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**United Nations Environment Programme**

**Food and Agriculture Organization of the United Nations**

**Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade**
**Chemical Review Committee**
Third meeting
Rome, 20–23 March 2007
Item 5 (b) (v) of the provisional agenda*

**Listing of chemicals in Annex III of the Rotterdam Convention: review of notifications of final regulatory actions to ban or severely restrict a chemical: mirex**

# Mirex: supporting documentation provided by Thailand

## Note by the Secretariat

The Secretariat has the honour to provide, in the annex to the present note, documentation received from Thailand in support of its notification of final regulatory action on mirex.

* UNEP/FAO/RC/CRC.3/1.

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# Annex

- Information exchange on banned and severely restricted chemicals in international trade;
- Recognised carcinogens
- Chemical profile for Mirex
- Mirex (IARC Summary and Evaluation, Volume 20, 1979)
- Mirex (HSG 39, 1990)
- Mirex: Carcinogen Potency Database

# ANNEX 1

## CONTROL ACTIONS TAKEN TO BAN OR SEVERELY RESTRICT CHEMICALS - listed by chemical

**as reported by the following countries:**

Australia
Austria
China
Cuba
Cyprus
Czech Republic
European Union
Hungary
New Zealand
Sri Lanka
St. Lucia
Sudan
Switzerland
Tanzania
USA

UNITED STATES

Common Name: **Daminozide** 1596-84-5
Chemical Name: **Butanedioic acid, mono(2,2-dimethylhydrazide)**
The substance is severely restricted for use. In July 1984 EPA initiated intensive evaluation of all daminozide products intended for use on food. Before EPA's review was completed, the sole registrant of daminozide voluntarily cancelled their registrations. EPA accepted voluntary cancellation and prohibited sale, distribution, and use for food-uses after 17.11.89. The compound is still approved for use on ornamental crops. Products containing this compound are still approved for use on ornamental crops in the US. Remaining uses are a minor portion of those which were previously approved. Tests on laboratory animals exposed to daminozide through dietary consumption have demonstrated tumor at multiple organ sites and in multiple species and strains of animals. EPA has classified daminozide and UDMH as a probable human carcinogen.
Effective Date: 17/11/1989

Common Name: **Nitrofen** 1836-75-5
Chemical Name: **Benzene, 2,4-dichloro-1-(4-nitrophenoxy)-**
The substance was voluntarily withdrawn (marketing in the US was suspended) by the sole manufacturer in August 1980. In 1983, while EPA was conducting a special investigation into the risks and benefits of nitrofen, the registrant requested voluntary cancellation of all products, as well as revocation of all tolerances. The cancellation became effective in February 1990. No remaining uses allowed. Test on laboratory rats indicate that nitrofen is a liver carcinogen. It also may present an unacceptable teratogenic risk to applicators, field workers, and/or consumers.
Effective Date: 01/02/1990

Common Name: **EPN** 2104-64-5
Chemical Name: **Phosphonothioic acid, phenyl-, O-ethyl O-(4-nitrophenyl) ester**
The substance has been voluntarily withdrawn by the registrant. Based on concerns about risks to applicators and non-target species, EPA decided to conduct a special analysis of risks and benefits of EPN in 1987. Following this decision, all registrants of technical and formulated EPN products (except one) voluntarily cancelled their registrations. When the remaining formulator failed to supply data required for continued registrations, EPA terminated the special analysis of EPN on December 23, 1987. No remaining uses allowed. EPN has been shown to produce delayed neurotical effects in animal studies. These health effects are of concern to mixers/loaders, applicators, and field workers. Also, dietary exposure to EPN through the consumption of treated foods is a concern as were the risks of reduced local/ regional populations of organisms such as honeybees; and, risks of acute toxicity to aquatic organisms.
Effective Date: 23/12/1987

Common Name: **Mirex** 2385-85-5
Chemical Name: **1,3,4-Metheno-1H-cyclobuta¬cd|pentalene, 1,1a,2,2,3,3a,4,5,5,5a,5b,6-dodecachlorooctahydro-**
The substance has been voluntarily withdrawn by the registrant. In March 1971, EPA proposed to cancel the registration of products containing mirex. Rather than accept the cancellation, one of the registrants requested that the matter be referred to a Scientific Advisory Committee, which advised that registration of mirex products be continued with labelling restrictions to minimize environmental contamination. In 1973, EPA announced its intention to hold hearings on the use of mirex. When a negotiated settlement could not be reached, the sole registrant transferred its registrations to the Mississippi Auth. for the Control of Fire Ants in 1976. The registrations were then phased out by June 1978. No remaining uses allowed. Mirex is considered to be a probable human carcinogen, it can cross the placenta and enter the fetus, and was found in one out of five human tissue samples from areas of frequent use, and in mothers' milk in the southern portion of the US. It is also acutely toxic to aquatic life, particularly juvenile shrimp and crabs and its toxic persistence can lead to biomagnification in the food chain.
Effective Date: 01/06/1978

Common Name: **Captafol** 2425-06-1
Chemical Name: **1H-Isoindole-1,3(2H)-dione, 3a,4,7,7a-tetrahydro-2-¬(1,1,2,2-tetrachloroethyl)thio|-**
The substance has been voluntary withdrawn by the registrant. In January 1985 EPA initiated a special investigation of captafol. Subsequent to the initiation of the investigation, the registrants voluntary cancelled their registrations, effective as of 15.05.87. No remaining uses allowed. Captafol is: oncogenic in rats and mice; highly toxic to fish; a skin sensitizer

**CARCINOGENS**

Hundreds of chemicals are capable of inducing cancer in humans or animals after prolonged or excessive exposure. There are many well-known examples of chemicals that can cause cancer in humans. The fumes of the metals cadmium, nickel, and chromium are known to cause lung cancer. Vinyl chloride causes liver sarcomas. Exposure to arsenic increases the risk of skin and lung cancer. Leukemia can result from chemically induced changes in bone marrow from exposure to benzene and cyclophosphamide, among other toxicants. Other chemicals, including benzo[a]pyrene and ethylene dibromide, are considered by authoritative scientific organizations to be probably carcinogenic in humans because they are potent carcinogens in animals. Chemically-induced cancer generally develops many years after exposure to a toxic agent. A latency period of as much as thirty years has been observed between exposure to asbestos, for example, and incidence of lung cancer.

References used to compile the list of Carcinogens

**Recognized Carcinogens**

*Note: For your convenience, these data are also available as a CSV file. Click here to download.*

| Chemical Name | CAS Registry Number (or EDF Substance ID) | Reference (s) |
|---|---|---|
| (1,1'-BIPHENYL)-4,4'-DIAMINE, 3,3'-DIMETHYL- | 119-93-7 | P65 |
| (1,1'-BIPHENYL)-4,4'-DIAMINE, 3,3'-DIMETHYL-, DIHYDROCHLORIDE (9CI) | 612-82-8 | P65 |
| (1,2-BENZENEDICARBOXYLATO(2-))DIOXOTRILEAD | 69011-06-9 | P65-MC |
| (DIBUTYLDITHIOCARBAMATO)NICKEL(II) | 13927-77-0 | P65-MC |
| 1,1'-BI(ETHYLENE OXIDE) | 1464-53-5 | P65 |
| 1,1,2,2-TETRACHLOROETHANE | 79-34-5 | P65 |
| 1,1,2,2-TETRAFLUOROETHYLENE | 116-14-3 | P65 |
| 1,1,2-TRICHLOROETHANE | 79-00-5 | P65 |
| 1,1-DICHLOROETHANE | 75-34-3 | P65 |
| 1,1-DIMETHYL HYDRAZINE | 57-14-7 | P65 |
| 1,2,3,4,5,6-HEXACHLOROCYCLOHEXANE (MIXTURE OF ISOMERS) | 608-73-1 | P65 |
| 1,2,3,4,6,7,8,9-OCTACHLORODIBENZOFURAN | 39001-02-0 | P65-MC |
| 1,2,3,4,6,7,8-HEPTACHLORODIBENZO-P-DIOXIN | 35822-46-9 | P65-MC |
| 1,2,3,4,6,7,8-HEPTACHLORODIBENZOFURAN | 67562-39-4 | P65-MC |
| 1,2,3,4,7,8,9-HEPTACHLORODIBENZOFURAN | 55673-89-7 | P65-MC |
| 1,2,3,4,7,8-HEXACHLORODIBENZO-P-DIOXIN | 39227-28-6 | P65-MC |
| 1,2,3,4,8-PENTACHLORODIBENZOFURAN | 67517-48-0 | P65-MC |
| 1,2,3,6,7,8-HEXACHLORODIBENZO-P-DIOXIN | 57653-85-7 | P65-MC |
| 1,2,3,6,7,8-HEXACHLORODIBENZOFURAN | 57117-44-9 | P65-MC |
| 1,2,3,7,8,9-HEXACHLORODIBENZO-P-DIOXIN | 19408-74-3 | P65-MC |
| 1,2,3,7,8-PENTACHLORODIBENZO-P-DIOXIN | 40321-76-4 | P65-MC |
| 1,2,3,7,8-PENTACHLORODIBENZOFURAN | 57117-41-6 | P65-MC |
| 1,2,3-TRICHLOROPROPANE | 96-18-4 | P65 |
| 1,2-DIBROMO-3-CHLOROPROPANE (DBCP) | 96-12-8 | P65 |
| 1,2-DIBROMOETHANE | 106-93-4 | P65 |
| 1,2-DICHLOROETHANE | 107-06-2 | P65 |
| 1,2-DICHLOROPROPANE | 78-87-5 | P65 |

| | | |
|---|---|---|
| METHYL METHANESULFONATE | 66-27-3 | P65 |
| METHYLAZOXYMETHANOL | 590-96-5 | P65 |
| METHYLAZOXYMETHANOL ACETATE | 592-62-1 | P65 |
| METHYLEUGENOL | 93-15-2 | P65 |
| METHYLTHIOURACIL | 56-04-2 | P65 |
| METIRAM | 9006-42-2 | P65 |
| METRONIDAZOLE | 443-48-1 | P65 |
| MICHLER'S KETONE | 90-94-8 | P65 |
| MIREX | 2385-85-5 | P65 |
| MITOMYCIN C | 50-07-7 | P65 |
| MN-52 | 14092-99-0 | P65-MC |
| MN-54 | 13966-31-9 | P65-MC |
| MN-56 | 14681-52-8 | P65-MC |
| MO-99 | 14119-15-4 | P65-MC |
| MONOCHLOROBIPHENYL | 27323-18-8 | P65-MC |
| MONOCHLORODIBENZOFURANS, TOTAL | EDF-200 | P65-MC |
| MONOCROTALINE | 315-22-0 | P65 |
| MUSTARD GAS | 505-60-2 | P65 |
| MX (3-CHLORO-4-(DICHLOROMETHYL)-5-HYDROXY-2 (5H)-FURANONE) | 77439-76-0 | P65 |
| N,N-BIS(2-CHLOROETHYL)-2-NAPHTHYLAMINE (CHLORNAPAZINE) | 494-03-1 | P65 |
| N-ETHYL-N-NITROSOUREA | 759-73-9 | P65 |
| N-METHYLOLACRYLAMIDE | 924-42-5 | P65 |
| N-NITROSO-N-METHYLUREA | 684-93-5 | P65 |
| N-NITROSO-N-METHYLURETHANE | 615-53-2 | P65 |
| N-NITROSODI-N-BUTYLAMINE | 924-16-3 | P65 |
| N-NITROSODIETHANOLAMINE | 1116-54-7 | P65 |
| N-NITROSODIETHYLAMINE | 55-18-5 | P65 |
| N-NITROSODIPHENYLAMINE | 86-30-6 | P65 |
| N-NITROSOMETHYLETHYLAMINE | 10595-95-6 | P65 |
| N-NITROSOMETHYLVINYLAMINE | 4549-40-0 | P65 |
| N-NITROSOMORPHOLINE | 59-89-2 | P65 |
| N-NITROSONORNICOTINE | 16543-55-8 | P65 |
| N-NITROSOPIPERIDINE | 100-75-4 | P65 |
| N-NITROSOPYRROLIDINE | 930-55-2 | P65 |
| N-NITROSOSARCOSINE | 13256-22-9 | P65 |
| N-[4-(5-NITRO-2-FURYL)-2-THIAZOLYL]ACETAMIDE | 531-82-8 | P65 |
| NA-24 | 13982-04-2 | P65-MC |
| NAFENOPIN | 3771-19-5 | P65 |
| NALIDIXIC ACID | 389-08-2 | P65 |
| NAPHTHALENE | 91-20-3 | P65 |
| NB-93M | 7440-03-1(m) | P65-MC |
| NB-94 | 14681-63-1 | P65-MC |
| NB-95 | 13967-76-5 | P65-MC |
| NB-95M | 13967-76-5(m) | P65-MC |
| NB-97 | 18496-04-3 | P65-MC |
| NB-97M | 18496-04-3(m) | P65-MC |

**Chemical:** MIREX
**CAS Number:** 2385-85-5

# Chemical Profile for MIREX (CAS Number: 2385-85-5)



## • Human Health Hazards

| Health Hazard | | Reference(s) |
|---|---|---|
| Recognized: | Carcinogen | P65 |
| Suspected: | Endocrine Toxicant | BKH EPA-SDWA IL-EPA JNIHS KEIT RTECS WWF |
| | Gastrointestinal or Liver Toxicant | ATSDR RTECS |
| | Kidney Toxicant | MERCK |

[ top ]

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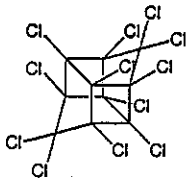
## • Hazard Rankings

More hazardous than most chemicals in 4 out of 4 ranking systems.
Ranked as one of the most hazardous compounds (worst 10%) to human health.

# Mirex
# CAS No. 2385-85-5

Reasonably anticipated to be a human carcinogen
First Listed in the *Second Annual Report on Carcinogens* (1981)




## Carcinogenicity

Mirex is *reasonably anticipated to be a human carcinogen* based on sufficient evidence of carcinogenicity in experimental animals (IARC 1974, 1979, 1987, NTP 1990). When administered by gavage for 4 weeks followed by incorporation in the diet, mirex increased the incidence of hepatomas in mice of both sexes. When administered in the diet, mirex increased the incidence of neoplastic nodules of the liver in rats of both sexes, pheochromocytomas of the adrenal gland in male rats, and mononuclear cell leukemias in female rats.

No adequate human studies of the relationship between exposure to mirex and human cancer have been reported (IARC 1979, 1987).

## Properties

Mirex occurs as a white, odorless, nonflammable crystalline solid. It is practically insoluble in water, but it is soluble in dioxane, xylene, benzene, carbon tetrachloride, and methyl ethyl ketone. Mirex is very stable at normal temperatures; however, at temperatures >500°C, it decomposes to hexachlorobenzene, hexachloropentadiene, carbon monoxide, carbon dioxide, hydrogen chloride, chlorine, carbon tetrachloride, and phosgene (IARC 1979, ATSDR 1995).

Technical grade mirex was formerly available in the United States as a white crystalline solid in two particle size ranges (5 to 10 µm or 40 to 70 µm). The technical grade contained approximately 95% mirex. Insect bait formulations contained 0.075% to 0.5% mirex. Chlordecone (Kepone®) occurred in technical mirex at concentrations up to 2.58 mg/kg, and in mirex bait up to 0.25 mg/kg as a contaminant (IARC 1979, ATSDR 1995).

## Use

Mirex was used in the United States from 1958 until 1978. The U.S. EPA canceled all registered uses of mirex in December 1977; however, selected applications were allowed until existing stocks were exhausted. Approximately 75% was used as a fire-retardant additive under the name "Dechlorane," and approximately 25% was used as an insecticide to control fire ants in southeastern states (ATSDR 1995). From 1962 to 1976, 132 million acres in 10 states were treated with approximately 500,000 lb of mirex bait, primarily by aerial application to control fire ants. Mirex was also used to control other species of ants, yellow jackets, and mealybugs in pineapples (IARC 1979).

## Production

Mirex was first synthesized in the mid 1940s, but it did not become commercially available in the United States until 1958. Technical-grade mirex was produced commercially by one company in the United States until 1967. The insecticidal baits were produced until 1975, when all registrations and the right to manufacture and sell mirex were transferred to the Mississippi Department of Agriculture (IARC 1979). One company produced an estimated 3.3 million lb of mirex between 1959 and 1975 and purchased an additional 1.5 million lb from another company. Peak production occurred from 1963 to 1968 (ATSDR 1995). In 1972, approximately 41,500 lb were produced, and in 1975, less than 1,000 lb were produced in the United States (HSDB 2001). Mirex is available in small quantities for laboratory use from nine U.S. suppliers (Chem Sources 2001).

Before cancellation of its registrations for technical products, some quantities were imported from Brazil; however, no import volumes were available. Over 90% of the mirex produced in the United States was exported (ATSDR 1995).

## Exposure

Although mirex is no longer produced or used in the United States, it is very persistent in the environment and highly resistant to degradation; therefore, the general population may continue to be exposed to low concentrations in the environment. Populations with the greatest potential for exposure include those who ingest fish caught from contaminated water bodies, reside near a former manufacturing or waste disposal site, or live in areas where mirex was extensively used to control fire ants. The primary route of potential human exposure to mirex is ingestion of contaminated food; however, no dietary intake estimates were available. Mirex has been detected in human adipose tissue, blood, and breast milk (ATSDR 1995).

The National Occupational Hazard Survey, conducted by NIOSH from 1972 to 1974, estimated that 932 workers were possibly exposed to mirex in the workplace (HSDB 2001). However, occupational exposure is now limited to workers employed at hazardous waste sites or those involved in remediation of sites contaminated with mirex (ATSDR 1995).

## Regulations

**DOT**

Mirex is considered a marine pollutant and special requirements have been set for marking, labeling, and transporting this material

**EPA**

Federal Insecticide, Fungicide, and Rodenticide Act

All uses have been cancelled

**FDA**

Action Level in the edible portion of fish = 0.1 ppm

### REFERENCES

ATSDR. 1995. Toxicological Profile for Mirex and Chlordecone (Final Report). NTIS Accession No. PB95-264354. Atlanta, GA: Agency for Toxic Substances and Disease Registry. 362 pp.

ChemSources. 2001. Chemical Sources International, Inc. http://www.chemsources.com.

HSDB. 2001. Hazardous Substances Data Base. National Library of Medicine. http://toxnet.nlm.nih.gov/cgi-bin/sis/htmlgen?HSDB.

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NTP. 1990. Toxicology and Carcinogenesis Studies of Mirex (1,1a,2,2,3,3a,4,5,5,5a,5b,6-Dodecachlorooctahydro-1,3,4- metheno-1H-cycloputa[cd]pentalene) (CAS No. 2385-85-5) in F344/N Rats (Feed Studies). Technical Report Series No 313. Research Triangle Park, NC and Bethesda, MD: National Toxicology Program. 140 pp.

# International Agency for Research on Cancer (IARC) - Summaries & Evaluations

## MIREX

**VOL.**: 20 (1979) (p. 283)

**CAS No.**: 2385-85-5
**Chem. Abstr. Name**: 1,1a,2,2,3,3a,4,5,5,5a,5b,6-Dodecachlorooctahydro-1,3,4-metheno-1*H*-
cyclobuta(cd)pentalene

## 5. Summary of Data Reported and Evaluation

### 5.1 Experimental data

Mirex has been tested in one experiment in two strains of mice and in one experiment in rats by oral administration. It has also been tested in two strains of mice by subcutaneous injection of single doses. In the studies using oral administration, it produced benign and malignant liver tumours in mice and rats of both sexes. An excess of liver tumours was also found in males of one of the two strains of mice following a single subcutaneous injection; this experiment also suggested that it produced reticulum-cell sarcomas in males of both strains.

Mirex is foetotoxic and produces teratogenic effects. It was negative in a dominant lethal assay in mice.

### 5.2 Human data

No case reports or epidemiological studies were available to the Working Group.

The extensive production and the widespread use of mirex since the late 1950s, together with the persistent nature of the compound, indicate that widespread human exposure has occurred. This is confirmed by many reports of its occurrence in the general environment and by its presence in human fat.

### 5.3 Evaluation

There is *sufficient evidence* that mirex is carcinogenic in mice and rats. In the absence of adequate data in humans, it is reasonable, for practical purposes, to regard mirex as if it presented a carcinogenic risk to humans.

**Previous evaluation**: Vol. 5 (1974)

**Subsequent evaluation**: Suppl. 7 (1987) (p. 66: **Group 2B**)

For definition of terms, see Preamble Evaluation.

## Synonyms

- CG-1283
- Dechlorane
- Dechlorane 515
- Dechlorane 4070
- Dodecachlorooctahydro-1,3,4-methano-2*H*-cyclobuta(*cd*)-pentalene
- Dodecachloropentacyclo(3.3.2.$O^{2,6}$.$O^{3,9}$.$O^{5,10}$)decane
- ENT 25,719
- Ferriamicide
- Hexachlorocyclopentadiene dimer
- 1,2,3,4,5,5-Hexachloro-1,3-cyclopentadiene dimer
- HRS 1276
- Perchlorodihomocubane
- Perchloropentacyclodecane
- Perchloropentacyclo(5.2.1.$O^{2,6}$.$O^{3,9}$.$O^{5,8}$)decane

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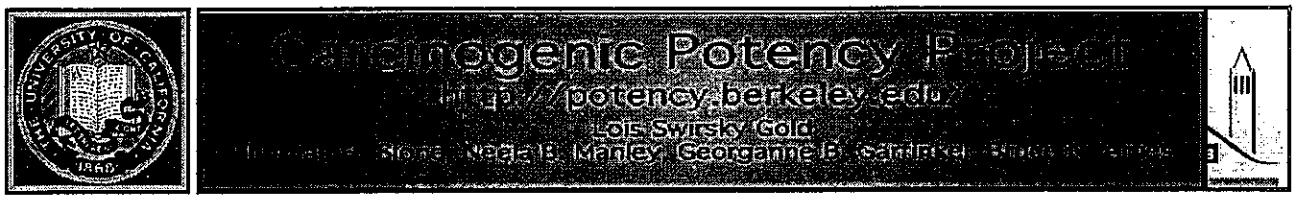
Last updated: 31 March 1998

See Also:
Mirex (EHC 44, 1984)
Mirex (IARC Summary & Evaluation, Volume 5, 1974)




# Mirex (CAS# 2385-85-5)

SMILES, InChI and Structure are below.

## Rats and Mice: Cancer Test Summary

| Rat Target Sites | | Mouse Target Sites | | $TD_{50}$ (mg/kg/day) | |
|---|---|---|---|---|---|
| Male | Female | Male | Female | Rat | Mouse |
| adr kid liv | hmo liv | liv | liv | $1.77^{m}$ | $1.45^{m}$ |

**Positivity**: For each positive (carcinogenic) chemical in the CPDB, results are included on carcinogenic potency (by species) and target site (by sex-species). Positivity is determined by the author's opinion in a published paper. If all experimental results in the CDPB are negative in a sex-species group, "no positive" appears. If the CPDB has no experiments in the sex-species group, "no test" appears.

**Target Site Codes**: **adr** = adrenal gland. **hmo** = hematopoietic system. **kid** = kidney. **liv** = liver. Target sites are listed when at least one author indicated that tumors were induced in that organ by the test agent. See Evaluation of Carinogenicity and Mutagenicity.

**$TD_{50}$**: $TD_{50}$ is the daily dose rate in mg/kg body weight/day to induce tumors in half of test animals that would have remained tumor-free at zero dose. Whenever there is more than one positive experiment in a species, the reported $TD_{50}$ value is a Harmonic Mean calculated using the $TD_{50}$ value from the most potent target site in each positive experiment.

**Superscripts**: **m** = More than one positive experiment in the species, and $TD_{50}$ values from each positive experiment are used in the calculation of the reported Harmonic mean of $TD_{50}$.

**Mutagenicity in Salmonella:** negative

The Carcinogenic Potency Database (CPDB) is a systematic and unifying resource that standardizes the results of 6153 chronic, long-term, animal cancer tests on 1485 chemicals that have been published since the 1950s. CPDB permits research into many areas of carcinogenesis. It includes both positive and negative experiments in rats, mice, hamsters, monkeys, prosimians, and dogs. For each experiment, information is included on species, strain, and sex of test animal; features of experimental protocol such as route of administration, duration of dosing, dose level(s) in mg/kg body weight/day, and duration of experiment; target organ, tumor type, and tumor incidence; carcinogenic potency ($TD_{50}$) and its statistical significance; shape of the dose-response, author's opinion as to carcinogenicity, and literature citation.

Only tests with dosing for at least 1/4 the standard lifespan of the species and experiment length at least 1/2 the lifespan are included. Only routes of administration with whole body exposure are included. Doses are standardized, average dose rates in mg/kg/day. A description of methods used in the CPDB to standardize the diverse literature of animal cancer tests is presented for: 1) Criteria for inclusion of experiments 2) Standardization of average daily dose levels and 3) $TD_{50}$ estimation for a standard lifespan. See Methods for other details.

The above summary presents the strongest evidence of carcinogenicity in each sex-species group. If there are both positive and negative experiments in a sex-species in the CDPB, the negative results are ignored in this Table. If there is more than one positive experiment in a sex-species, target sites listed may be from more than one experiment, e.g. if liver and lung are both listed, then liver may have been a target in one experiment and lung in another. More than half the chemicals in the CPDB are positive in at least one experiment. See interpretation of positive results in animal cancer tests.

Results of all experiments are below:

# Mirex: All Experiments and Citations in CPDB

**The definition of each code in the plot below will appear in a pop-up window when the field name in the header line is clicked, e.g., Strain, Site, Path. Each numbered line starts a new experiment and reports protocol information in black. Average daily dose-rates per kg body weight per day are in green. Remaining lines report carcinogenicity results in blue. Abbreviations of fields in header line: Xpo = duration of dosing; Xpt = duration of experiment; Site = tissue; Path = tumor type; DR = dose-response; AuOp = author's opinion about carcinogenicity; LoConf, UpConf = confidence limits (99%) on $TD_{50}$; Inc = tumor incidence for each dose group.**

**Help to improve readablility by increasing text size, enhancing color or fitting results onto the screen. See Guide for details on each field.**

Chemical (Synonym) CAS#

| # | Species | Sex | Strain | Route | Xpo+Xpt | PaperNum | | 0 Dose | 1 Dose | 2 Dose | 3 Dose |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Site | Path | Notes | TD50 | DR | Pval | AuOp | LoConf UpConf | Cntrl | 1 Inc | 2 Inc | 3 Inc |
| MIREX (1,1a,2,2,3,3a,4,5,5,5a,5b,6-dodecachlorooctahydro-1,3,4-metheno-1H-cyclob | | | | | | | | | | | |
| 3776 | M | f | b6a | orl | 68w68 | 202 | | 0 | 3.67mg | | |
| liv | hpt | evx | 1.10mg | | P<.0005 | + | .512mg 2.89mg | 0/17 | 10/16 | | |
| lun | ade | evx | no dre | | P=1. | | 5.18mg n.s.s. | 1/17 | 0/16 | | |
| tba | mix | evx | 1.26mg | | P<.003 | | .540mg 7.45mg | 2/17 | 10/16 | | |
| 3777 | M | m | b6a | orl | 58w58 | 202 | | 0 | 3.48mg | | |
| liv | hpt | evx | 2.13mg | | P<.04 | + | .718mg n.s.s. | 1/18 | 5/15 | | |
| lun | ade | evx | no dre | | P=1. | | 3.34mg n.s.s. | 2/18 | 0/15 | | |
| tba | mix | evx | 3.32mg | | P<.3 | | .797mg n.s.s. | 3/18 | 5/15 | | |
| 3778 | M | f | b6c | orl | 69w69 | 202 | | 0 | 3.67mg | | |
| liv | hpt | evx | 1.60mg | | P<.0005 | | .705mg 4.95mg | 0/16 | 8/16 | | |
| lun | mix | evx | no dre | | P=1. | | 5.32mg n.s.s. | 0/16 | 0/16 | | |
| tba | mix | evx | 1.60mg | | P<.0005 | | .705mg 4.95mg | 0/16 | 8/16 | | |
| 3779 | M | m | b6c | orl | 58w58 | 202 | | 0 | 3.48mg | | |
| liv | mix | evx | 1.50mg | | P<.002 | | .641mg 6.13mg | 0/16 | 7/18 | | |
| liv | hpt | evx | 1.83mg | | P<.004 | | .738mg 11.2mg | 0/16 | 6/18 | | |
| lun | mix | evx | no dre | | P=1. | | 4.01mg n.s.s. | 0/16 | 0/18 | | |
| tba | mix | evx | 1.50mg | | P<.002 | | .641mg 6.13mg | 0/16 | 7/18 | | |
| 3780 | R | f | f34 | eat | 24m25 | TR313 : | | 0 | 4.77ug | 47.9ug | .481mg |
| MXA | mnl | | 5.97mg | * | P<.02 | c | 2.69mg n.s.s. | 8/52 | 8/52 | 11/52 | 14/52 |
| TBA | MXB | | 22.4mg | * | P<.9 | | 1.75mg n.s.s. | 48/52 | 48/52 | 49/52 | 47/52 |
| liv | MXB | | 16.5mg | * | P<.3 | | 4.54mg n.s.s. | 10/52 | 5/52 | 4/52 | 5/52 |
| 3781 | R | f | f34 | eat | 24m24 | TR313a : | | 0 | 2.45mg | 4.95mg | |
| liv | MXA | | 3.17mg | * | P<.0005 | c | 2.17mg 5.50mg | 2/52 | 23/52 | 31/52 | |
| liv | nnd | | 3.22mg | * | P<.0005 | c | 2.19mg 5.67mg | 2/52 | 23/52 | 30/52 | |
| MXB | MXB | | 3.34mg | * | P<.0005 | | 2.11mg 7.24mg | 8/52 | 25/52 | 37/52 | |
| MXA | mnl | | 15.7mg | * | P<.05 | c | 6.61mg n.s.s. | 6/52 | 9/52 | 14/52 | |
| TBA | MXB | | 21.9mg | * | P<.7 | | 2.93mg n.s.s. | 49/52 | 47/52 | 48/52 | |
| liv | MXB | | 3.17mg | * | P<.0005 | | 2.17mg 5.50mg | 2/52 | 23/52 | 31/52 | |
| 3782 | R | m | f34 | eat | 24m24 | TR313 : | | 0 | 3.89ug | 39.1ug | .392mg |
| MXB | MXB | | .669mg | * | P<.0005 | | .443mg 1.14mg | 16/52 | 11/52 | 17/52 | 23/52 |
| tes | ict | | .708mg | * | P<.0005 | | .392mg 2.25mg | 50/52 | 51/52 | 43/52 | 48/52 |
| liv | MXA | | .825mg | * | P<.0005 | c | .545mg 1.39mg | 6/52 | 5/52 | 6/52 | 15/52 |
| liv | nnd | | .870mg | * | P<.0005 | c | .574mg 1.47mg | 3/52 | 5/52 | 5/52 | 14/52 |
| adr | MXA | | 1.43mg | * | P<.0005 | c | .840mg 3.18mg | 10/52 | 7/52 | 13/52 | 12/52 |
| liv | hpc | | 7.09mg | * | P<.009 | | 2.70mg 356.mg | 3/52 | 0/52 | 2/52 | 2/52 |
| thy | MXA | | 10.4mg | * | P<.003 | | 3.67mg 100.mg | 0/52 | 1/52 | 0/52 | 1/52 |
| thy | fca | | 12.7mg | * | P<.003 | | 4.33mg 88.7mg | 0/52 | 0/52 | 0/52 | 1/52 |
| k/p | tpp | | 13.5mg | * | P<.002 | c | 4.58mg 72.4mg | 0/52 | 0/52 | 0/52 | 0/52 |
| TBA | MXB | | .618mg | * | P<.0005 | | .374mg 1.39mg | 45/52 | 46/52 | 40/52 | 45/52 |
| liv | MXB | | .825mg | * | P<.0005 | | .545mg 1.39mg | 6/52 | 5/52 | 6/52 | 15/52 |
| 3783 | R | m | sda | eat | 91w91 | 1160 | | 0 | 40.9ug | 200. | |

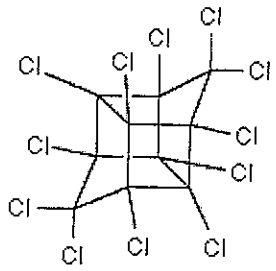
| | | | | | | |
|---|---|---|---|---|---|---|
| liv nnd | no dre | P=1. | 52.6ug n.s.s. | 0/10 | 0/10 | 0/10 |

SMILES Code for Mirex: ClC53C1(Cl)C4(Cl)C2(Cl)C1(Cl)C(Cl)(Cl)C5(Cl)C2(Cl)C3(Cl)C4(Cl)Cl

InChI Code for Mirex: InChI=1/C10Cl12/c11-1-2(12)7(17)4(14)3(13,5(1,15)9(7,19)20)6(1,16)10(21,22)8(2,4)18

Source for SMILES and InChI: USEPA Distributed Structure-Searchable Toxicity (DSSTox) Database

Chemical Structure for Mirex:




Source for structure: National Library of Medicine ChemIDPlus

See full CPDB Summary Table on 1485 chemicals. See Full CPDB for all results on 6153 experiments of 1485 chemicals.

A complete list of CPDB chemicals, which is searchable by name or by CAS number, is available here.

The CPDB is available in several formats that permit printing and downloading into spreadsheets and statistical databases.

1. A plot of the CPDB presents results of 1485 experiments on 6153 chemicals in an easily readable format that has been used in publications of the CPDB.
2. A Screen version plot for use on a single computer screen, with the same data.
3. Excel version of the same data.
4. Tab-separated versions of the same data, which can be easily read into databases.

A Supplementary Dataset gives details on dosing and survival for each experiment.


For more information about this Web Page, contact Lois Swirsky Gold, Ph.D. (cpdb@potency.berkeley.edu).
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IPCS INTERNATIONAL PROGRAMME ON CHEMICAL SAFETY
Health and Safety Guide No. 39

**MIREX**
**HEALTH AND SAFETY GUIDE**

UNITED NATIONS ENVIRONMENT PROGRAMME

INTERNATIONAL LABOUR ORGANISATION

WORLD HEALTH ORGANIZATION

WORLD HEALTH ORGANIZATION, GENEVA 1990

This is a companion volume to Environmental Health Criteria 44: Mirex

Published by the World Health Organization for the International Programme on Chemical Safety (a collaborative programme of the United Nations Environment Programme, the International Labour Organisation, and the World Health Organization)

This report contains the collective views of an international group of experts and does not necessarily represent the decisions or the stated policy of the United Nations Environment Programme, the International Labour Organisation, or the World Health Organization

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of its authorities, or concerning the delimitation of its frontiers or boundaries.

The mention of specific companies or of certain manufacturers' products does not imply that they are endorsed or recommended by the World Health Organization in preference to others of a similar nature that are not mentioned. Errors and omissions excepted, the names of proprietary products are distinguished by initial capital letters.

CONTENTS



INTRODUCTION

The Environmental Health Criteria (EHC) documents produced by the

International Programme on Chemical Safety include an assessment of the effects on the environment and on human health of exposure to a chemical or combination of chemicals, or physical or biological agents. They also provide guidelines for setting exposure limits.

The purpose of a Health and Safety Guide is to facilitate the application of these guidelines in national chemical safety programmes. The first three sections of a Health and Safety Guide highlight the relevant technical information in the corresponding EHC. Section 4 includes advice on preventive and protective measures and emergency action; health workers should be thoroughly familiar with the medical information to ensure that they can act efficiently in an emergency. Within the Guide is an International Chemical Safety Card which should be readily available, and should be clearly explained, to all who could come into contact with the chemical. The section on regulatory information has been extracted from the legal file of the International Register of Potentially Toxic Chemicals (IRPTC) and from other United Nations sources.

The target readership includes occupational health services, those in ministries, governmental agencies, industry, and trade unions who are involved in the safe use of chemicals and the avoidance of environmental health hazards, and those wanting more information on this topic. An attempt has been made to use only terms that will be familiar to the intended user. However, sections 1 and 2 inevitably contain some technical terms. A bibliography has been included for readers who require further background information.

Revision of the information in this Guide will take place in due course, and the eventual aim is to use standardized terminology. Comments on any difficulties encountered in using the Guide would be very helpful and should be addressed to:

The Manager
International Programme on Chemical Safety
Division of Environmental Health
World Health Organization
1211 Geneva 27
Switzerland

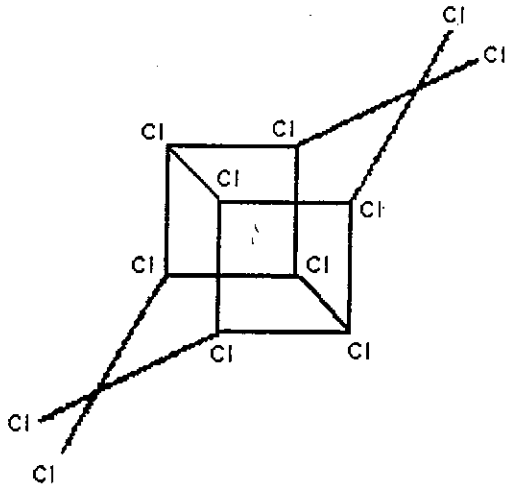
THE INFORMATION IN THIS GUIDE SHOULD BE CONSIDERED AS A STARTING POINT TO A COMPREHENSIVE HEALTH AND SAFETY PROGRAMME

## 1. PRODUCT IDENTITY AND USES

### 1.1 Identity

Common name: Mirex

Chemical structure:




| | |
|---|---|
| Molecular formula: | $C_{10}Cl_{12}$ |
| Common trade names: | Dechlorane, Ferriamicide, GC 1283 |
| Common synonyms: | dodecachloropentacyclo[5.2.1.$0^{26}0^{39}0^{58}$]-decanedodecachloro-octahydro-1,3,4-metheno-2H-cyclo-buta *[cd]*pentalene |
| CAS chemical name: | 1,1a,2,2,3,3a,4,5,5,5a,5b,6-dodecachlorooctahydro-1,3,4-metheno-1H-cyclobuta- *[cd]*pentalene |
| CAS registry number: | 2385-85-5 |
| Relative molecular mass: | 545.5 |

1.2 Physical and Chemical Properties

Mirex is a white crystalline, odourless solid with a melting point of 485°C. It is soluble in several organic solvents including tetrahydrofuran (30%), carbon disulfide (18%), chloroform (17%), and benzene (12%), but is practically insoluble in water. It has a vapour pressure of 3 × 10-7mmHg at 25°C.

Mirex is considered to be extremely stable. It does not react with sulfuric, nitric, hydrochloric, or other common acids and is unreactive with bases, chlorine, or ozone. Despite its stability, reductive dechlorination of mirex can be brought about by reaction with reduced iron porphyrin or more effectively by vitamin $B_{12}$. Slow partial decomposition will also result from exposure to ultraviolet radiation (UVR) in hydrocarbon solvents or to gamma rays. Photomirex (8-monohydro-mirex) is the major product of dechlorination by UVR, and may represent the fate of most of the mirex in the environment.

Mirex is quite resistant to pyrolysis; decomposition begins at 525°C, and 98-99% combustion is accomplished at 700°C within 1 second. Hexachlorobenzene is a major pyrolytic product with lesser amounts of carbon monoxide, carbon dioxide, hydrogen chloride, chlorine, carbon tetrachloride, and phosgene given off in the form of a vapour.

Technical grade preparations of mirex contain 95.19% mirex and 2.58% chlordecone, the rest being unspecified. The term "mirex" is also used to refer to bait comprising corncob grits, soya bean oil, and mirex. Insect bait formulations for aerial application containing 0.3-0.5% mirex and fire ant formulations containing 0.075-0.3% mirex

have also been used in the USA.

1.3 Analytical Methods

Gas chromatography with electron capture detection is the analytical method most commonly used for its determination.

1.4 Uses

Mirex is mainly used as a flame-retardant and as a stomach insecticide, usually formulated into baits, for the control of ants, especially fire ants and harvester ants. The USA appears to be the main country in which mirex was used for pest control, but this use was discontinued in 1978.

The same chemical substance is used, under the name Dechlorane, as a fire retardant in plastics, rubbers, paints, etc. This application is not restricted to the USA.

Recently, the use of mirex has become increasingly restricted or prohibited in many countries (see, e.g., section 7.3).

2. SUMMARY AND EVALUATION

2.1 Human Exposure to Mirex

Food probably represents the major source of intake of mirex for the general population, fish, wild game, and meat being the main sources. Normally, such intake is below established residue tolerances. Mirex may occur in breast milk, but levels are very low or below detection limits.

No data are available regarding occupational exposure.

2.2 Kinetics and Metabolism

Following oral ingestion, mirex is only partly absorbed into the body and the remainder, depending on the dose administered, is eliminated unchanged in the faeces. Mirex can also be absorbed following inhalation and via the skin.

It is a lipophilic compound and, as such, is stored in adipose tissue to a greater extent than in any other tissue. Mirex is transferred across the placenta to the fetus and is excreted with the milk.

Mirex does not appear to have been metabolized to any extent in any animal species investigated. Its elimination from the body is slow and, depending on the species, it has a half-life in the body of several months.

It is one of the most stable pesticides in use today.

2.3 Effects on Experimental Animals

Mirex was moderately toxic in single-dose animal studies (oral $LD_{50}$ values ranged from 365 to 3000 mg/kg body weight). Toxic effects included neurological symptoms, especially tremors and convulsions.

The most sensitive effects of repeated exposure in experimental animals are principally associated with the liver (liver hypertrophy with morphological changes in the liver cells, and induction of mixed-function oxidases). These effects have been observed with doses as low as 1 mg/kg diet (0.05 mg/kg body weight per day), the lowest dose tested.

In studies to investigate the toxicity of mirex in pregnant animals, teratogenic effects were seen in rats given 6 mg/kg body weight per day by gavage, and fetotoxic effects were seen in animals given 25 mg/kg diet. In addition, exposure of male mice to dietary levels of about 2 mg/kg for 3 months resulted in impaired reproductive performance.

Mirex was not generally active in short-term tests for genetic activity. However, mirex is carcinogenic for both mice and rats.

2.4 Effects on Human Health

No data on effects on human beings were available to the Task Group.

2.5 Effects on the Environment

Mirex is one of the most stable and environmentally persistent pesticides in use today. It is not biodegraded by microorganisms, except occasionally under aerobic conditions, and hydrolysis is very slow. Although general environmental levels are low, it is widespread in the biotic and abiotic environment. Mirex is both accumulated and biomagnified. It is strongly adsorbed on sediments and has a low water solubility.

The delayed onset of toxic effects and mortality is typical of mirex poisoning. The long-term toxicity of mirex is uniformly high. It is toxic for a range of aquatic organisms, crustacea being particularly sensitive. Mirex induces pervasive long-term physiological and biological disorders in vertebrates.

Although no field data are available, the adverse effects of long-term exposure to low levels of mirex, combined with its persistence, suggest that the use of mirex presents a long-term environmental risk.

3. CONCLUSIONS AND RECOMMENDATIONS

3.1 Conclusions

1. No data on human health effects are available in connection with occupational exposure to mirex. On the basis of findings in mice and rats, this chemical should be considered, for practical purposes, as being potentially carcinogenic for human beings.

2. For the same reason, reservations must remain about the safety of this chemical in food, despite the relatively low residues so far reported.

3. Effects on the organisms studied, as well as its persistence, suggest that mirex presents a long-term hazard for the environment.

4. Taking into account these considerations, it is felt that the use of this chemical for both agricultural and non-agricultural applications should be discouraged, except where there is no adequate alternative.

3.2 Recommendations

1. Surveillance should be maintained over any future production, transport, and disposal of mirex and the nature and extent of both its agricultural and non-agricultural use.

2. Comprehensive monitoring of levels of mirex in the environment should be continued.

## 4. HUMAN HEALTH HAZARDS, PREVENTION AND PROTECTION, EMERGENCY ACTION

### 4.1 Main Human Health Hazards, Prevention and Protection, First Aid

Mirex is an organochlorine insecticide. It is toxic and may be hazardous for human beings if incorrectly or carelessly handled. It is therefore essential that the correct precautions should be observed during handling and use.

For details, see the International Chemical Safety Card (section 6).

#### 4.1.1 Advice to physicians

##### 4.1.1.1 Symptoms of poisoning

Mirex is toxic by mouth, by skin contact (especially liquid formulations), and by inhalation of dust from powder concentrates. It acts as a stimulant of the central nervous system.

Following accidental ingestion or over-exposure, symptoms may include headache, dizziness, nausea, vomiting, weakness in the legs, and convulsions.

Organochlorines can cause respiratory depression. They also sensitize the heart to endogenous catecholamines leading to ventricular fibrillation and cardiac arrest in severe cases.

Respiratory depression may lead to metabolic acidosis and, if necessary, blood gases should be checked. The use of an ECG monitor is recommended if the symptoms are severe.

No cases of poisoning in man have been reported so far.

##### 4.1.1.2 Medical advice

Medical treatment is largely symptomatic and supportive and directed against convulsions and hypoxia. Because many liquid formulations contain hydrocarbon solvent, vomiting should *not* be induced and emetics are contraindicated. If swallowed, the stomach should be emptied as soon as possible by careful gastric lavage (with a cuffed endotracheal tube), avoiding aspiration into the lungs. This should be followed by intragastric administration of 3-4 tablespoons of activated charcoal and 30 g magnesium sulfate or sodium sulfate in a 30% aqueous solution. Oily purgatives are contraindicated. No fats, oils, or milk should be given.

If convulsions occur, anti-convulsants should be given, e.g., diazepam, 10 mg slowly intravenously (children 1-5 mg), repeated as necessary; or thiopental sodium, or hexobarbital sodium slowly intravenously in a dose of 10 mg/kg body weight with a maximum total dose of up to 750 mg for an adult. On account of their short action,

these barbiturates should always be followed by phenobarbital given orally at 3 mg/kg body weight (up to 200 mg for an adult), or phenobarbital sodium given intramuscularly at 3 mg/kg (also up to 200 mg for an adult).

*Morphine and its derivatives, epinephrine and norepinephrine should* **never** *be given.*

An unobstructed airway must be maintained. Oxygen and/or artificial respiration may be needed.

4.1.2 Health surveillance advice

A pre-employment and an annual general medical examination are advised for regularly exposed workers. Special attention should be paid to liver and kidney function.

4.2 Safety in Use

| | |
|---|---|
| Handling liquid formulations: | Wear protective neoprene or PVC gloves, cotton overalls, rubber boots, and face shield. |
| Handling powder formulations: | Avoid raising a dust cloud. Wear protective gloves and dust mask. Follow the advice relating to personal hygiene. |

4.3 Explosion and Fire Hazards

4.3.1 Explosion hazards

The explosion hazard will depend on the solvent used in the formulation, or on the characteristics of the dust.

4.3.2 Fire hazards

Liquid products containing organic solvents may be flammable. Extinguish fires with alcohol-resistant foam, carbon dioxide, or powder. With sufficient burning or external heat, mirex will decompose, emitting toxic fumes. Fire-fighters should wear a self-contained breathing apparatus, eye protection, and full protective clothing.

Confine the use of water spray to the cooling of unaffected stock, thus avoiding the accumulation of polluted run-off from the site.

4.4 Storage

Products should be stored in locked buildings, preferably dedicated to insecticides.

Keep products out of reach of children and unauthorized personnel. Do not store near foodstuffs or animal feed.

4.4.1 Leaking containers in store

Take precautions and use appropriate personal protection. Empty any product remaining in damaged/leaking containers into a clean empty drum, which should then be tightly closed and suitably labelled.

Sweep up spillage with sawdust, sand, or earth (moisten for powders), and dispose of safely.

Emptied leaking liquid containers should be rinsed with at least 1 litre water per 20-litre drum. Swirl round to rinse the walls, empty, and add the rinsings to the sawdust or earth. Do not re-use containers for any other purpose. Puncture the container to prevent re-use.

4.5 Transport

Comply with any local requirements regarding movement of hazardous goods. Do not transport with foodstuffs or animal feed. Make sure that containers are in good condition and labels undamaged before

dispatch.

4.6 Spillage and Disposal

4.6.1 Spillage

Before dealing with any spillage, precautions should be taken as required and appropriate personal protection should be used.

Prevent liquid from spreading or contaminating other cargo and vegetation, and avoid pollution of surface waters and ground water by using the most suitable available material, e.g., earth or sand.

Absorb spilled liquid with sawdust, sand, or earth, sweep up and place it in a closeable container for later transfer to a safe place for disposal.

As soon as possible after the spillage and before re-use, cover all contaminated areas with damp sawdust, sand, or earth. Sweep up and place in a closeable container for later transfer to a safe place for disposal. Care should be taken to avoid run-off into surface waters or drains.

4.6.2 Disposal

Surplus product, contaminated absorbents, and containers should be disposed of in an appropriate way. Mirex is not readily decomposed chemically or biologically and is relatively persistent. Waste material should be burned only in a proper incinerator designed for organochlorine waste disposal (1000°C and 30-min residence time with effluent gas scrubbing). If this is not possible, bury in an approved dump or landfill where there is no risk of contamination of surface or ground water. Comply with any local legislation regarding disposal of toxic wastes.

5. HAZARDS FOR THE ENVIRONMENT AND THEIR PREVENTION

5.1 Hazards

Mirex is one of the most stable of the organochlorine insecticides. Although general environmental levels are low, it is widespread in the biotic and abiotic environment. Mirex is both accumulated and biomagnified. It is strongly adsorbed on sediments and has a low water solubility.

Delayed onset of toxic effects and mortality is typical of mirex poisoning. The long-term toxicity of mirex is uniformly high. Mirex is toxic for a range of aquatic organisms, crustacea being particularly sensitive.

Although no field data are available, the adverse effects of long-term exposure to low levels of mirex, combined with its persistence, suggest that the use of mirex presents a long-term environmental risk.

5.2 Prevention

Industrial discharges from manufacturing, formulation, and technical applications should not be allowed to pollute the environment and should be treated properly.

Any spillage or unused product should be prevented from spreading to vegetation or waterways and should be treated and disposed of properly.

## 6. INTERNATIONAL CHEMICAL SAFETY CARD

*This card should be easily available to all health workers concerned with, and users of, mirex. It should be displayed at, or near, entrances to areas where there is potential exposure to mirex, and on processing equipment and containers. The card should be translated into the appropriate language(s). All persons potentially exposed to the chemical should also have the instructions on the chemical safety card clearly explained.*

*Space is available on the card for insertion of the National Occupational Exposure Limit, the address and telephone number of the National Poison Control Centre, and for local trade names.*

### MIREX

CAS chemical name: 1,1a,2,2,3,3a,4,5,5,5a,5b,6-dodecachloroocta-hydro-1,3,4-m
CAS registry number: 2385-85-5
RTECS registry number: PC8225000
Molecular formula: $C_{10}Cl_{12}$

### PHYSICAL PROPERTIES

| | |
|---|---|
| Melting point (°C) | 485 |
| Vapour pressure (mmHg at 25°C) | $3 \times 10^{-7}$ |
| Relative molecular mass | 545.5 |
| Solubility: | |
| in water | practically insoluble |
| in tetrahydrofuram | 30% |
| in carbon disulfide | 18% |
| in chloroform | 17% |
| in benzene | 12% |

### OTHER C

Mirex i
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### HAZARDS/SYMPTOMS

GENERAL: Potential human carcinogen; on repeated exposure mirex may accumulate in the body

SKIN: Overexposure may cause poisoning

EYES: Irritation, redness

INHALATION: Dust may irritate

INGESTION: Unlikely occupational hazard

Accidental or intentional ingestion may cause poisoning

### PREVENTION AND PROTECTION

Avoid skin contact; wear protective clothing, PVC or neoprene gloves, rubber boots

Wear face-shield or goggles

Wear appropriate dust mask or respirator

Do not eat, drink, or smoke during work; wash hands before eating, drinking, or smoking

ENVIRONMENT: Toxic for aquatic and terrestrial life; persistent

Do not spill on animal feed or in waterways

SPILLAGE

Take appropriate personal precautions; prevent liquid from spreading or contaminating other cargo, vegetation, or waterways, with a barrier of the most suitable available material, e.g., earth or sand

Absorb spilled liquid with sawdust, sand, or earth; sweep up and place it in a closeable container for later safe disposal

STORAGE

Products should be stored in locked buildings, preferably dedicated to insecticides

Keep products out of reach of children and unauthorized personnel; do not store near foodstuffs or animal feed

WASTE DISPOSAL

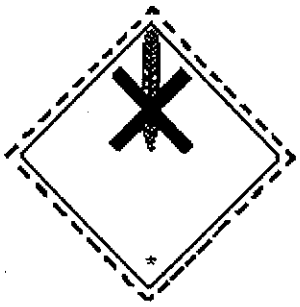
Mirex is not readily decomposed chemically or biologically and is relatively persistent; waste material should be burned in a proper incinerator designed for organochlorine waste disposal; if this is not possible, bury in an approved dump or landfill where there is no risk of contamination of surface or ground water; comply with any local legislation regarding disposal of toxic wastes

NATIONAL INFORMATION

National Occupational Exposure Limit:

National Poison Control Centre:

Local trade names:



## 7. CURRENT REGULATIONS, GUIDELINES, AND STANDARDS

The information given in this section has been extracted from the International Register of Potentially Toxic Chemicals (IRPTC) legal file and other United Nations sources. Its intention is to give the reader a representative but non-exhaustive overview of current regulations, guidelines, and standards.

taken in a certain country can only be fully understood in the framework of the legislation of that country. Furthermore, the regulations and guidelines of all countries are subject to change and should always be verified with the appropriate regulatory authorities before application.

7.1 Previous Evaluations by International Bodies

IARC (1979) evaluated the carcinogenic hazard resulting from exposure to mirex and concluded that "there is sufficient evidence for its carcinogenicity to mice and rats. In the absence of adequate data in humans, it is reasonable, for practical purposes, to regard mirex as if it presented a carcinogenic risk to humans".

An acceptable daily intake (ADI) for mirex has not been established by FAO/WHO.

7.2 Exposure Limit Values

Some exposure limit values are given in the table on the opposite page.

7.3 Specific Restrictions

Recently, the use of mirex has been increasingly restricted or prohibited in many countries.

In the USA, all registered products containing mirex have been cancelled. It has been banned in Ecuador and in various other countries. In the German Democratic Republic, mirex is not permitted in agricultural formulations.

EXPOSURE LIMIT VALUES

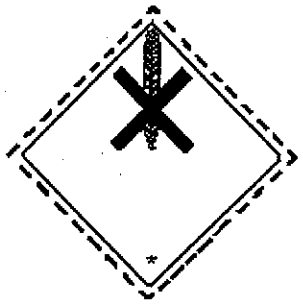
| Medium | Specification | Country/ organization | Exposure limit descriptio |
|---|---|---|---|
| FOOD, ANIMAL FEED | | USA | Acceptable residue limit<br>- Specified animal produc<br>- General |
| FOOD | | Germany, Federal Republic of | Maximum residue limit (MR<br>- Plant (all) |
| FOOD | Animal | Germany, Federal Republic of | Maximum residue limit (MR<br>- of animal origin (speci |
| | | | - of animal origin (gener |

7.4 Labelling, Packaging, and Transport

The United Nations Committee of Experts on the Transportation of Dangerous Goods classified mirex in:

- Hazard Class 6.1: poisonous substance
- Packing Group III: a substance presenting a relatively low risk of poisoning in transport (mirex liquid formulations >60%)

The label should be as follows:



**St Andrew's Cross over an ear of wheat (black); Background white.**

The bottom half of the label should bear the inscriptions:

*Harmful, stow away from foodstuffs.*

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See Also:

Toxicological Abbreviations
Mirex (EHC 44, 1984)
Mirex (IARC Summary & Evaluation, Volume 5, 1974)
Mirex (IARC Summary & Evaluation, Volume 20, 1979)