cell multiplication inhibition was 135 mg/l *(WHO, 1994)*.

The freshwater blue-green algae, *Microcystis aeruginosa*, was seven
more sensitive to ethylene dichloride than green algae, *Scened*
quadricauda, with a nominal 7-day ED_{50}s for inhibition of cell miltiplica
27 °C of 105 and 710 mg/l, respectively *(WHO, 1994)*.

Based on bioluminescence, the 5-minute IC_{50} was 700 mg/l in a Mi
test with *Photobacterium phosphoreum (WHO, 1994)*.

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Aquatic vertebrates

In a study in which embryos and larvae of the north-western salam
(*Ambystoma gracile*) and the leopard frog (*Rana pipiens*) were contin
exposed to ethylene dichloride from 30 minutes of fertilization (embryo
maintained through four days posthatching (larvae), the resulting LC
the salamander were 6.53 mg/l at the day of hatching (day 5) and 2.5
4-day posthatching (day 9). LOEL was 0.99 mg/l for 23% reduction

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	hatchability. The measured 5-day and 9-day LC_{50} values for the frog 4.52 and 4.40 mg/l respectively, while the 5-day posthatch LOEL wa mg/l *(WHO, 1994)*.
Terrestrial invertebrates	In an acute contact test, a 48-hour LC_{50} for earthworms (*Esinia* exposed to ethylene dichloride-treated filter paper was 60 μg/m^2 (*1994)*.
Plants	Ethylene dichloride vapour was both lethal and mutagenic to barley k (two-rowed variety, *Bonus*) following exposure to 3 mg/m^3 for 24 hours

Annex 2 - Details on reported control actions

AUSTRIA

Effective: 1992.

Control action: All agricultural uses banned.

Reasons: Carcinogenic and mutagenic properties. The substance has a poten reproductive effects in males and central nervous system effects.

Alternatives: Many alternatives for designated purposes.

BELIZE

Effective: 1985.

Control action: The substance is banned for agricultural use.

Reasons: Mixed with CCl_4, a carcinogen.

CANADA

Effective: 1984.

Control action: Suspended/banned for agricultural use.

EUROPEAN UNION

Effective: 1989.

Control action: The placing on the market and the use of plant protection products con 1,2-dichloroethane is prohibited. No remaining uses in agriculture allowed

Reasons: The use of 1,2-dichloroethane as a plant protection product, in partic fumigate plants and soil, is likely to give rise to harmful effects on huma animal health as well as unreasonable adverse influence on the enviro 1,2-dichloroethane has been classified by the European Community category 2 carcinogen (probably carcinogenic to humans).

(Member States of the European Union are: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ir Italy, Luxembourg, Netherlands, Portugal, Spain, Sweden, United Kingdom.)

SLOVENIA

Effective: 1997.

Control action: Banned for use in agriculture.

Reasons: This chemical was banned from the use in agriculture due to the effect toxic properties to human health and the environment according to the op given by the Commission on Poisons.

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THAILAND

Effective:	1995
Control action:	Ethylene dichloride was totally banned for the export, import, produc having in possession as a pesticide. Use of Ethylene dichloride for fumiga stored products was totally banned by the final regulatory action. Industr as a raw material in manufacture of vinylchloride remains allowed.
Reasons:	Possible carcinogen.

UNITED KINGDOM

Effective:	1989.
Control action:	All agricultural uses revoked under the Control of Pesticides Regulations.
Reasons:	Evidence of carcinogenicity.

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Annex 3 – List of Designated National Authorities

AUSTRIA

CP
Department II/3
Ministry of the Environment, Youth and Family
Stubenbastei 5
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BELIZE

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Public Health Bureau
Ministry of Health
Belize City

CANADA

C
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P
The Director
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EUROPEAN UNION

CP
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European Commission, Directorate-General XI
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THAILAND

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UNITED KINGDOM

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Phone +44 171 8905230

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Deleted: *Dr. P.J. Corcoran*¶
e-mail ¶
p.corcoran@detrbiotech.demon.co.uk¶

CP **DNA** Industrial Chemicals and Pesticides
P **DNA** Pesticides
C **DNA** Industrial Chemicals

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