



WORLD HEALTH ORGANIZATION
INTERNATIONAL AGENCY FOR RESEARCH ON CANCER

IARC Monographs on the Evaluation of Carcinogenic Risks to Humans

Volume 15

Some Fumigants, the Herbicides 2,4-D and 2,4,5-T, Chlorinated Dibenzodioxins and Miscellaneous Industrial Chemicals

Summary of Data Reported and Evaluation

1,2-Bis(chloromethoxy)ethane
1,4-Bis(chloromethoxymethyl)benzene
Copper 8-hydroxyquinoline
2,4-D and esters
1,2-Dibromo-3-chloropropane
trans-1,4-Dichlorobutene
Dihydroxybenzenes (Catechol, Resorcinol, Hydroquinone)
Dimethoxane
Eosin and eosin disodium salt
Ethylene dibromide
Hexamethylphosphoramide
Isopropyl alcohol and isopropyl oils
Methyl iodide
para-Quinone
Succinic anhydride
2,4,5-T and esters
1,2,3-Tris(chloromethoxy)propane

Last updated: 13 April 1999

1,2-BIS(CHLOROMETHOXY)ETHANE

VOL.: 15 (1977) (p. 31)

CAS No.: 13483-18-6

5. Summary of Data Reported and Evaluation

5.1 Animal data

1,2-Bis(chloromethoxy)ethane is carcinogenic in mice, the only species tested, following its application to the skin or its subcutaneous or intraperitoneal administration; it produced malignant tumours at the sites of administration.

5.2 Human data

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

Subsequent evaluation: [Vol. 71 \(1999\)](#)

For definition of Groups, see [Preamble Evaluation](#).

Synonyms

- Bis-1,2-(chloromethoxy)ethane
- Ethylene glycol bis(chloromethyl)ether

Last updated: 13 April 1999

1,4-BIS(CHLOROMETHOXYMETHYL)BENZENE

VOL.: 15 (1977) (p. 37)

CAS No.: 56894-91-8

5. Summary of Data Reported and Evaluation

5.1 Animal data

1,4-Bis(chloromethoxymethyl)benzene is carcinogenic in mice, the only species tested, following its application to the skin or its subcutaneous administration; it produced malignant tumours at the sites of application.

5.2 Human data

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

Subsequent evaluation: [Vol. 71 \(1999\)](#)

Synonyms

- Bis-1,4-(chloromethoxy)-*para*-xylene
- 1,4-Bis(chloromethoxy)-*para*-xylene

Last updated: 13 April 1999

COPPER 8-HYDROXYQUINOLINE

VOL.: 15 (1977) (p. 103)

CAS No.: 10380-28-6

Chem. Abstr. Name: Bis (8-quinolinolato-N¹,O⁸)copper

5. Summary of Data Reported and Evaluation

5.1 Animal data

Copper 8-hydroxyquinoline has been tested in two strains of mice by oral and by single subcutaneous administration. Although a significantly increased incidence of reticulum-cell sarcomas was observed only in males of one strain following single subcutaneous injection, no evaluation of the carcinogenicity of this compound can be made on the basis of the available data.

5.2 Human data

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

Subsequent evaluation: Suppl. 7 (1987) (p. 61: **Group 3**)

Synonyms

- Bis(8-oxyquinoline)copper
- Bis(8-quinolinato)copper
- Bis(8-quinolinolato)copper
- Copper hydroxyquinolate
- Copper 8-hydroxyquinolate
- Copper hydroxyquinolinate
- Copper 8-hydroxyquinolinate
- Copper oxinate
- Copper(2+) oxinate
- Copper oxine
- Copper oxyquinolate
- Copper oxyquinoline
- Copper quinolate
- Copper 8-quinolate
- Copper 8-quinolinol
- Copper quinolinolate
- Copper 8-quinolinolate
- Cupric 8-hydroxyquinolate
- Cupric 8-quinolinolate
- Oxine copper
- Bioquin
- Cunilate 2472
- Cuproquin
- Dormycin
- Milmer 1
- Quinolate
- Quinolate 15
- Quinolate 20
- Tomo-oxiran

Last updated: 26 March 1998

2,4-D and ESTERS

VOL.: 15 (1977) (p. 111)

5. Summary of Data Reported and Evaluation

5.1 Animal data

2,4-D and several of its esters were tested in rats and mice by oral administration and in mice by subcutaneous administration. All of these studies had limitations, due either to inadequate reporting or to the small number of animals used. Therefore, although increased incidences of tumours were observed in one study in which rats received 2,4-D orally and in another in which mice received its isooctyl ester by subcutaneous injection, no evaluation of the carcinogenicity of this compound could be made.

5.2 Human data

The results of the single cohort study of a small number of workers exposed to various herbicides, including 2,4-D, 2,4,5-T and 3-amino-1,2,4-triazole (amitrole) (IARC, 1986 - Vol. 41), are not sufficient to evaluate the carcinogenicity of 2,4-D to man [Because 2,4-D may be used with 2,4,5-T, which is contaminated with 2,3,7,8-tetrachlorodibenzo-*para*-dioxin, see also monograph on polychlorinated dibenzodioxins (IARC, 1997 - Vol. 69)].

Subsequent evaluations: [Vol. 41 \(1986\) \(Chlorophenoxy Herbicides, occupational exposures to\)](#); [Suppl. 7 \(1987\) \(Chlorophenoxy herbicides\)](#)

Last updated: 26 March 1998

***trans*-1,4-DICHLOROBUTENE**

VOL.: 15 (1977) (p. 149)

CAS No.: 110-57-6

Chem. Abstr. Name: (E)-1,4-Dichloro-2-butene

5. Summary of Data Reported and Evaluation

5.1 Animal data

trans-1,4-Dichlorobutene has been tested in female mice by skin application and by subcutaneous and intraperitoneal injection. When injected subcutaneously or intraperitoneally, it produced low incidences of local sarcomas. The available data do not allow an evaluation of the carcinogenicity of this compound to be made.

5.2 Human data

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

Subsequent evaluation: [Vol. 71 \(1999\)](#)

For definition of Groups, see [Preamble Evaluation](#).

Last updated: 13 April 1999

DIMETHOXANE

VOL.: 15 (1977) (p. 177)

CAS No.: 828-00-2

Chem. Abstr. Name: 2,6-Dimethyl-1,3-dioxan-4-ol acetate

5. Summary of Data Reported and Evaluation

5.1 Animal data

Dimethoxane is carcinogenic in male rats after its oral administration, the only species, sex and route tested; it produced malignant tumours, predominantly in the liver.

5.2 Human data

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

Subsequent evaluation: Suppl. 7 (1987) (p. 62: **Group 3**)

For definition of Groups, see [Preamble Evaluation](#).

Synonyms

- Acetomethoxan
- Acetomethoxane
- 6-Acetoxy-2,4-dimethyl-*meta*-dioxane
- 2,6-Dimethyl-*meta*-dioxan-4-ol acetate
- 2,6-Dimethyl-*meta*-dioxan-4-yl acetate
- Giv Gard DXN

EOSIN and EOSIN DISODIUM SALT

VOL.: 15 (1977) (p. 183)

Eosin

CAS No.: 15086-94-9

Chem. Abstr. Name: 2',4',5',7'-Tetrabromo-3',6'-dihydroxy-spiro[isobenzofuran-1(3*H*),9'-(9*H*)-xanthen]-3-one

Eosin Disodium Salt

CAS No.: 17372-87-1

Chem. Abstr. Name: 2',4',5',7'-Tetrabromo-3',6'-dihydroxy-spiro[isobenzofuran-1(3*H*),9'-(9*H*)-xanthen]-3-one, disodium salt

5. Summary of Data Reported and Evaluation

5.1 Animal data

Eosin has been tested only in rats by oral and subcutaneous administration, and eosin disodium salt has been administered to rats by subcutaneous injection; the data are insufficient for an evaluation of carcinogenicity of these compounds to be made.

5.2 Human data

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

Subsequent evaluation: Suppl. 7 (1987) (p. 63: **Group 3**)

For definition of Groups, see [Preamble Evaluation](#).

Synonyms for Eosin

- Bromeosin
- Bromoeosin
- Bromofluoresceic acid
- C.I. Solvent Red 43
- D and C Red No. 21
- Eosine
- Eosine Acid
- Red 11731
- 2,4,5,7-Tetrabromo-3,6-fluorandiol
- Tetrabromofluorescein
- 2',4',5',7'-Tetrabromofluorescein

Synonyms for Eosin Disodium Salt

- Aizen Eosine GH
- Bromo acid
- Bromo Acid J
- Bromo Acid XL
- Bromo B
- Bromoeosine

- Bromofluoresceic acid
- Bromo fluorescein
- Bromofluorescein
- Bronze Bromo
- Bronze Bromo ES
- Certiqua Eosine
- C.I. Acid Red 87
- Cogilor Orange 212.00, 212.10, 212.42
- D and C Red No. 22
- Disodium eosin
- Disodium salt of 2,4,5,7-tetrabromo-9-ortho-carboxyphenyl-6-hydroxy-3- isoxanthone
- Eosin
- Eosine
- Eosine Extra Conc. A Export
- Eosine K Salt Free
- Eosine Lake Red Y
- Eosine Salt Free
- Eosine sodium salt
- Eosine Yellowish
- Fenazo Eosine XG
- Food Red No. 103
- Hidacid Boiling Bromo
- Hidacid Bromo Acid Regular
- Hidacid Dibromo Fluorescein
- Hidacid Eosine Soda Salt
- Hidacid White Bromo
- Irgalite Bronze Red CL
- Phloxine Red 20-7600
- Phloxine Toner B
- Phlox Red Toner X-1354
- Pure Eosine YY
- 11445 Red
- 11731 Red
- Sodium eosinate
- Sodium eosine
- Symuler Eosin Toner
- 2,4,5,7-Tetrabromo-3,6-fluorandiol
- Tetrabromofluorescein
- 2',4',5',7'-Tetrabromofluorescein, sodium salt
- 2-(2,4,5,7-Tetrabromo-6-hydroxy-3-oxo-3*H*-xanthene-9-yl)benzoic acid, disodium salt
- Toyo Eosine G
- 1903 Yellow Pink

HEXAMETHYLPHOSPHORAMIDE

VOL.: 15 (1977) (p. 211)

CAS No.: 680-31-9

Chem. Abstr. Name: Hexamethylphosphoric triamide

5. Summary of Data Reported and Evaluation

5.1 Animal data

Hexamethylphosphoramide is carcinogenic in rats, the only species tested, following its administration by inhalation; in this study, which was reported as a preliminary note, it produced squamous-cell carcinomas of the nasal cavity. It has also been inadequately tested in rats by oral administration.

5.2 Human data

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

Subsequent evaluation: [Vol. 71 \(1999\)](#)

For definition of Groups, see [Preamble Evaluation](#).

Synonyms

- ENT 50,882
- Hempa
- Hexametapol
- Hexamethylphosphamide
- Hexamethylphosphoric acid triamide
- N,N,N,N,N,N-Hexamethylphosphoric triamide
- Hexamethylphosphorotriamide
- Hexamethylphosphotriamide
- HMPA
- HMPT
- HPT
- Phosphoric tris(dimethylamide)
- Phosphoryl hexamethyltriamide
- Tris(dimethylamino)phosphine oxide
- Tris (dimethylamino)phosphorus oxide

METHYL IODIDE

VOL.: 15 (1977) (p. 245)

5. Summary of Data Reported and Evaluation

5.1 Animal data

Methyl iodide is carcinogenic in rats, inducing local sarcomas after single or repeated subcutaneous injections. In a study in which only a few mice were used, it caused an increased incidence of lung tumours after its intraperitoneal injection.

5.2 Human data

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

Subsequent evaluations: [Vol. 41 \(1986\)](#); [Vol. 71 \(1999\)](#)

For definition of Groups, see [Preamble Evaluation](#).

Last updated: 13 April 1999

para-QUINONE

VOL.: 15 (1977) (p. 255)

CAS No.: 106-51-4

Chem. Abstr. Name: 2,5-Cyclohexadiene-1,4-dione

5. Summary of Data Reported and Evaluation

5.1 Animal data

para-Quinone has been tested in mice by skin application and inhalation and in rats by subcutaneous injection. The available data are insufficient to evaluate the carcinogenicity of this compound.

5.2 Human data

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

Subsequent evaluation: [Vol. 71 \(1999\)](#)

For definition of Groups, see [Preamble Evaluation](#).

Synonyms

- Benzoquine
- Benzoquinone
- 1,4-Benzoquinone
- *para*-Benzoquinone
- Chinone
- Cyclohexadienedione
- 1,4-Cyclohexadienedione
- 1,4-Cyclohexadiene dioxide
- Quinone

Last updated: 13 April 1999

SUCCINIC ANHYDRIDE

VOL.: 15 (1977) (p. 265)

CAS No.: 108-30-5

Chem. Abstr. Name: Dihydro-2,5-furandione

5. Summary of Data Reported and Evaluation

5.1 Animal data

In the study available, which involved few rats, succinic anhydride produced local sarcomas after its subcutaneous injection. Further studies are required before an evaluation of the carcinogenicity of this compound can be made.

5.2 Human data

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

Subsequent evaluation: Suppl. 7 (1987) (p. 72: **Group 3**)

For definition of Groups, see [Preamble Evaluation](#).

Synonyms

- Butanedioic anhydride
- 2,5-Diketotetrahydrofuran
- Succinic acid anhydride
- Succinyl oxide
- Tetrahydro-2,5-dioxofuran

Last updated: 26 March 1998

2,4,5-T and ESTERS

VOL.: 15 (1977) (p. 273)

5. Summary of Data Reported and Evaluation

5.1 Animal data

2,4,5-T was tested in mice in three studies by oral and subcutaneous administration. All of these studies had limitations due to the small numbers of animals used. Therefore, although an increased incidence of tumours at various sites was observed in one study in which 2,4,5-T (containing less than 0.05 ppm chlorinated dibenzodioxins) was given orally, no evaluation of the carcinogenicity of this compound could be made on the basis of the available data.

5.2 Human data

The results of the single cohort study of a small number of workers exposed to various herbicides, including 2,4-D, 2,4,5-T and 3-amino-1,2,4-triazole (amitrole) (see IARC, 1976, Vol. 41), are not sufficient to evaluate the carcinogenicity of 2,4,5-T to man (Because 2,4,5-T is contaminated with 2,3,7,8-tetrachlorodibenzo-*para*-dioxin, see also monograph on chlorinated dibenzodioxins; IARC, 1997 - Vol. 69).

Subsequent evaluations: [Vol. 41 \(1986\) \(Chlorophenoxy herbicides, Occupational exposures to\)](#); [Suppl. 7 \(1987\) \(Chlorophenoxy herbicides\)](#)

Last updated: 26 March 1998

1,2,3-TRIS(CHLOROMETHOXY)PROPANE

VOL.: 15 (1977) (p. 301)

CAS No.: 38571-73-2

5. Summary of Data Reported and Evaluation

5.1 Animal data

1,2,3-Tris(chloromethoxy)propane is carcinogenic in mice, the only species tested, following its subcutaneous or intraperitoneal administration; it produced malignant tumours at the sites of administration. Skin papillomas and a low incidence of skin carcinomas were observed in skin-painting studies in mice.

5.2 Human data

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

Subsequent evaluation: [Vol. 71 \(1999\)](#)

Synonyms

- Glycerol[tri(chloromethyl)]ether
- Tris-1,2,3-(chloromethoxy) propane

Last updated: 13 April 1999