UNITED NATIONS

PIC

United Nations Environment Programme

Food and Agriculture Organization of the United Nations

Distr.
GENERAL

UNEP/FAO/PIC/ICRC.5/9/Add.1
27 November 2003

ENGLISH ONLY

Interim Chemical Review Committee
Fifth session
Geneva, 2 – 6 February 2004
Item 5(a) of the provisional agenda*

INCLUSION OF CHEMICALS IN THE INTERIM PRIOR INFORMED CONSENT PROCEDURE - SUPPORTING DOCUMENTATION

Endrin

Note from the Secretariat

1. Annexed to this note is the documentation provided by Jordan in support of their notification of final regulatory action on endrin.

* UNEP/FAO/PIC/ICRC.5/1

List of Documentation Annexed to UNEP/FAO/PIC/ICRC5/9/Add.1

Supporting documentation on endrin from Jordan:

Focused summary – endrin
English translation of regulatory action against endrin and dimefox
Health and safety guide 60 – Endrin (1991)
Data sheet on pesticides No. 1 – Endrin (1975)
Excerpt of the Pesticide Manual 10th edition – endrin
Excerpt of the Crop Protection Handbook 2003 – endrin
Excerpt of the WHO Recommended Classification of Pesticides 2000-2001

19/11/2003

To: The Interim Secretariat of Rotterdam Convention,
Food and Agriculture Organization of the United Nations,
AGPP, Rome, Italy
Attention: Murray William
Cc: Elisabetta Tagliati

Subject: Focused Summary –endrin – Mevinphos- Vinclozolin -Dimefox

Dear Sir,

Focused Summary- Endrin

1\ INTRODUCTION:

This section should provide a brief statement / summary of the final regulatory actions and the reasons for the action taken (e.g. occupational health concerns, environmental concerns). Could include:

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

The committee received information about potential hazards of endrin to human health and the environment. The action was taken in the 68th session of the agricultural pesticides committee dated 29/10/1980. It was stated that the control action will enter into force on 1/1/1981.

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

The banning of endrin would reduce the hazards to human health and the environment as it is highly toxic and persistent in the environment as well as its residues bioaccumulates in food chain and human tissues.

© An overview of the regulatory system of the notifying country if relevant;

Pesticides were used to be regulated by the law of Agriculture No. 20 for the year 1973, through a multi-stake holder committee called the Agricultural Pesticides Committee. Recently the law was amended to the Interim Law of Agriculture No. 44 for the year 2002. According to this law a national multi-stake holder committee called Pesticides Registration Committee is formed and responsible for registration, re-registration and cancellation of registration of pesticides within the Hashemite Kingdom of Jordan. The pesticide division within the ministry of agriculture is responsible for approval of label while the provinces had the authority of granting license for retailers as well as inspection of any miss-use or off law activities.

(d) Scope of the regulatory action-precise description of the chemicals subject to the regulatory action;

It is prohibited to place on the market or use plant products containing endrin. The decision at that time was against the registered formulations (Endrin, Endrin 75 WP

It is prohibited to place on the market or use plant products containing endrin. The decision at that time was against the registered formulations (Endrin, Endrin 75 WP and Endrin 50 INS). This decision was interpreted to include all formulations containing endrin.

11\ RISK EVALUATION;

This section should provide evidence that a risk evaluation was carried out under the prevailing conditions of the notifying country. It should confirm that criteria Annex 11 (b) are met. May include;

(a) **Key finding of a national risk evaluation;**

- high toxicity to humans, animals and birds;
- long residual effects assisting the environmental pollution
- Improper use by farmers (as it is used in vegetables during fruit picking) resulting in poisoning cases.

(Minutes of the meeting did not clearly indicate a national data was generated, there is indication that there was some exposure information but no data available in the meeting documents).

(b) **Key data reviews consulted and a brief description;**

- pesticide manual
- IPCS

(c) **Reference to national studies, e.g. toxicological and ecotoxicological studies;**

No national study was carried out.

(d) **Summary of actual (or potential) human exposure and or environmental fate.**

Improper use by farmers (as it used in vegetables during fruit picking) resulting in poisoning cases (source: minutes of the meeting, but no detailed data available).

111\ RISK REDUCTION AND RELEVANCE TO OTHER STATES

This section should provide evidence that the control action is of relevance to other states. Could include information on the followings;

(a) **Estimation of quantities of chemicals used or imported/exported at the time of the regulatory action and if possible information on ongoing trade;**

In 1979 Jordan had imported and used 940 Kg of this product. The Hashemite Kingdom of Jordan has no information on ongoing trade.

(b) **Relevance to other states, i.e. those with similar conditions of use;**

The Hashemite Kingdom of Jordan has no information.

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

The product was registered to be used as insecticide. Farmers may improperly use it in vegetables during fruit picking which result in poisoning cases (Source; minutes of the meeting, no further data available).

Translations of document No. 1:
Re: Regulatory action against endrin and dimefox
Session 68 of the Agricultural Pesticide committee
Date 29/10/1980
Excerpts of the minutes related to the control actions against endrin and dimefox

The committee of agricultural pesticides met at 10 am on Wednesday the 29th/ 10/1980 under the chair ship of the director of agric. production and service, the Agric. Eng. Mr. Kinana Abdalhadi and the membership of head of protection division, the Agric. Eng. Dr. Hani Hadadain, Head pesticide division, Agric. Eng. Mr. Shoukat Gasim, Representative of research and agric. extension, Agric. Eng. Mr. Khalil Qusour. After the study of documents presented by agric. companies regarding their application for registration of agric. pesticides the committee decided in its 68th session the followings:
Paragraphs 1-11 were not relevant to the chemicals in question and therefore not translated.
Last paragraph:
Based on article 15 of the decision No. (12/wn) for the year 1974 which has been issued based on article 66 of the law of Agriculture No. 20 for the year 1974, the committee decided to raise to his Excellency the Minster its decision to cancel the registration of the following pesticides starting from 1/1/1981 for the following reasons:

- high toxicity to humans, animals and birds;
- long residual effects assisting the environmental pollution
- Improper use by farmers (as it used in vegetables during fruit picking) resulting in poisoning cases.

These pesticides[1] are:

Name of pesticide	Registration No.	Registering company
Endrin	47	Abdalhafiz Agric.
Endrin 75 WP	78	Abdalwhab Hamam
Endrin 50 INS	114	Eastern Company
Pestox 50 EC	40	Agric. Union

Fourteen other chemicals are included in the decision (not shown here as they were not relevant) as indicated by the footnote.

Signatures of attendants:
Pesticide Division, Mr. Showkat Gasim
Head of Protection Division, Agric. Eng. Dr. Hani Hadadain
Committee Chair, Director of Agric. Production and Service, Agric. Eng. Mr. Kinana Abdalhadi

[1] A total of 18 formulations were included in the decision, but only those related to the endrin and dimefox were translated.

IPCS INTERNATIONAL PROGRAMME ON CHEMICAL SAFETY
Health and Safety Guide No. 60

ENDRIN
HEALTH AND SAFETY GUIDE

UNITED NATIONS ENVIRONMENT PROGRAMME

INTERNATIONAL LABOUR ORGANISATION

WORLD HEALTH ORGANIZATION

WORLD HEALTH ORGANIZATION, GENEVA 1991

This is a companion volume to Environmental Health Criteria 130: Endrin

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)

WHO Library Cataloguing in Publication Data

Endrin : health and safety guide.

(Health and safety guide ; no. 60)

1. Endrin - standards I. Series

ISBN 92 4 151060 9 (NLM Classification: WA 240)
ISSN 0259-7268

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 a Summary of Chemical Safety Information 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

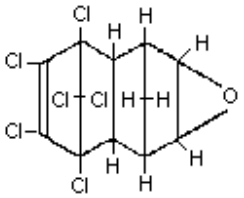
1. PRODUCT IDENTITY AND USES

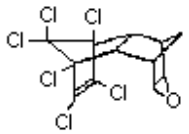
1.1 Identity

Common name: endrin

Molecular formula: $C_{12}H_8Cl_6O$

Chemical structure:





Synonyms: Endrex, Experimental Insecticide 269, Hexadrin, Nendrin, NCI-COO157, ENT 17251 OMS 197, and Mendrin

CAS chemical name: (1a,2,2a,3,6,6a,7,7a)-3,4,5,6,9,9-hexachloro-1a,2,2a,3,6,6a,7,7a-octahydro-2,7:3,6-dimethanonaphth[2,3-b] oxirene (9CI-CAS).

Former CAS chemical name: 1,2,3,4,10,10-hexachloro-6,7-epoxy-1,4,4a,6,7,8,8a-octahydro-1,4-endo,endo-5,8-dimethanonaphthalene)

IUPAC chemical name: (IR,4S,4aS,5S,6S,7R,8R,8aR)-1,2,3,4,10.10-h exachloro-1,4,4a,5,6,7,8,8a-octahydro-6,7-epoxy-1,4:5,8-dimethano-naphthalene

CAS registry number: 72-20-8

RTECS registry number: IO1575000

Technical product

Trade name: Endrin

Purity: Not less than 92%. Impurities include dieldrin (0.42%), aldrin (0.03%), isodrin (0.73%), endrin half-cage ketone (1.57%), endrin aldehyde (0.05%), and heptachloro-norbornene (0.09%).

1.2 Physical and Chemical Properties

Endrin is a crystalline solid with a mild odour. Technical endrin is stable when stored at ambient temperatures. It is stable in formulations containing alkaline agents, emulsifiers, wetting agents, and solvents. It decomposes with concentrated mineral acids, acid

catalysts, acid oxidizing agents, and active metals. When heated above 200°C, endrin forms a less toxic and less insecticidally active compound, delta-ketoendrin.

Some physical properties of endrin are given in Table 1.

Table 1. Physical properties of endrin

Melting point	226-230°C (above 200°C decomposition)
Flash-point	None
Explosion limits	Stable
Vapour pressure	2.7 x 10^{-7}mmHg at 25°C (3.6 x 10^{-5}Pa at 25°C)
Relative molecular mass	380.9
Density	1.64 g/ml at 20°C
Solubility in water	Practically insoluble
Solubility in organic solvents	Sparingly soluble in alcohols, petroleum hydrocarbons, moderately soluble in aliphatic hydrocarbons, and quite soluble in solvents, such as acetone, benzene, carbon tetrachloride, and xylene
Partition coefficient log P octanol/water	5.34

Conversion factors (20°C):

1 ppm = 16 mg/m^3;
1 mg/m^3 = 0.063 ppm.

1.3 Analytical Methods

Analytical methods for the determination of endrin are mainly based on gas-liquid chromatography with electron-capture detection.

1.4 Production and Uses

Endrin has been manufactured since 1950, and was used throughout the world up to the early 1970s. No actual production figures are available, but the use of endrin has declined since the early 1970s, because of severe restrictions on use, or banning, in several countries.

It is a contact and stomach poison, used as a foliar insecticide,

which acts against a wide range of pests, particularly Lepidoptera. It can be used at 0.2-0.5 kg a.i./ha on cotton, maize, sugar cane, upland rice, and many other crops.

Endrin formulations include emulsifiable concentrates (ECs) at 190-200 g a.i./litre, wettable powders (WPs) at 500 g a.i./kg, granules at 10-50 g a.i./kg, field strength dusts (FSDs), and pastes.

2. SUMMARY AND EVALUATION

2.1 Exposure

Endrin is an organochlorine insecticide that has been used since the 1950s to control a wide range of agricultural pests, mainly on cotton, but also on rice, sugar cane, maize, and other crops. It is also used as a rodenticide and avicide. Commercially, it is available in the form of a dust, granules, paste, and as an emulsifiable concentrate (EC).

Endrin enters the air mainly through volatilization and aerial drift. In general, volatilization takes place after application to soils and crops, and depends on many factors, such as the organic matter and moisture content of the soil, humidity, air flow, and the surface area of plants.

The most important route of contamination of surface water is run-off from soil.

Contamination from precipitation, in the form of snow or rain, is negligible. Local contamination of the environment may occur from industrial effluents and careless application practices.

The main source of endrin in the soil is its direct application to soil and crops. In soil, endrin can be retained, transported, or degraded, depending on a number of factors. The highest retention occurs in soils with a high organic matter content. The persistence of endrin is highly dependent on local conditions. Its half-life in soil can range up to 12 years.

Volatilization and photodecomposition are primary factors in the disappearance of endrin from soil surfaces. Under the influence of sunlight (UV radiation), the isomer delta-ketoendrin is formed. In intense summer sunlight, about 50% of the endrin is isomerized to this ketoendrin in 7 days. Microbial transformation (fungi and bacteria) takes place, especially under anaerobic conditions, yielding the same product.

Aquatic invertebrates and fish take up endrin rapidly from water. Bioconcentration factors ranging between 14 and 10 000 have been recorded after continuous exposure. Exposed fish transferred to uncontaminated water lose endrin rapidly. Soil invertebrates may also take up endrin readily.

The occasional presence of low levels of endrin in air and in surface water or drinking-water (in agricultural areas) is of little significance from the point of view of public health. The only exposure that may be of relevance is the dietary intake. In general, the reported intake levels are far below the ADI of 0.0002 mg/kg body weight, established in 1970 (FAO/WHO, 1971).

2.2 Uptake, Metabolism, and Excretion

Unlike dieldrin, its stereoisomer endrin is rapidly metabolized by animals; accumulation in the fat of animals is very low compared with that of other compounds of similar chemical structure. In rats, it is eliminated mainly in the faeces as endrin, anti-12-hydroxyendrin, and a hydroxylated endrin derivative; a third metabolite, 12-ketoendrin, accumulates in the tissues.

Both uptake and excretion after oral administration are rapid in rats. The biological half-life is 1-6 days, depending on the dose level. A steady state, when the excreted amount equals the daily intake, is reached after 6 days. Excretion of both endrin and its metabolites via the bile is much more rapid in male rats than in females, resulting in lower accumulation in adipose tissue in males.

In rats, endrin and its metabolites are mainly eliminated via the faeces in the first 24 h (70-75%). In rabbits, 50% of the metabolites are excreted in the urine, compared with only 2% in rats. Only unchanged endrin is found in the faeces of rabbits.

When cows were administered 0.1 mg endrin/kg diet for 21 days, up to 65% was excreted as metabolites in the urine, 20% was found in the faeces, partly as unchanged endrin, and 3% was excreted in the milk, also mainly as endrin. Residue levels of 0.003-0.006 mg/litre in milk, 0.001-0.002 mg/ kg in meat, and 0.02-0.1 mg/kg in fat were found.

Depending on dose levels, laying hens fed endrin showed residues of up to 0.1 mg/kg in meat and 1 mg/kg in fat; eggs (yolk) contained 0.2-0.3 mg/kg and liver and kidneys each contained 0.2-0.5 mg/kg. The residues found were mainly unchanged endrin, except in the liver and kidneys. About 50% of the administered endrin was excreted in the faeces, mainly in the form of metabolites.

It is clear that in the rat, rabbit, cow, hen, and man, the major biotransformation metabolites of endrin are anti-12-hydroxyendrin, and its sulfate and glucuronide conjugates. Four other metabolites are present only in minor quantities. In body tissues and milk, mainly unchanged endrin is found.

After application of endrin to plants, unchanged endrin and transformation products including delta-ketoendrin and a very hydrophilic compound were identified.

2.3 Effects on Organisms in the Environment

The effects of endrin on soil bacteria and fungi are minimal. Dose levels of between 10 and 1000 mg/kg soil did not have any effects on the decomposition of organic matter, denitrification, or the generation of methane. Endrin is very toxic for fish, aquatic invertebrates, and phytoplankton; the 96-h LC_{50} values are mostly below 1.0 g/litre. In a life-cycle test, a lowest-observed-effect level (LOEL) for the mysid shrimp *(Mysidopsis bahia)* was established of 30 ng/litre.

The reported acute toxicity tests on aquatic organisms have been conducted in aquaria without sediment. The presence of sediment would be expected to attenuate the toxicity of endrin. Heavily contaminated sediment had little effect on species living in open water, suggesting low bioavailability of sediment-bound endrin. No tests have been conducted on sediment-living aquatic animals.

The LD_{50} values for terrestrial mammals and birds are of the order of 1.0-10.0 mg/kg body weight. Endrin fed to Mallard ducks at doses of up to 3.0 mg/kg body weight, for 12 weeks, did not produce any effects on egg production, fertility, or hatchability.

Resistance to endrin toxicity has been reported in several animal groups including: aquatic invertebrates, fish, and small mammals. Exposure to several different organochlorine pesticides led to the selection of strains resistant to endrin.

Fish-kills occurring in agricultural (run-off) and industrial (discharge) areas, and population decline in brown pelicans (Louisiana, USA) and sandwich terns (the Netherlands) have been attributed to a combination of endrin and other halogenated chemicals.

2.4 Effects on Experimental Animals and In vitro Test Systems

Endrin is a highly toxic pesticide. The oral LD_{50} values for technical endrin in laboratory animals are in the range of 3-43 mg/kg body weight. Dermal LD_{50} values for the rat range from 5 to 20 mg/kg body weight. No substantial differences were found in the acute oral and dermal toxicities of technical and formulated EC and wettable powder (WP) products. Signs of intoxication are of a neurotoxic nature.

Short-term oral toxicity studies were carried out on mice, rats, rabbits, dogs, and domestic animals. In mice and rats, the maximum tolerated doses for 6 weeks were 5 and 15 mg/kg diet (equivalent to 0.7 mg/kg body weight), respectivley. Rats survived a 16-week exposure to a level of 1 mg/kg diet (equivalent to 0.05 mg/kg body weight). Rabbits, administered repeated doses of 1 mg endrin/kg body weight, died. In studies on dogs, a dietary level of 1mg/kg diet (approx. 0.025 mg/kg body weight), given over 2 years, did not induce any effects.

At low doses, the neurologically based sign of intoxication is an inhibition of the GABA-ergic function. As is the case with other chlorinated hydrocarbon insecticides, endrin also affects the liver. Stimulation of enzyme systems involved in the metabolism of other chemicals was evident as shown by, for instance, a decreased hexobarbital sleeping time.

Doses of 75-150 mg endrin/kg, applied dermally as the dry powder for 2 h daily, caused convulsions and death in the rabbit, but did not result in skin irritation. The production of systemic toxicity without irritation at the site of contact is noteworthy.

Long-term toxicity/carcinogenicity studies were carried out on the mouse and rat. No carcinogenic effects were found, but it should be mentioned that there were shortcomings in the studies, e.g., poor survival of the animals. In a 2-year study on the rat, the no-observed-effect level was 1 mg/kg diet (ca 0.05 mg/kg body weight). Tumour-promoting effects were not observed when endrin was tested in combination with subminimal quantities of animal carcinogens. Endrin was not found to be genotoxic in several mutagenicity studies. The WHO Task Group on Environmental Health Criteria for Endrin concluded that the data are insufficient to indicate that endrin is a carcinogenic hazard for human beings.

Endrin was found not to be teratogenic in mice, rats, and hamsters, even at dose levels causing maternal or fetotoxicity. NOELs of 0.5 mg/kg body weight in mice and rats and 0.75 mg/kg body weight in hamsters were demonstrated. Endrin, at a dose of 2 mg/kg diet (ca

0.1 mg/kg body weight), did not induce reproductive effects over 3 generations in the rat.

A number of metabolites have acute toxicities that are similar to, or higher than, that of endrin. The transformation product delta-ketoendrin is less toxic. 12-Ketoendrin is considered to be the most toxic metabolite of endrin in mammals, with an oral LD_{50} in the rat of 0.8-1.1 mg/kg body weight.

2.5 Effects on Human Beings

Several episodes of fatal and non-fatal accidental and suicidal poisoning have occurred. Cases of acute non-fatal intoxication, due to accidental overexposure, have been observed in workers in an endrin-manufacturing plant. The oral dose causing death was estimated to be approximately 10 mg/kg body weight. The single oral dose causing convulsions was estimated to be 0.25-1.0 mg/kg body weight.

The primary site of action of endrin is the central nervous system. Exposure of humans to a toxic dose may lead to signs and symptoms of intoxication, such as excitability and convulsions, within a few hours, and death may occur within 2-12 h following exposure, if appropriate treatment is not administered immediately. In cases of non-fatal poisoning, recovery is rapid and complete.

Endrin does not accumulate in the human body to any significant extent. Medical supervision of occupationally exposed workers (duration of exposure ranging from 4 to 27 years) showed that long-term adverse effects were not present (observation period for 232 workers ranged from 4 to 29 years). The only effect observed in the workers was indirect evidence of a reversible stimulation of drug metabolizing enzymes.

Endrin was not detected in a large number of samples of adipose tissue, blood, and breast milk analysed in many countries. The Task Group attributed this to the minor exposure of the general population to endrin and its rapid metabolism.

Endrin could be detected in the blood (up to 450 µg/litre) and tissues (adipose tissue, 89.5 mg/kg) in cases of fatal accidental poisonings. No endrin was found in workers under normal circumstances. The threshold level of endrin in the blood, below which no signs or symptoms of intoxication occur, has been estimated to be in the range of 50-100 µg/litre. The half-life of endrin in the blood may be of the order of 24 h.

3. CONCLUSIONS AND RECOMMENDATIONS

3.1 Conclusions

Endrin is an insecticide of high acute toxicity. Overexposure through careless handling during manufacture or use, or from contaminated food, may cause severe poisoning.

Exposure of the general population to endrin arises mainly through residues in food. The reported intakes have generally been far below the Acceptable Daily Intake established by FAO/WHO. Such exposure should not constitute a health hazard for the general population.

When good work practices, hygiene measures, and safety precautions are enforced, endrin is unlikely to present a hazard for those occupationally exposed.

It is clear that the high toxicity of endrin can cause acute environmental problems when there are uncontrolled discharges during its manufacture, formulation, or use. Effects on wildlife from agricultural use are less clear, though fish and fish-eating birds are at risk from surface run-off.

Declines in the populations of some bird species have been associated with high residues of various organochlorine pesticides in the tissues of adults and in the eggs. While endrin has been found in some of these species, it is very difficult to separate the effects of the different organochlorines present.

3.2 Recommendations

Endrin should not be used, unless it is indispensable or less toxic alternatives are not available.

For the health and welfare of workers and the general population, the handling and application of endrin should only be entrusted to competently supervised and well-trained operators, who will ensure adequate safety precautions and apply endrin according to good agricultural practice.

The manufacture, formulation, agricultural use, and disposal of endrin should be carefully managed to minimize contamination of the environment, particularly surface waters.

Periodic health evaluations should be carried out in those regularly exposed to endrin.

Epidemiological studies of exposed populations of workers should be

continued.

In countries where endrin is still used, food should be monitored for endrin residues.

If the use of endrin continues, more information is required on the presence, ultimate fate, and toxicity of 12-ketoendrin and delta-ketoendrin.

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

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

Endrin is an organochlorine insecticide. It is highly toxic (oral rat LD_{50} approximately 7 mg/kg) and can be hazardous for human beings, if incorrectly or carelessly handled. It is therefore essential that the correct precautions should be observed during its handling and use.

The human health hazards of endrin exposure, preventive and protective measures, and first aid are listed in Table 2.

4.1.1 Symptoms of poisoning

Endrin is readily absorbed and toxic by mouth, by skin contact, and by inhalation. It acts as a stimulant of the central nervous system. An oral dose of 0.25 mg/kg body weight has been reported to cause convulsions in human beings.

Symptoms may appear between 20 min and 12 h following accidental ingestion or gross overexposure, and may include headache, dizziness, nausea, vomiting, weakness in the legs, and convulsions, sometimes leading to death.

Organochlorine compounds can cause respiratory depression. They may also sensitize the heart to endogenous catecholamines, leading to cardiac arrhythmias and, in severe exposure cases, to ventricular fibrillation and cardiac arrest.

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.

4.1.2 Medical treatment

Treatment of endrin poisoning requires immediate action; it is largely

symptomatic and supportive and directed against convulsions and hypoxia.

Endrin is quickly eliminated from the blood and can only be detected for 1 or 2 days following massive overexposures. Signs and symptoms of poisoning occur only at concentrations in whole blood of more than 50 µg endrin/litre.

If endrin is swallowed, the stomach should be emptied as soon as possible, by careful gastric lavage (with a cuffed endotracheal tube already in place), avoiding aspiration into the lungs. In a rural situation, where this is not feasible, vomiting should be induced immediately, if the victim is conscious. This should be followed by intragastric administration of 50 g of activated charcoal and 30 g

TABLE 2. HUMAN HEALTH HAZARDS, PREVENTIVE AND PROTECTIVE MEASURES, AND FIRST AID

HAZARDS/SYMPTOMS	PREVENTION AND PROTECTION	FIRST AID
SKIN: may cause poisoning in immediately contact with skin	Avoid contact with skin; wear suitable, impervious, protective clothing and gloves	After contact with skin, wash with plenty of water and soap; remove immediately all contaminated clothing and launder separately
EYES: may cause irritation to eyes	Avoid contact with eyes; wear eye protection	In case of contact with eyes, rinse immediately with plenty of water and seek medical advice
INHALATION: dusts and mist may cause poisoning by inhalation	Do not breathe dusts or spray; wear appropriate dust mask or respirator	
INGESTION: unlikely occupational hazard	Do not eat, drink, or smoke during work; wash hands before eating, drinking, or smoking	
Accidental or intentional ingestion may cause poisoning		If swallowed, seek medical advice immediately and show container or label;

keep at rest and gastric lavage is situation, induce conscious)

ensure a clear airway; if not possible in a rural vomiting (only if victim is

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magnesium or sodium sulfate in a 30% aqueous solution. Oily purgatives are contraindicated. No fats, oils, or milk should be given.

If convulsions occur, anticonvulsants should be given immediately, e.g., 10 mg of diazepam, slowly, intravenously (children 1-5 mg), repeated as necessary; or thiopental sodium or hexobarbital sodium slowly, intravenously, in a dose of 10 mg/kg, with a maximum total dose of up to 750 mg for an adult, or 5 ml of paraldehyde by intramuscular injection. These short-acting anticonvulsants should always be followed by phenobarbital given orally at 3 mg/kg (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, adrenaline and noradrenaline, should never be given.

An unobstructed airway must be maintained. Respiratory inadequacy, which may be accentuated by barbiturate anticonvulsants, should be corrected, and oxygen and/or artificial ventilation may be needed.

Some guidelines on the management of major status epilepticus are provided in Annex 1.

4.1.3 Health surveillance advice

A complete medical history and physical examination of regularly exposed workers should be made at least annually, and a pre-employment examination is recommended. Special attention should be paid to liver function and signs and symptoms of stimulation of the central nervous system (see 4.1.1).

4.2 Safety in Use

Handling liquid formulations: Wear protective neoprene or PVC gloves, cotton overalls, rubber apron and boots, and face shield.

Handling powder formulations:	Avoid raising a dust cloud. Wear protective gloves, cotton overalls, rubber boots, and an appropriate dust-mask or respirator. Follow the advice relating to personal hygiene.

Application in the field

Aerial application:	Ensure that flag-men (markers) do not stand in the spray-path of the aircraft; do not spray over residences occupied by human beings or over surface waters, and avoid spraying over ditches, canals, rivers, streams, ponds, or lakes.
Ground spraying:	Wear suitable protective clothing (i.e., cap or hat, cotton overalls or long-sleeved cotton shirt and long trousers, boots or shoes); when spraying tall crops or when there is a risk of accidental contamination by the spray, an impermeable hood and jacket should be worn; always avoid exposure to the spray mist; do not spray into the wind.
After application:	Take off heavily splashed or contaminated clothing; wash hands and exposed skin before eating, drinking, or smoking; wash overalls, boots, hat, and other protective clothing thoroughly, especially the inside of gloves; keep application equipment in good condition, and free from leaks and external contamination; keep contents tightly closed in original labelled container, when not fully used; do not re-use empty containers for any other purpose; keep containers in a safe place away from food, children, and animals; empty containers must be

washed out and disposed of, as advised in section 4.6.2.

4.3 Explosion and Fire Hazards

4.3.1 Explosion hazard

The explosion hazard depends on the solvent used in the formulation and on the characteristics of the dust.

4.3.2 Fire hazard

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

The use of water spray should be confined to the cooling of unaffected containers, thus avoiding the accumulation of polluted run-off from the site.

4.4 Storage

Products should be stored in locked buildings, preferably buildings dedicated to insecticides, and in compliance with label recommendations. They should be segregated from incompatible chemicals.

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

4.5 Transport

Comply with any national or local requirements regarding movement of hazardous goods or wastes. Do not transport in the same compartment as foodstuffs or animal feed. Before dispatch, check that containers are sound and labels undamaged.

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 (section 4.2). Empty any product remaining in damaged/leaking containers into

a clean empty drum, which should then be tightly closed and suitably labelled.

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.

After emptying, leaking containers should be rinsed with at least 1 litre of water per 20-litre drum. Swirl around to rinse the walls of the container, empty, and add the rinsings to the sawdust or earth. Puncture or crush the container to prevent re-use.

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.

4.6.2 Disposal

Any surplus product, contaminated absorbents, and containers should be disposed of in an appropriate way. Waste material should be burned in a proper incinerator designed for organochlorine waste disposal, 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 requirements regarding the disposal of toxic wastes. Puncture and/or crush all containers to prevent re-use.

5. HAZARDS FOR THE ENVIRONMENT AND THEIR PREVENTION

Endrin is highly toxic for all animal species, especially fish and other aquatic organisms. It is readily bioaccumulated in fish, but disappears rapidly when exposure is discontinued. It does not persist for long periods in the water, but may persist in sediments.

Discharges from the manufacture, formulation, or use of endrin, and any spillage or unused product, must be prevented from polluting the environment and spreading to vegetation or waterways, and must be treated and disposed of properly (section 4.6.2).

6. 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 not an exhaustive, overview of current regulations, guidelines, and standards.

The reader should be aware that regulatory decisions about chemicals, 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.

6.1 Previous Evaluations by International Bodies

The International Agency for Research on Cancer (IARC) reviewed endrin in 1974 and 1987 and concluded that there was inadequate evidence for the carcinogenicity of endrin in experimental animals and data in humans were inadequate. Endrin was classified in Group 3: not classifiable as to carcinogenicity to humans.

WHO classifies technical endrin as highly hazardous in normal use (WHO, 1990). A data sheet on endrin was issued in 1978 (WHO/FAO, 1978).

Endrin was evaluated by the Joint FAO/WHO Meeting on Pesticide Residues (JMPR) in 1963, 1965, and 1970. In 1970, the JMPR established an Acceptable Daily Intake (ADI) for man of 0-0.0002 mg/kg body weight.

The maximum residue limits (MRL) established for endrin by the Joint FAO/WHO Codex Alimentarious Commission 1986 are shown in Table 3.

6.2 Exposure Limit Values

Some exposure limit values are shown in the table on pages 28 and 29.

Table 3. Maximum residue limits for endrin

Commodity	MRL[a] in mg/kg product
Apples	0.02[b]
Barley	0.02[b]
Cottonseed	0.1
Cottonseed oil (crude)	0.1
Cottonseed oil (edible)	0.02[b]
Eggs	0.2

	(on a shell-free basis)	
Meat	0.1[c]	
	(in the carcass fat)	
Milk	0.0008[c]	
Poultry	1	
	(in the carcass fat)	
Rice, husked or polished	0.02[bb]	
Sorghum	0.02[b]	
Sweet corn	0.02[b]	
Wheat	0.02[b]	

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[a] Definition of residue: Sum of endrin and delta-ketoendrin.
[b] Level at, or about, the limit of determination.
[c] ERL:extraneous residue limit.

6.3 Specific Restrictions

The use of endrin is prohibited (with minor exceptions) in several countries, including, Australia, the countries of the European Community, Hungary, India, Japan, and Sweden. In the USSR, endrin is prohibited for use in agriculture.

In some other countries, endrin is registered only for certain uses, e.g., in Argentina, Brazil, and the USA.

6.4 Labelling, Packaging, and Transport

The United Nations Committee of Experts on the Transport of Dangerous Goods classifies endrin in:

Hazard Class 6.1:	poisonous substance;
Packing Group I:	substances and preparations presenting a very severe risk of poisoning, when the content of the active ingredient is 60-100%;
Packing Group II:	substances and preparations presenting a serious risk of poisoning, when the content of active ingredient is 6-60%;
Packing Group III:	substance presenting a relatively low risk of poisoning in transport, when the content of active ingredient is 1-6% (solid) or 0.5-6% (liquid).

As endrin may be carried in solution in flammable solvents, a "Flammable liquid" subsidiary risk label (red) is also required when the flash point of the solution is below or equal to 61°C (closed cup); the flammable risk takes precedence when the flash-point is below or equal to 23°C (closed cup); the solution is then classified in Class 3, with a Class 6.1 subsidiary risk.

For the purposes of international transport, the types of labelling shown below (page 30) are required by:

* the United Nations Committee of Experts on the Transport of Dangerous Goods;

* the International Maritime Dangerous Goods (IMDG) Code;

* the ICAO Technical Instructions for the Safe Transport of Dangerous Goods by Air;

* the European Agreement concerning the International Carriage of Dangerous Goods by Road (ADR);

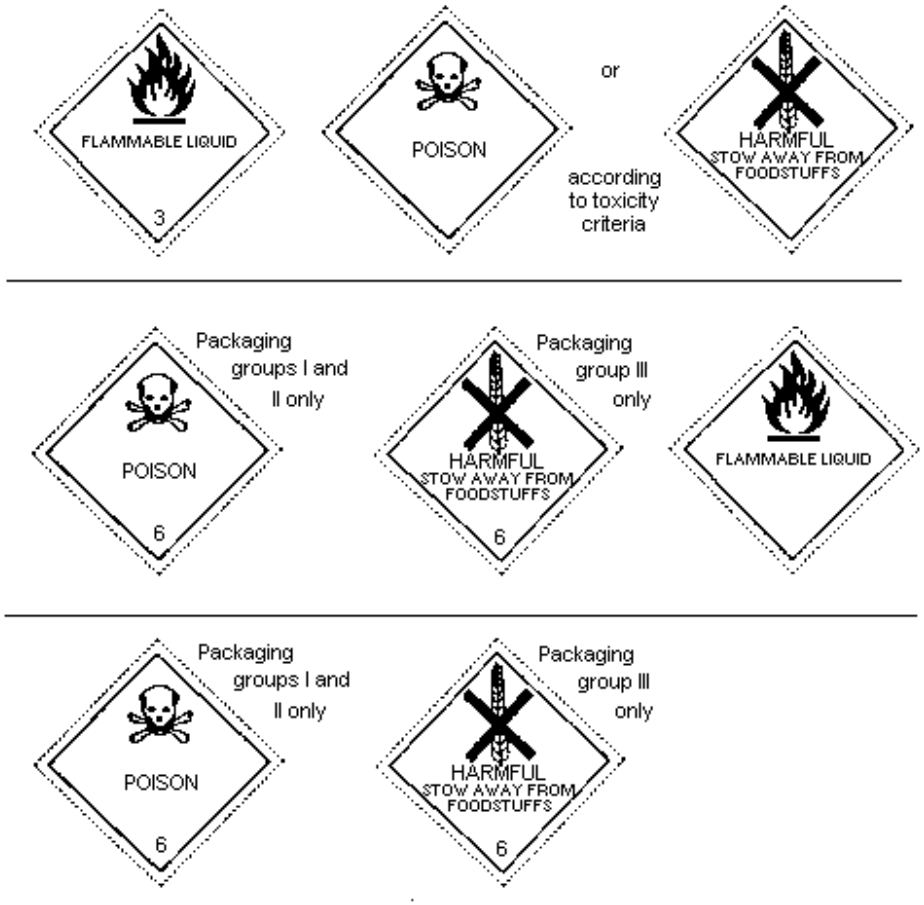
* the Regulations concerning the International Carriage of Dangerous Goods by Rail (RID).

TABLE 4. EXPOSURE LIMIT VALUES

Medium	Specification	Country/ organization	Exposure limit description	Value	Effective date
AIR	Workplace	Germany, Federal Republic of	Maximum worksite concentration (MAK)		1985
			- time weighted average (TWA)	0.1 mg/m^3[a]	
			- short term exposure limit (STEL) (30 min; 1 × /shift)	1.0 mg/m^3	
		United Kingdom	Recommended limit (RECL)		1985
			- time-weighted average (TWA)	0.1 mg/m^3[a]	
			- short term exposure level (STEL)	0.3 mg/m^3	

			(10-min TWA)	
		USA - OSHA	Permissible Exposure Limit (PEL)	
1989				
			- time-weighted average (TWA)	0.1 mg/m^{3}[a]
FOOD	Intake from	FAO/WHO	Acceptable daily intake (ADI)	0-0.0002 mg/kg
1970				
				body weight
	Residue	FAO/WHO	Maximum residue limit	0.0008-1mg/kg
1986				
			(for specified products)	
WATER	Ambient	Mexico	Maximum permissible concentration (for drinking-water purification)	0.001 mg/litre
1973				
			(coastal)	0.0002 mg/litre
1973				
			(estuarine)	0.002 mg/litre
1973				
		USA	Maximum permissible concentration	
1981				
			(bottled water for human consumption)	0.0002 mg/litre

[a] Skin absorption.



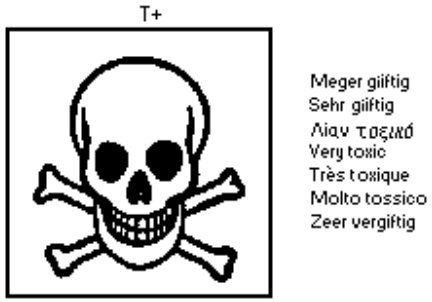
Note: The text on the label is optional, and is not required by RID/ADR. The class number at the bottom of the main hazard is not required by RID/ADR, but is not optional for the other modes.

Endrin has been identified as a severe marine pollutant in the International Maritime Dangerous Goods (IMDG) Code, therefore a "Marine pollutant" mark is required for the transport by sea of all concentrations greater than or equal to 1%.

The FAO specifications for plant protection products containing endrin specify the composition and purity of the technical product and its formulations. They also advise on methods for checking this. The endrin content should be stated and may not differ by more than 4% from this for the technical product (and up to 10% for some formulations). Technical endrin should contain a minimum of 92%w/w active material.

The European Economic Community legislation on the labelling of pesticide preparations classified endrin in Class I/a for the purpose of determining the label for preparations containing endrin and other active ingredients.

The European Economic Community legislation requires labelling as a dangerous substance using the symbol:



The label must read:

> *Very toxic by inhalation, in contact with skin and if swallowed; keep locked up; keep away from food, drink and animal feeding stuffs; after contact with skin, wash immediately with plenty of water; in case of accident or if you feel unwell, seek medical advice (show the label where possible).*

6.5 Waste Disposal

In the USA, any non-domestic waste containing endrin and its metabolites must be treated as a hazardous waste. Specific instructions are given for notification and incineration. Owners/operators of vessels or onshore or offshore facilities must notify the US Government (National Response Center) of any release of endrin in or on navigable waters, adjoining shorelines, in the contiguous zone or beyond the contiguous zone or to any other environmental media (air, land, or ground water) in an amount equal to, or greater than, one pound (0.454 kg).

An owner or operator of a hazardous waste incinerator must achieve 99.99% destruction and removal efficiency for this substance.

6.6 Other Measures

Aquatic environment

The European Economic Community legislation has established limit values for the discharge of, and quality objectives for, aldrin, dieldrin, endrin, and isodrin in the aquatic environment.

The limit values for emission standards are:

(a) Plants producing aldrin and/or dieldrin and/or endrin, including formulation of these substances on the same site, must:

* on a monthly average value, not exceed 3 g in effluent per tonne of production capacity (g/tonne) or a concentration in effluent of 2 g/litre of water discharged (to be complied with as from 1 January 1989).

* on a daily average value, not exceed 15 g in effluent per tonne of production capacity (g/tonne) or a concentration in effluent of 10 g/litre of water discharged (to be complied with as from 1 January 1989).

(b) For inland surface waters, estuary waters, internal coastal waters other than estuary waters, territorial waters, for the compounds aldrin, dieldrin, endrin, and isodrin together:

* 30 ng/litre (to be complied with as from 1 January 1989); and 10 ng/litre for aldrin, 10 ng/litre for dieldrin, 5 ng/litre for endrin, and 5 ng/litre for isodrin (to be complied with as from 1 January 1994).

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ANNEX. MANAGEMENT OF MAJOR STATUS EPILEPTICUS IN ADULTS[a]

(A) Initial management

1. Assess the patient, verify the diagnosis, remove false teeth and place in the lateral semi-prone position, establish an airway.

2. Diazepam, iv (see Note 1), (10 mg in 2 ml), 0.15-0.25 mg/kg, usually 10 mg (2 ml) bolus followed immediately by a further 10 mg (2 ml) over 1-2 minutes. This may be repeated according to response.

3. Take blood for determination of anticonvulsant drug levels, blood alcohol level, and blood sugar (5 ml of blood in a sugar tube), also blood for determination of calcium (5 ml in a plain tube), and a drop of blood to determine blood glucose.

4. If this shows a low blood glucose level: administer glucose 50%, iv, 25ml, preferably by catheter, and not into a small distal vein.

If alcohol is likely to be a factor: administer thiamine, iv, 100 mg.

5. Phenytoin, iv, 250 mg in 5 ml, 10-15 mg/kg, no faster than 50 mg (1 ml) per minute, by infusion pump or slow iv injection (see Note 2).

(B) If fits continue, transfer to an intensive care unit, and consult an anaesthetist

6. Chlormethiazole, iv (8 mg/ml). A loading dose of up to 800 mg (100 ml) over 10 minutes (10 ml/min); maintain with 0.5-1 ml/min (4-8 mg).

7. Thiopental, iv, 5 mg/kg loading dose, then 1-3 mg/kg per hour, to a maximum blood thiopental level of 100 mg/litre.

8. If this fails - consult a neurologist.

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[a] Adapted from a guideline prepared by Guy's Hospital, London.

NOTES

1. Diazepam: A bolus injection of 10 mg may cause respiratory depression and hypotension, which may be pronounced if there is concurrent use of other CNS depressant drugs, especially phenobarbital.

Diazepam must not be given:

* intramuscularly;

* added to an intravenous infusion;

* with phenobarbital unless artificial ventilation is available.

Rectal diazepam (using a rectal administration set), 5 or 10 mg in 2.5 ml, may be used for the immediate treatment of epilepsy instead of intravenous diazepam.

2. Phenytoin must not be given:

* intramuscularly;

* by central line;

* into a dextrose infusion;

* with any other drug.

Intravenous phenytoin should be monitored with continous ECG recording. If this is not available, it may be safer to use a diluted solution of 250 mg (5 ml) in 250 ml of normal saline, no faster than 50 mg/min. The diluted solution should be used immediately, provided there is no evidence of precipitation (this use of phenytoin is not licensed).

OPTIONS

The following drugs may also be used:

1. Paraldehyde: 2 x 5 ml by separate, deep, intramuscular injection, or 10ml diluted into 100 ml of normal saline given intravenously over 10-15 minutes.

Note: paraldehyde should only be used with glass syringes.

2. Phenobarbital (200 mg/ml). Should not be given intravenously, except where artificial ventilation is available, and not at all if the patient normally takes phenobarbital. The maximum rate of infusion is 100 mg/min, to a maximum dose of 15 mg/kg.

3. Lignocaine, iv, 100 mg, by slow intravenous injection, followed by 50-100 mg of lignocaine in 250 ml of 5% dextrose at 1-2 mg/min.

Note: It is essential that this treatment is given with ECG monitoring.

4. Diazepam, iv (10 mg in 2 ml), 40 mg in 500 ml of 5% dextrose, at a maximum infusion rate of 100 mg/h.

5. Sodium valproate, iv (400 mg in 4 ml), 400-800 mg, iv, over 3-5 minutes (up to 10 mg/kg), followed by intravenous infusion, to a maximum of 2.5 g/day (unlicensed).

Paediatric Doses

For children, dosing should be adapted as follows:

Diazepam	0.2-0.3 mg/kg intravenous.
Phenytoin	10-20 mg/kg intravenous.
Chlormethiazole	5-10 mg/kg per hour, which is equivalent to 0.6-1.25 ml/kg per hour.

See Also:
Toxicological AbbreviationsEndrin (EHC 130, 1992)Endrin (ICSC)Endrin (PDS)Endrin (FAO Meeting Report PL/1965/10/1) Endrin (AGP:1970/M/12/1)Endrin (WHO Pesticide Residues Series 4)Endrin (WHO Pesticide Residues Series 5)Endrin (IARC Summary & Evaluation, Volume 5, 1974)

WORLD HEALTH ORGANIZATION

ORGANISATION MONDIALE DE LA SANTE

FOOD AND AGRICULTURE ORGANIZATION

ORGANISATION POUR L'ALIMENTATION ET L'AGRICULTURE

VBC/DS/75.1
ORIGINAL : ENGLISH

DATA SHEETS ON PESTICIDES No. 1

January 1975

ENDRIN

It must be noted that the issue of a Data Sheet for a particular pesticide does not imply endorsement of the pesticide by WHO or FAO for any particular use, or exclude its use for other purposes not stated. While the information provided is believed to be accurate according to data available at the time when the sheet was compiled, neither WHO nor FAO are responsible for any errors or omissions, or any consequences therefrom.

ENDRIN

Part 1 - General information

CLASSIFICATION:

Primary use: Insecticide

Secondary uses: Acaricide, rodenticide

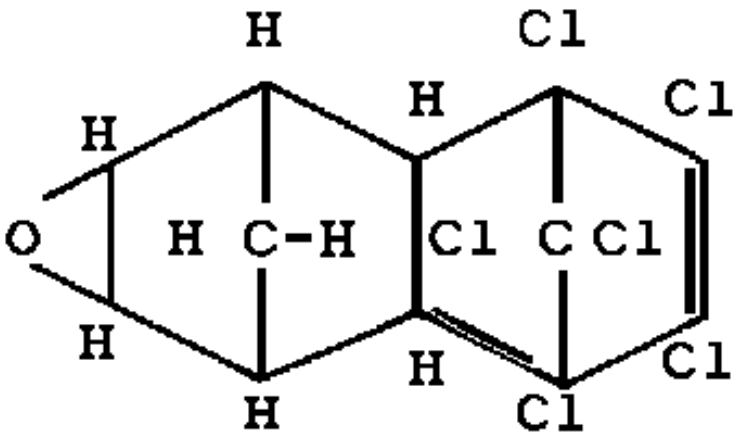
Chemical group: Organochlorine compound

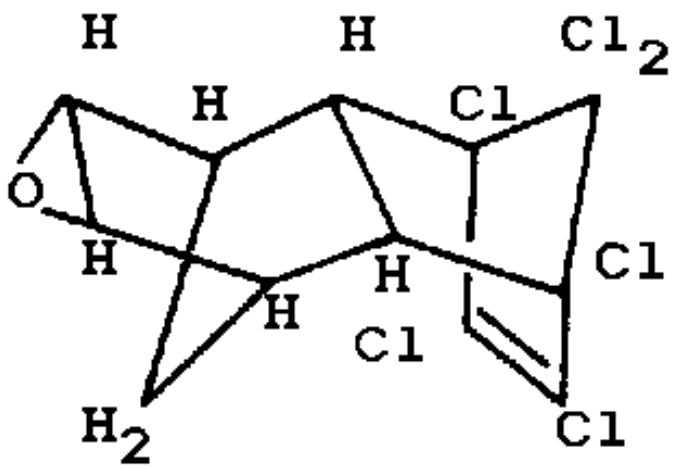
Data sheet No. 1

Date issued: January 1975

1.1 COMMON NAME: endrin (ISO)

1.1.1 Identity: 1,2,3,4,10,10-hexachloro-6,7-epoxy-1,4,4a,5,6,7,8,8a-octahydro-1,4-exo-exo-5, 8-dimethanonaphthalene. In the convention of the American Chemical Society the configuration is endo-endo.





1.1.2 Synonyms: OMS 197 Local Synonyms

1.2 SYNOPSIS: a highly toxic organochlorine pesticide which does not accumulate in the tissues of man or animals, and which is not persistent in the environment.

1.3 SELECTED PROPERTIES

1.3.1 Physical characteristics: when pure, a white crystalline solid m.p.> 200°C (with decomposition); the technical product is a light tan powder, with a characteristic odour.

1.3.2 Solubility: water at 20°C, practically insoluble (<0.1 ppm), alcohol, slightly soluble 74%); benzene and acetone, moderately soluble (37 and 28%).

1.3.3 Stability: stable in alkali and acids, but rearranges to less

insecticidally active substances in the presence of strong acids, on exposure to sunlight, or on heating above 200°C. Compatible with most biocides in present use.

1.3.4 Vapour pressure very low (2 x 10^{-7} mm Hg at 25°C).

1.4 AGRICULTURE, HORTICULTURE AND FORESTRY

1.4.1 Common formulations

Emulsifiable concentrate 20%, wettable powder 25 to 50%, dusts and granules 1 to 2%. FAO specifications for technical endrin, emulsifiable concentrates, dispersible powders and dusts have been published. A specification for granules is in course of preparation.

1.4.2 Pests mainly controlled

Effective against a very wide range of insect species. Main uses are against cotton boll worms, corn borers, cut worms and leaf hoppers.

1.4.3 Use pattern

Main use is to control pests of cotton; from one to ten applications in a given crop season. Also used for rice, small cereal grains, and sugar cane. Has limited use usually under local government authority for control of mice in orchards and plantations.

1.4.4 Unintended effects

Use, or possibly misapplication, in orchards and forest plantations to control mice has resulted in casualties amongst farm and wild animals. Contamination of water, e.g. in association with use on rice, has resulted in kills of fish. Not generally phytotoxic at insecticidal concentrations.

1.5 PUBLIC HEALTH PROGRAMMES

No recommended use.

1.6 HOUSEHOLD USE

No recommended use (due to toxicity).

ENDRIN

Part 2 - Toxicology and risks

Common name: endrin

Data sheet No. 1

Date issued: January 1975

2.1 TOXICOLOGY - MAMMALS

2.1.1 Absorption route: absorbed by the intact skin as well as by inhalation and from the gastrointestinal tract.

2.1.2 Mode of action: central nervous system stimulant producing convulsions.

2.1.3 Excretion: rapidly metabolized and excreted in the faeces largely as the 9-hydroxy derivative.

2.1.4 Toxicity, single dose

Oral: LD_{50} rat (M) 18 mg/kg
rat (F) 7.5 mg/kg

Dermal: LD_{50} rat (M) 18 mg/kg
rat (F) 15 mg/kg

Dermal: LD_{50} rabbit 60-120 mg/kg

2.1.5 Toxicity, repeated doses

Oral: daily administration of 5 mg/kg for 50 days led to 3 deaths out of 3 rats; there were no deaths when the dose was reduced to 2 mg/kg.

Inhalation: 2 out of 4 deaths when rabbits were exposed for 826 hours, 7 hours a day, 5 days a week to an atmospheric concentration of 5.44 mg/m^3 of endrin mist.

Cumulation of compound: does not accumulate in mammalian tissues to any significant extent; may be measured in blood and other tissues during acute poisoning.

2.1.6 Dietary studies

Short-term: significant increase in mortality when rats were fed 5 ppm (0.25 mg/kg/day) for 16 weeks but not when fed 1 ppm (0.05 mg/kg/day).

Long-term: in a 2 year study there was increased liver to body-weight ratios in males and increased kidney to body-weight ratios in females fed 5 ppm (0.25 mg/kg/day); the no-effect level was 1 ppm (0.05 mg/kg/day).

2.1.7 Supplementary studies of toxicity

Carcinogenicity

Mouse: no increase in neoplasms from dietary levels up to 3 ppm (0.15 mg/kg/day) of endrin (the highest level fed).

Rat: no increase in malignant tumours at dietary levels up to 12 ppm (0.6 mg/kg/day) (the highest level fed).

Teratogenicity

Rat: no terata reported to have been observed in a three-generation reproduction study with dietary levels up to a maximum level of 2 ppm (0.1 mg/kg/day).

2.1.8 Modifications of toxicity

The acute toxicity of endrin was increased by a factor of 2.5 when rats were fed a low protein diet.

2.2 TOXICOLOGY - MAN

2.2.1 Absorption: see 2.1.1

Ingestion has proved to be an important cause of poisoning with this compound.

2.2.2 Dangerous doses

Single: it has been estimated that a single convulsion may result from ingestion of 0.2-0.25 mg/kg of endrin and repeated fits from 1 mg/kg. A level of about 150 ppm eaten in bread is reported to have produced convulsions in man.

Repeated: no information.

2.2.3 Observations of occupationally exposed workers

Extensive observations of plant workers have been conducted. Measureable levels of endrin in blood (0.05-0.1 µg/ml) were only found in cases of intoxication and clinical recovery was complete within a few hours.

2.2.4 Observations on exposure of the general population

Not detected in the body fat of the general population in at least three countries.

2.2.5 Observations of volunteers

No information.

2.2.6 Reported mishaps

In two countries in Asia, four successive outbreaks of poisoning

occurred resulting in 874 people being hospitalized, of whom 26 died. In two separate shipments when flour and endrin were transported together, the flour became contaminated. Bread made from the flour contained 48-1500 ppm of endrin. In a European country 59 cases of poisoning with no deaths are believed to have been caused from eating bread containing 150 ppm of endrin.

Spilled endrin had contaminated flour during shipment in a railway car. In an African country three cases of poisoning with no deaths are believed to have been caused from eating bread containing 126-172 ppm of endrin. The manner in which the contamination occurred is not known - assumed to be during transport or storage.

2.3 TOXICITY TO NON-MAMMALIAN SPECIES

(The entries in these sections are intended to draw attention to special risks and to give warnings of any needs for special precautions).

2.3.1 Fish

Is very toxic to fish. Has caused fish kills following use on rice.

2.3.2 Birds

High toxicity. Uses in orchards and similar sites have resulted in bird kills. The risks are from acute poisoning by ingestion of water or seeds, not from long-term build-up of residues.

2.3.3 Other species

Toxicity to bees is fairly high. Described as moderately hazardous in USDA classification. Toxic to wildlife in general.

ENDRIN

Part 3 - For regulatory authorities

Common name: endrin

Data sheet No. 1

Date issued: January 1975

RECOMMENDATIONS ON REGULATION OF COMPOUND

3.1 RECOMMENDED RESTRICTIONS ON AVAILABILITY

(For definition of categories see introduction). Liquid and solid formulations above 10%: category 2. All other formulations: category 3.

3.2 TRANSPORTATION AND STORAGE

All formulations

UN classification 6.1. Should be transported or stored in clearly labelled rigid and leakproof containers. No food or drink should be transported or stored in the same compartment. Storage should be under lock and key, and secure from access by unauthorized persons and children.

3.3 HANDLING

All formulations

Full protective clothing (see Part 4) should be used for all handling of the compound. Adequate washing facilities should be available at all times during handling and should be close to the site of handling. Eating, drinking and smoking should be prohibited during handling and before washing after handling.

3.4 DISPOSAL AND/OR DECONTAMINATION OF CONTAINERS

All formulations

Container must either be burned or crushed and buried below topsoil. Care must be taken to avoid subsequent contamination of water sources. Decontamination of containers in order to use them for other purposes should not be permitted.

3.5 SELECTION, TRAINING AND MEDICAL SUPERVISION OF WORKERS

All formulations

Pre-employment, and routine medical examination of workers desirable. Special account should be taken of the workers' mental ability to comprehend and follow instructions. Training of workers in techniques to avoid contact essential.

3.6 ADDITIONAL REGULATIONS RECOMMENDED IF DISTRIBUTED BY AIRCRAFT

All formulations

Pilots and loaders should have special training in application methods and recognition of early symptoms of poisoning. Use of flagmen not recommended. Flagmen, if used, should wear overalls, a respirator, hat and gloves, and be located well away from the dropping zone.

3.7 LABELLING

Formulations

All formulations

Minimum cautionary statement

"POISON"

(Skull and cross bones insignia)

"Endrin is a highly toxic organochlorine compound which may be very hazardous to man and animals if use is not strictly controlled. Contact with the skin, inhalation of dust or spray or swallowing may cause convulsions and may be fatal. Avoid skin contact; wear protective gloves, clean protective clothing and a respirator when handling this material.. Wash hands and exposed skin immediately after work."

"Ensure that containers are stored under lock and key. Empty containers must be disposed of in such a way as to prevent all accidental contact with them. Keep the material out of reach of children and well away from foodstuffs, animal feed and their containers."

"In case of contact, immediately remove contaminated clothing and wash the skin thoroughly with soap and water; for eyes, flush with water for 15 minutes."

"If poisoning occurs, obtain medical attention."

3.8 RESIDUES IN FOOD

Apart from accidental gross contamination of foods, e.g. from spillages, residues in foods have not resulted in major problems.

3.8.1 Maximum residue levels

The Joint FAO/WHO meeting on Pesticide Residues (1972) has recommended the following limits:

Cottonseed, cottonseed oil (crude)	0.1 ppm
Cottonseed oil (finished), maize (sweet), wheat, barley, sorghum, rice (brown or polished), apples	0.02 ppm
Milk and milk products (fat basis)	0.02 ppm
Eggs (shell free)	0.2 ppm

Fat of poultry 1.0 ppm

ENDRIN

Part 4 - Prevention of poisoning in man emergency aid

Common name: endrin and

Data sheet No. 1

Date issued: January 1975

4.1 PRECAUTIONS IN USE

4.1.1 General

Endrin is a highly toxic organochlorine pesticide which penetrates the intact skin and is also absorbed by inhalation as dusts and by the gastrointestinal tract. Formulations should be handled by trained personnel wearing protective clothing.

4.1.2 Manufacture and formulation

T.L.V.

(A.C.G.I.H.) 0.1 mg/m^3; (U.S.S.R.) - formulation should not be attempted without advice from the manufacturer.

4.1.3 Mixers and applicators

When opening the container and when mixing, protective impermeable boots, clean overalls, gloves and dust mask should be worn. Mixing, if not mechanical, should always be carried out with a paddle of appropriate length. When spraying tall crops or during aerial application, a face mask should be worn as well as an impermeable hood, clothing, boots and gloves. The applicator should avoid working in spray mist and avoid contact with the mouth, skin and eyes. Particular care is needed when equipment is being washed after use. All protective clothing should be washed immediately after use, including the insides of gloves. Splashes must be washed immediately from the skin, hair and eyes with large quantities of water. Before eating, drinking or smoking, hands and other exposed skin should be washed.

4.1.4 Other associated workers (including flagmen in aerial operations)

Persons exposed to endrin and associated with its application should wear protective clothing and observe the precautions described above in 4.1.3 under "mixers and applicators".

4.1.5 Other populations likely to be affected

With good agricultural practice subject to 4.2 below, other populations should not be exposed to hazardous amounts of endrin.

4.2 ENTRY OF PERSON INTO TREATED AREAS

Unprotected persons should be kept out of treated areas for at least one day.

4.3 SAFE DISPOSAL OF CONTAINERS AND SPILLAGE

Containers should be emptied in a diluted form into a deep pit taking care to avoid contamination of ground waters. Containers should be destroyed (see 3.4). Decontamination of containers in order to use them for other purposes should not be permitted. Spillage should be washed into a deep dry pit and the remainder washed away with large quantities of water, taking care not to contaminate surface or ground waters.

4.4 EMERGENCY AID

4.4.1 Early symptoms of poisoning

Early symptoms of poisoning are headache, dizziness, nausea, vomiting, weakness of the legs, loss of appetite and possibly insomnia and temporary deafness. Generalized convulsions may occur, and in some cases are the first symptom.

4.4.2 Treatment before person is seen by a physician, if these symptoms appear following exposure

The person should stop work immediately, remove contaminated clothing and wash the affected skin with water and soap, if available, and flush the area with large quantities of water. If swallowed, vomiting should be induced, if the person is conscious.

ENDRIN

Part 5 - For medical and laboratory personnel

Common name: endrin

Data sheet No. 1

Date issued: January 1975

5.1 MEDICAL DIAGNOSIS AND TREATMENT OF CASES OF POISONING

5.1.1 General information

An organochlorine pesticide of high acute toxicity which may be absorbed through the intact skin as well as by inhalation and via the gastrointestinal tract. Its mode of action is as a central nervous system stimulant producing convulsions. It is rapidly metabolized and excreted in the faeces and does not persist in the tissues.

5.1.2 Symptoms and signs

Mild symptoms of poisoning involve headache, dizziness, nausea, vomiting, weakness of the legs, loss of appetite, and possibly insomnia and temporary deafness. More serious symptoms are convulsions of several minutes duration followed by semi-consciousness for 15-30 minutes. Terminal symptoms prior to death may be continuous convulsions, causing anoxia and high fever.

5.1.3 Laboratory

Blood levels of endrin associated with poisoning are 0.05-0.1 µg/ml. The electroencephalogram may show bilateral synchronous spikes, spike and wave complexes and slow theta waves. It returns to normal gradually and usually has become normal three months after the incident of poisoning.

5.1.4 Treatment

If the pesticide has been ingested, gastric lavage should be performed with 2-4 litres of tap water followed by saline purgatives (30 g sodium sulfate in 250 ml of water). Barbiturates (preferably phenobarbitone or pentobarbitone) or diazepam should be given I.M. or I.V. in sufficient dosage to control restlessness or convulsions. Mechanical respiratory assistance with oxygen may be required. In addition, calcium gluconate, 10% in 10 ml, may be injected four hourly. Contraindications are oily purgatives, epinephrine and other adrenergic drugs and central stimulants of all types.

5.1.5 Prognosis

If the convulsions are survived the chances of complete recovery are good. However, in very severe cases there is a possibility of permanent brain damage secondary to continued hypoxia if the convulsions are not promptly controlled.

5.1.6 References of previously reported cases

The following references give methods of treatment and diagnosis used in cases of poisoning:

1. Davies, G. M. L Lewis, I. (1956) Brit. med. J., 2, 393-398.

2. Weeks, D. E. (1967) Bull. Wld Hlth Org., 37, 499-512.

5.2 SURVEILLANCE METHODS

There are no readily available techniques to determine the degree of absorption prior to the appearance of symptoms. Endrin can only be detected in the blood in situations of acute gross overexposure. The threshold level below which no signs-or symptoms of intoxication occur appears to be in the range of 0.05-0.1 µg/ml of endrin in the blood (limit of detection).

5.3 LABORATORY METHODS

5.3.1 Detection and analysis

Endrin residues in foodstuffs can be determined by the multi-residue methods of the AOAC (United States Food and Drug Administration, Pesticides Analytical Manual, 1971) and of de Faubert Maunder et al. (1964), Wood (1969) and Abbott et al. (1969). All these are gas chromatographic methods, but involve various clean-up procedures. Identity can be confirmed by derivative formation. Several references to gas chromatographic methods for determination of organochlorine pesticides-in blood are cited by Jager (1970), in particular the method described by Richardson et al. (1967) for the determination of dieldrin. For the examination of grossly contaminated materials or of samples of formulated products, an infrared spectro-scopic method can be used (AOAC method, see CIPAC Handbook, Vol. 1, pp. 378-390).

5.3.2 Other tests in cases of poisoning

Electroencephalographic changes after endrin poisoning are described in Hoogendam, I., Versteeg, J. P. J. & de Vlieger, M. (1962), Arch. environm. Hlth., 4, 86-94

REFERENCES

Abbott, D. C., Holmes, D. C. & Tatton, J. O'G. (1969) Pesticide residues in the total diet in England and Wales, 1966-1967. II. Organochlorine pesticide residues in the total diet, J. Sci. Food Agric., 20, 245

Faubert Maunder, M. J. de et al. (1964) Clean-up of animal fats and dairy products for the analysis of chlorinated pesticide residues, Analyst., 89, 168

Jager, K. W. (1970) Aldrin, dieldrin, endrin and telodrin, Elsevier, Amsterdam, p. 34

Richardson, A. et al. (1967) Determination of dieldrin (HEOD) in blood, Arch. environm. Hlth, 14, 703

United States Food and Drug Administration (1971) Pesticide Analytical Manual, Vol. I, Sections 211, 212

Wood, N. F. (1969) Extraction and clean-up of organochlorine pesticide residues by column chromatography, Analyst, 94, 399

See Also:

Toxicological AbbreviationsEndrin (EHC 130, 1992)Endrin (HSG 60, 1991)Endrin (ICSC)Endrin (FAO Meeting Report PL/1965/10/1)Endrin (AGP:1970/M/12/1)Endrin (WHO Pesticide Residues Series 4)Endrin (WHO Pesticide Residues Series 5)Endrin (IARC Summary & Evaluation, Volume 5, 1974)

SUPERSEDED ENTRIES

Materials believed to be no longer manufactured, or marketed for crop protection use

These entries are short descriptions including the following information: Entry number, entry/common names, chemical names, molecular formula, Chemical Abstracts Service Registry Number, other names, use and early scientific reference, name of company inventing or developing the product, code numbers (development codes and official codes), trade names. For an explanation of this information, if needed, the Guide to use of the Main entries should be consulted.

The last item of information, prefaced **Details**, gives the last Edition of the Pesticide Manual to contain full details of the material, with the entry number in that Edition. In a few instances, the entry 'Handbook' is given, which means that no earlier reference will be found in the Pesticide Manual, but may be found in the Agrochemicals Handbook.

The entries in this Section are readily identified in the indexes by an 'S' before the entry number (e.g. S768).

It is difficult in some cases to be sure whether or not all commercial activity in a substance has ceased. The Editor will be grateful for details of any materials in this Section which are still in commercial use.

ENDRIN

970 dofenapyn - common name (BSI, draft E-ISO); dofénapyne ((*m*) draft F-ISO). **Chemical name (IUPAC)** 4-(pent-4-ynyloxy)phenyl phenyl ether; $C_{17}H_{16}O_2$. ***(C.A.)*** 1-(4-= pentynyloxy)-4-phenoxybenzene. **CAS RN** *[42873-80-3]*. Acaricide discovered by Ciba-Geigy AG. **Code No.** CGA 29 170.

971 drazoxolon - common name (BSI, E-ISO, (*m*) F-ISO). **Chemical name** (IUPAC) 4-(2-= chlorophenylhydrazono)-3-methyl-1,2-oxazol-5(4*H*)-one; 4-(2-chlorophenylhydrazono)-3-= methylisoxazol-5(4*H*)-one. $C_{10}H_8ClN_3O_2$. ***(C.A.)*** 3-methyl-4,5-isoxazoledione 4-[(2-= chlorophenyl)hydrazone]. **CAS RN** *[5707-69-7]*. Fungicide reported by M. J. Geoghegan (*Proc. Br. Insectic. Fungic. Conf., 4th,* 1967, **1,** 451). Introduced by ICI Plant Protection Division (now Zeneca). **Code No.** PP781. **Trade Mark** 'Mil-Col' (Zeneca) **Details:** *PM9,* Entry 5500

972 eglinazine - common name (BSI, E-ISO, (*f*) F-ISO, WSSA). **Chemical name** (IUPAC) *N*-(4-chloro-6-ethylamino-1,3,5-triazin-2-yl)glycine; $C_7H_{10}ClN_5O_2$. ***(C.A.)*** *N*-[4-chloro-6-(ethylamino)-1,3,5-triazin-2-yl]glycine.
CAS RN *[68228-19-3]* ; (eglinazine-ethyl: *[6616-80-4]*) The ethyl ester, eglinazine-ethyl, introduced as a herbicide by Nitrokémia Ipartelepek. **Trade Mark** 'MG-06' (Nitrokemia) **Details:** *PM9,* Entry 5520

973 EL 177 - development code. Chemical name (IUPAC) 1-*tert*-butyl-5-cyano-*N*-= methylpyrazole-4-carboxamide; $C_{10}H_{14}N_4O$. ***(C.A.)*** 5-cyano-1-(1,1-dimethylethyl)-*N*-= methyl-1*H*-pyrazole-4-carboxamide. **CAS RN** *[98477-07-7]*. Herbicide reported by H. E. Chamberlain *et al.* (*Proc. 1987 Br. Crop Prot. Conf. - Weeds,* **1,** 35). Introduced by Eli Lilly. **Code No.** EL-177; LYI 81 977. **Details:** *PM9,* Entry 1680

974 endothion - common name (BSI, E-ISO, (*m*) F-ISO, ESA, formerly ANSI); no name (Portugal). **Chemical name (IUPAC)** *S*-5-methoxy-4-oxo-4*H*-pyran-2-ylmethyl *O,O*-dimethyl phosphorothioate; 2-dimethoxyphosphinoylthiomethyl-5-methoxypyran-4-one; $C_9H_{13}O_6PS$. ***(C.A.)*** *S*-[(5-methoxy-4-oxo-4*H*-pyran-2-yl)methyl] *O,O*-dimethyl phosphorothioate. **CAS RN** *[2778-04-3]*. **Official code No.** ENT 24 653. Insecticide reported by F. Chaboussou & P. Ramadier (*Rev. Zool. Agric. Appl.,* 1957, **55,** 116). Introduced by Rhône-Poulenc Phytosanitaire and later by American Cyanamid Co. and FMC Corp. **Code No.** 7175 RP (Rhône Poulenc); AC 18 737 (American Cyanamid Co.); FMC 5767 (FMC Corp.); **Trade Mark** '*Endocide*' (Rhône Poulenc). **Details:** *PM5,* p. 234.

975 endrin - common name (BSI, E-ISO, ESA, JMAF); endrine ((*f*) F-ISO); nendrin (Republic of South Africa). **Chemical name (IUPAC)** (1*R*,4*S*,4a*S*,5*S*,6*S*,7*R*,8*R*,8a*R*)-= 1,2,3,4,10,10-hexachloro-1,4,4a,5,6,7,8,8a-octahydro-6,7-epoxy-1,4:5,8-= dimethanonaphthalene; 1,2,3,4,10,10-hexachloro-6,7-epoxy-1,4,4a,5,6,7,8,8a-octahydro-= *exo*-1,4-*exo*-5,8-dimethanonaphthalene; $C_{12}H_8Cl_6O$.
(C.A.) (1aα,2β,2aβ,3α,6α,6aβ,7β,7aα)-3,4,5,6,9,9-hexachloro-1a,2,2a,3,6,6a,7,7a-octahydro-= 2,7:3,6-dimethanonaphth[2,3-*b*]oxirene. **CAS RN** *[72-20-8]*. **Official code No.** OMS 197; ENT 17 251. Developed by Shell International Chemical Co. after introduction by J. Hyman & Co. **Code No.** Insecticide 269 (Hyman & Co.). **Details:** *PM7,* Entry 05560.

976 ENT 17596 - official code number. Chemical name (IUPAC) 1,4,4a,5a,6,9,9a,9b-= octahydrodibenzofuran-4a-carbaldehyde; $C_{13}H_{16}O_2$. ***(C.A.)*** 1,5a,6,9,9a,9b-hexahydro-=

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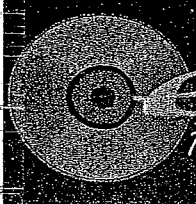

MEISTERPRO CROP PROTECTION

The "Must Have" software companion to the Handbook

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Pyrinex Forte* — Aragonesas Agro, S.A.
+ *lambda*-cyhalothrin
Polka* — Insecticidas Internacionales, C.A.
+ cypermethrin
Cyperfan* — Chimac-Agriphar S.A.
Faraon* — Insecticidas Internacionales, C.A.
+ dimethoate
Demecor* — Chimac-Agriphar S.A.
+ methomyl
Endomil* — Insecticidas Internacionales, C.A.
Methofan* — Makhteshim-Agan
Metofan Forte* — Aragonesas Agro, S.A.
+ methyl parathion
Hekthionex Methyl* — Hektas Ticaret T.A.S.
Sulfanex Methyl* — AGRO-SAN Chemicals Industry and Trade Inc.
Thiosulfan-methyl* — Midiltipi Agro-Chemicals, Inc.

Registration Notes
OUTSIDE U.S.: Endofan* in Spain. Luxafan*, Polirac* in South America. Thionate*.

Environmental Guidelines
HAZARDS: Fish, Bird: Toxic. Bee: Moderately toxic (direct application). Relatively nontoxic to beneficials (parasitic wasps, lady bird beetles, and beneficial mites).
SOLUBILITY (IN WATER): Tech insoluble.

Safety Guidelines
SIGNAL WORD: DANGER (Tech); POISON (most form.).
TOXICITY CLASS: I.
TOXICITY: Tech (Rat): Oral LD_{50} 160 mg/kg (male), 22.7 mg/kg (female). (Rat): Dermal >500 mg/kg, (Rabbit) 359 mg/kg.
PROTECTIVE CLOTHING: Long-sleeved shirt and long pants, waterproof gloves, shoes or boots, hat, and approved mask or respirator.
HANDLING AND STORAGE CAUTIONS: Do not breathe dust, spray mist. Avoid eye, skin, clothing contact. Wash hands immediately after handling. Do not store in or around home. Do not store near heat, open flame, or hot surfaces.

Emergency Guidelines
FIRST AID: Call a physician or Poison Control Center immediately. Eyes, rinse immediately with water for at least 15 minutes. Skin, wash thoroughly with soap and water. Discard contaminated clothing. Inhalation, remove to fresh air and keep at rest. Ingestion, if conscious and time since ingestion is less than 1 to 2 hours, induce vomiting.

Endosun* — see Endosulfan.

Endotaf* — see Endosulfan.

Endothal — see Endothall.

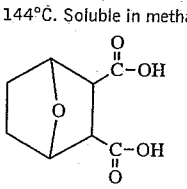
Endothal* — see Endothall.

Endothall

BP: Cerexagri, Inc. (Accelerate*, Aquathol*, Aquathol* K, Des-I-Cate*, Endothal*, Hydrothol*)
Cerexagri S.A. (Accelerate*, Aquathol*, Hydrothol*)

Identification
COMMON NAME: endothal (ISO, BSI); endothall (ANSI, CSA, WSSA).
CODE NUMBERS: CAS 129-67-9; SHA 038901.
DISCONTINUED NAMES:
Herbicide 273* Hydout*
Niagrathal* Tribetol*

Chemistry
COMPOSITION: 7-oxabicyclo[2,2,1]heptane-2,3-dicarboxylic acid (IUPAC) used as sodium, potassium, or amine salts.
PROPERTIES: Melting point 144°C. Soluble in methanol.



Endothall

Action/Use
ACTION: Aquatic herbicide, algaecide, defoliant, desiccant, growth regulator.
USE: For sugar beets, turf; hops sucker suppression; alfalfa, clover desiccant; cotton harvest aid (Accelerate*); potato vine killer. Aquatic herbicide, algaecide (Aquathol*, Hydrothal*).
FORMULATIONS: Granular.

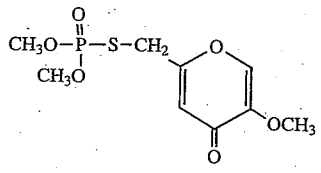
Environmental Guidelines
HAZARDS: Fish: Toxic. Bee: Nontoxic.
SOLUBILITY (IN WATER): Soluble.

Safety Guidelines
SIGNAL WORD: WARNING.
TOXICITY CLASS: II.
TOXICITY: (Rat): Oral LD_{50} 51 mg/kg.
HANDLING AND STORAGE CAUTIONS: Avoid contact or drift to other plants as injury may result. As an aquatic herbicide, certain water use restrictions apply. Keep from freezing.

Endothion

Identification
COMMON NAME: Endothion (ISO, BSI, ESA, ex-ANSI).
EXP. CODE NUMBERS: AC 18737 (American Cyanamid Co.); NIA 5767 (FMC Corp.).
OTHER CODE NUMBERS: CAS 2778-04-3; SHA 422100; ENT 24653.
DISCONTINUED NAMES:
Endocide*

Chemistry
COMPOSITION: S-5-methoxy-4-oxo-4H-pyran-2-ylmethyl O,O-dimethyl phosphorothioate (IUPAC).



Endothion

Action/Use
ACTION: Systemic insecticide, acaricide.

Safety Guidelines
SIGNAL WORD: DANGER.
TOXICITY CLASS: I.
TOXICITY: (Rat): Oral LD_{50} 30-50 mg/kg.

Endo-Tox* — see Endosulfan.

Endoxan

Identification
TRIVIAL NAME: Cyclophosphamide.
CODE NUMBERS: CAS 50-18-0.

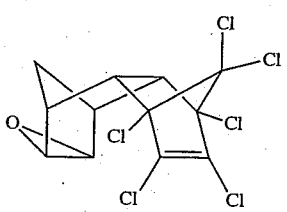
Chemistry
COMPOSITION: N,N-bis(2-chloroethyl)tetrahydro-2H-1,3,2-oxazaphosphorin-2-amine 2-oxide (CAS 9CI).

Endozol* — see Endosulfan.

Endrex* Insecticide (endrin) — Discontinued by Shell International Chemical Co. Ltd.

Endrin

Identification
COMMON NAME: Endrin (ISO-E, BSI, ESA, JMAF); endrine (ISO-F); nendrin (India, So. Africa).
CODE NUMBERS: CAS 72-20-8; SHA 041601; OMS 197 (WHO); ENT 17251; EINECS 200-775-7.
DISCONTINUED NAMES:
Endrex*



Endrin

Action/Use
ACTION: Insecticide.

Safety Guidelines
SIGNAL WORD: DANGER.
TOXICITY CLASS: I.
TOXICITY: (Rat): Oral LD_{50} 7-15 mg/kg. Dermal 15 mg/kg (female).

Emergency Guidelines
ANTIDOTE: Central nervous system depressant and hepatotoxin; no antidote. Diazepam, intravenous glucose, B vitamins, large amounts of activated charcoal, saline laxatives help to control convulsions, protect the liver, and limit GI absorption. Oxygen may be necessary.

Endrine — see Endrin.

Endura* — see Nicobifen.

Endura* PB — see Piperonyl butoxide.

Endurance* — see Prodiamine.

Enduro* — see *beta*-Cyfluthrin; Oxydemeton-methyl.

Endyl* Insecticide (carbophenothion) — Discontinued by Planters Products.

Enercol* — see Propineb.

Enercol Combi* — see Cymoxanil; Propineb.

Enfield* — see Trifloxysulfuron-sodium.

Engame* — see AMADS; glyphosate.

EnGarde* Disinfectant — Discontinued by Microgen, Inc.

Enhance* — see Captan; Carboxin.

Enhance* Plus — see Carboxin; Lindane; Maneb.

Enide* Herbicide (diphenamid) — Discontinued 1988 by NOR-AM.

Enide Dinitro* Herbicide (dinoseb + diphenamid) — Discontinued 1977 by TUCO.

Enilconazole — see Imazalil.

eNKamphos* — see Propetamphos.

Enofol* — see Folpet.

WHO/PCS/01.5
ENGLISH ONLY

THE WHO RECOMMENDED CLASSIFICATION OF PESTICIDES BY HAZARD AND GUIDELINES TO CLASSIFICATION 2000-01

The WHO Recommended Classification of Pesticides by Hazard was approved by the 28th World Health Assembly in 1975 and has since gained wide acceptance. When it was published in the WHO Chronicle, 29, 397-401 (1975), an annex, which was not part of the Classification, illustrated its use by listing examples of classification of some pesticidal active ingredients and their formulations. Later suggestions were made by Member States and pesticide registration authorities that further guidance should be given on the classification of individual pesticides. Guidelines were first issued in 1978, and have since been revised and reissued at 2-yearly intervals.

The document is arranged as follows:

Part I: The Classification as recommended by the World Health Assembly. This part is not subject to periodic review and the classification table and text can only be changed by resolution of the World Health Assembly.

Part II: Guidelines to Classification. Individual products are classified in a series of tables, according to the oral or dermal toxicity of the technical product, and its physical state. The tables are subject to review periodically.

The toxicity values are intended to be a guide only. Formulations should be separately classified using the methods set out on pages 3 (single technical product) and 6 (mixtures) and the table in Part I. To assist in the classification of formulations, an annex is now provided giving numerical tables from which the classification may also be derived.

Comments on Part II of the document are welcome, together with proposals for new entries. These should be addressed to the International Programme on Chemical Safety, World Health Organization, 1211 Geneva 27, Switzerland, and should include supporting data on the compound being commented on or proposed.

This document is a revision of the document previously issued as WHO/PCS/98.21

TABLE 6. ACTIVE INGREDIENTS BELIEVED TO BE OBSOLETE OR DISCONTINUED FOR USE AS PESTICIDES

Ingredients discontinued have been identified from the previous edition of this classification, from the Pesticide Manual (Pesticide Manual, 1991, 1994; 1997), and in some cases from the manufacturer. It is difficult, in some cases, to be sure whether or not all commercial activity in a substance has ceased; some of these materials are known to be still in use for non-agricultural purposes. IPCS will be grateful for details of any materials in this Section, which are still in commercial use. The common name and CAS number are indicated.

Active ingredient	CAS no
Acrylonitrile	107-13-1
Aldoxycarb	1646-88-4
Aldrin[1,2]	309-00-2
Allidochlor	93-71-0
Allyxycarb	6392-46-7
Amidithion	919-76-6
Aminocarb	2032-59-9
Anilazine	101-05-3
ANTU	86-88-4
Aramite	140-57-8
Arsenous oxide	1327-53-3
Athidathion	19691-80-6
Atraton	1610-17-9
Aziprotryne	4658-28-0
Azothoate	5834-96-8
Barban	101-27-9
Barium carbonate	513-77-9
Benodanil	15310-01-7
Benquinox	495-73-8
Benzoximate	29104-30-1
Benzoylprop-ethyl	33878-50-1
Benzthiazuron	1929-88-0
Binapacryl[1]	485-31-4
Bis(tributyltin) oxide	56-35-9
Bisthiosemi	39603-48-0
Bromocyclen	1715-40-8
Bromophos	2104-96-3
Bromophos-ethyl	4824-78-6
Bufencarb	8065-36-9
Butacarb	2655-19-8
Butam	35256-85-0
Butenachlor	87310-56-3
Buthidazole	55511-98-3
Buthiobate	51308-54-4
Butonate	126-22-7
Butopyronoxyl	532-34-3
Buturon	3766-60-7
Calcium cyanamide	156-62-7
Camphechlor[1,2]	8001-35-2
Carbamorph	31848-11-0
Carbanolate	671-04-5
Carbon disulfide	75-15-0
Carbophenothion	786-19-6
Chloraniformethan	20856-57-9
Chloranil	118-75-2
Chloranocryl	2164-09-2
Chlorbenside	103-17-3
Chlorbufam	1967-16-4
Chlorbicyclen	2550-75-6
Chlordecone	143-50-0
Chlordimeform[1]	6164-98-3
Chlorfenac	85-34-7
Chlorfenethol	80-06-8
Chlorfenprop-methyl	14437-17-3
Chlorfenson	80-33-1
Chlorfensulfide	22274-74-0
Chlorfentazine	
Chlorflurenol	2536-31-4
Chlormebuform	37407-77-5
Chlormethiuron	28217-97-2
Chlornitrofen	1836-77-7
Chlorobenzilate[1]	510-15-6
Chloroneb	2675-77-6
Chloropropylate	5836-10-2
Chloroxuron	1982-47-4
Chlorquinox	3495-42-9
Chlorphoxim	14816-20-7
Chlorthiophos	21923-23-9
Cloethocarb	51487-69-5
Clofop	26129-32-8
Coumachlor	81-82-3
Crimidine	535-89-7
Credazine	14491-59-9
Crotoxyphos	7700-17-6
Crufomate	299-86-5
Cyanofenphos	13067-93-1
Cyanthoate	3734-95-0
Cycloheximide	66-81-9
Cycluron	2163-69-1
Cyometrinil	63278-33-1
Cypendazole	28559-00-4
Cyprofuram	69581-33-5
Cypromid	2759-71-9
Delachlor	24353-58-0
Demephion-O	682-80-4
Demephion-S	2587-90-8
Demeton-O	298-03-3
Demeton-S	126-75-0
Demeton-S-methylsulphon	17040-19-6
Dialifos	10311-84-9
Di-allate	2303-16-4
Diamidafos	1754-58-1
Dibromochloro-propane	96-12-8
Dibutyl phthalate	84-74-2
Dibutyl succinate	141-03-7
Dichlofenthion	97-17-6
1,2-Dichloropropane	78-87-5
Dichlozoline	24201-58-9
Diclobutrazol	75736-33-3
Dieldrin[1,2]	60-57-1
Diethatyl	38727-55-8
Difenoxuron	14214-32-5
Dimefox	115-26-4
Dimetilan	644-64-4
Dimexano	1468-37-7
Dinex	131-89-5
Dinocton	32534-96-6
Dinoseb[1]	88-85-7
Dinoseb acetate[1]	2813-95-8
Dioxabenzophos	3811-49-2
Dioxacarb	6988-21-2
Dioxathion	78-34-2
Dipropetryn	4147-51-7
Disul	149-26-8
Ditalimfos	5131-24-8
Drazoxolon	5707-69-7
Eglinazine	6616-80-4
Endothion	2778-04-3
Endrin[2]	72-20-8
EPBP	3792-59-4
Erbon	136-25-4
ESP (Oxydeprofos)	2674-91-1
Etacelasil	37894-46-5
Etaconazole	60207-93-4
Ethidimuron	30043-49-3
Ethiolate	2941-55-1
Ethoate-methyl	116-01-8
Ethohexadiol	94-96-2
Ethyleneglycolbis (trichloroacetate)	2514-53-6
EXD	502-55-6