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Committee of Experts on the Transport of Dangerous Goods and on the Globally Harmonized System of Classification and Labelling of Chemicals

Sub-Committee of Experts on the Globally Harmonized System of Classification and Labelling of Chemicals
Thirty-second session
Geneva, 7– 9 (morning) December 2016
Item 4 (a) of the provisional agenda
Implementation of the GHS:
Development of a list of chemicals classified in accordance with the GHS

18 November 2016

Report on the proposal for classification and labelling of Dicyclopentadiene

Transmitted by the secretariat of the Organisation for Economic Cooperation and Development (OECD)

Organisation de Coopération et de Développement Économiques
Organisation for Economic Co-operation and Development

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English - Or. English

ENVIRONMENT DIRECTORATE
JOINT MEETING OF THE CHEMICALS COMMITTEE AND THE WORKING PARTY ON CHEMICALS, PESTICIDES AND BIOTECHNOLOGY

REPORT ON THE PROPOSAL FOR CLASSIFICATION AND LABELLING (C&L) OF DICYCLOPENTADIENE

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Unclassified

English - Or. English

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Series on Testing & Assessment

No. 248

REPORT ON THE PROPOSAL FOR CLASSIFICATION AND LABELLING (C&L) OF DICYCLOPENTADIENE

Joint Pilot Project of the OECD and the UN Sub-Committee of Experts on the Globally Harmonised System of Classification and Labelling of Chemicals

IOMC

INTER-ORGANIZATION PROGRAMME FOR THE SOUND MANAGEMENT OF CHEMICALS

A cooperative agreement among FAO, ILO, UNDP, UNEP, UNIDO, UNITAR, WHO, World Bank and OECD

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Paris, 2016

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FOREWORD

In 2014, the OECD Task Force on Hazard Assessment (TFHA) and the Joint Meeting of the Chemicals Committee and the Working Party on Chemicals, Pesticides and Biotechnology (JM) agreed to provide a coordination role for a pilot classification project upon invitation from the UN Sub-Committee of Experts on the Globally Harmonised System of Classification and Labelling of Chemicals (UNSCEGHS). A report of the Pilot Project of the OECD and the UN Sub-Committee of Experts on the Globally Harmonised System of Classification and Labelling of Chemicals detailing the process of the pilot project and learnings is published along with this report. (Report on the Pilot Project on Assessing the Potential Development of a Global List of Classified Chemicals. ENV/JM/MONO(2016)43, Series on Testing & Assessment No. 246). It also contains a template for Proposals for Classification and Labelling (Annex 1 to ENV/JM/MONO(2016)43/ANN1/PART1 & PART2).

Accompanying the report are three case study chemicals where non-binding agreement on their classification have been reached. The results of this pilot project will be submitted to the UNSCEGHS for consideration in their deliberations on the potential development of a global list of classified chemicals.

This report on the Proposal for Classification and Labelling (C&L) of Dicyclopentadiene was prepared by the Russian Federation, with review and input from the project team established for this pilot project under the OECD Task Force for Hazard Assessment. It contains a C&L report as well as an Annex with additional background information.

The following two reports on the Proposal for Classification and Labelling (C&L) are published with this report:

1. Report on the Proposal for Classification and Labelling (C&L) of Dimethyltin Dichloride ENV/JM/MONO(2016)44, Series on Testing & Assessment No. 247.

2. Report on the Proposal for Classification and Labelling (C&L) of Dibutyl Phthalate ENV/JM/MONO(2016)46, Series on Testing & Assessment No. 249.

This document is being published under the responsibility of the Joint Meeting of the Chemicals Committee and the Working Party on Chemicals, Pesticides and Biotechnology.

Proposal for Classification and Labelling (C&L)

Based on the Globally Harmonized System of Classification and Labelling of Chemicals (GHS)

International Chemical Identification: Dicyclopentadiene

CAS Number: 77-73-6

Contact details for dossier submitter:
Russian Federation (CIS Center)

Version number: 4 **Date: 15/06/2016**

Note on confidential information
Please be aware that this report is intended to be made publicly available. Therefore it should not contain any confidential information.

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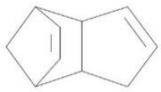
1. IDENTITY OF THE SUBSTANCE

1.1 Name and other identifiers of the substance

Table 1: Substance identity and information related to molecular and structural formula of the substance

International Chemical Identification - **Name(s) in the IUPAC nomenclature or other international chemical name(s)**	3a,4,7,7a-tetrahydro-1H-4,7-methanoindene
Other names (usual name, trade name, abbreviation)	DCPD Dicyclopentadiene Bicyclopentadiene Biscyclopentadiene 3a,4,7,7a-Tetrahydro-4,7-methano-1H-indene 3a,4,7,7a-Tetrahydro-4,7-methanoindene 4,7-Methano-1H-indene, 3a,4,7,7a-tetrahydro- 3a,4,7,7a-tetrahydro-4,7-methanoindene Cyclopentadiene dimer 1,3-Cyclopentadiene dimer Alpha-dicyclopentadiene (endo form)
ISO common name (if available and appropriate)	Not applicable.
CAS number (if available)	77-73-6
Other identifier(s) (if available)	EC number: 201-052-9 RTECS No. PC1050000
In case the substance is already included in a classification list - identifier of the entry	EU Index number in Annex VI, CLP Regulation: 601-044-00-9 NITE Classification ID: 783 HNSO CCID Approval Number: HSR001123
Molecular formula	$C_{10}H_{12}$
Structural formula	
SMILES notation (if available)	C12C3C=CC(C3)C1C=CC2
Molecular weight or molecular weight range	132.20 g/mol
Information on optical activity and typical ratio of (stereo) isomers (if applicable and appropriate)	DCPD can exist as two stereoisomers, the endo and exo forms, with commercial DCPD being predominantly the endo isomer. *[Kirk-Othmer Encyclopedia of Chemical Technology. 3rd ed., Volumes 1-26. New York, NY: John Wiley and Sons, 1978-1984., p. V7 417 (1979)]*
Description of the manufacturing process and identity of the source (for UVCB substances only)	Not a UVCB substance.
Degree of purity (%) (if relevant for the classification proposal)	75% < conc. > 99%

1.2 Composition of the substance

Table 2: Constituents (non-confidential information)

Constituent (Name and numerical identifier)	Concentration range (% w/w minimum and maximum)
3a,4,7,7a-tetrahydro-1H-4,7-methanoindene	75% < conc. > 99%

Table 3: Impurities (non-confidential information) if relevant for the classification of the substance

Impurity (Name and numerical identifier)	Concentration range (% w/w minimum and maximum)	The impurity contributes significantly to the classification and labelling
The available information on impurities was included in appropriate summary tables.		

Table 4: Additives (non-confidential information) if relevant for the classification of the substance

Additive (Name and numerical identifier)	Function	Concentration range (% w/w minimum and maximum)	The additive contributes significantly to the classification and labelling (yes/no)
No data available.			

Table 5: Test substances (non-confidential information)

Identification of test substance	Purity	Impurities and additives (identity, %, classification if available)	Other information	The study(ies) in which the test substance is used
Not considered useful for this dossier.				

2. PROPOSED CLASSIFICATION AND LABELLING

2.1 Proposed classification and labelling according to the GHS criteria (GHS rev. 6)

Table 6: Proposed classification and reason for not proposing a classification for a hazard class

GHS chapter ref.	Hazard class or differentiation	Proposed classification - Hazard Class and Category Code(s); Hazard statement Code(s)	Proposed SCL(s) and M-factor(s)	Reason for no proposed classification*
2.1	**Explosives**	Not classified		Hazard class not applicable
2.2	**Flammable gases**	Not classified		Hazard class not applicable
2.3	**Aerosols**	Not classified		Hazard class not applicable
2.4	**Oxidising gases**	Not classified		Hazard class not applicable
2.5	**Gases under pressure**	Not classified		Hazard class not applicable
2.6	**Flammable liquids**	Flam. Liq. 3; H226 *for liquid DCPD (see Note 1)*		
2.7	**Flammable solids**	Not classified		Data lacking
2.8	**Self-reactive substances**	Not classified		Hazard class not applicable
2.9	**Pyrophoric liquids**	Not classified		Hazard class not applicable
2.10	**Pyrophoric solids**	Not classified		Hazard class not applicable
2.11	**Self-heating substances**	Not classified		Hazard class not applicable
2.12	**Substances which in contact with water emit flammable gases**	Not classified		Hazard class not applicable
2.13	**Oxidising liquids**	Not classified		Hazard class not applicable
2.14	**Oxidising solids**	Not classified		Hazard class not applicable
2.15	**Organic peroxides**	Not classified		Hazard class not applicable
2.16	**Corrosive to metals**	Not classified		Data lacking
2.17	**Desensitized explosives**	Not classified		Hazard class not applicable
3.1	**Acute toxicity** **- via oral route**	Acute Tox. 3; H301		
	- via dermal route	Acute Tox. 5; H313		
	- via inhalation route	Acute Tox. 2; H330		
3.2	**Skin corrosion/irritation**	Skin Irrit. 2; H315		

3.3	**Serious eye damage/eye irritation**	Not classified		Data conclusive but not sufficient for classification
3.4	**Respiratory sensitisation**	Not classified		Data lacking
	Skin sensitisation	Not classified		Data conclusive but not sufficient for classification
3.5	**Germ cell mutagenicity**	Not classified		Data conclusive but not sufficient for classification
3.6	**Carcinogenicity**	Not classified		Data lacking
3.7	**Reproductive toxicity**	Repr.2; H361 (developmental toxicity)		
3.8	**Specific target organ toxicity-single exposure**	STOT SE 3; H335, H336		
3.9	**Specific target organ toxicity-repeated exposure**	STOT RE 2; H373		
3.10	**Aspiration hazard**	Asp. Tox. 1; H304		
4.1	**Hazardous to the aquatic environment**	Aquatic Acute 1; H400 Aquatic Chronic 2; H411	M=1	
4.2	**Hazardous to the ozone layer**	Not classified.		Hazard class not applicable
** Note 1. Above 32.2 °C/90° F, the pure substance is a liquid as also commercial grades with purity < 97% at room temperature*				

Proposed labelling

Pictogram Code(s): GHS02 (Flame), GHS06 (Skull and crossbones), GHS08 (Health hazard), GHS09 (Environment)

Signal Word Code(s): Danger.

Hazard statement Code(s):

H226: Flammable liquid and vapour [*for liquid DCPD*]
H301: Toxic if swallowed.
H304: May be fatal if swallowed and enters airways.
H313: May be harmful in contact with skin.
H315: Causes skin irritation.
H330: Fatal if inhaled.
H335: May cause respiratory irritation.
H336: May cause drowsiness and dizziness.

H361: Suspected of damaging the unborn child.

H373: May cause damage to organs through prolonged or repeated exposure via oral and inhalation routes of exposure

H400: Very toxic to aquatic life.

H411: Toxic to aquatic life with long lasting effects.

Supplemental information:

According to 1.410.5.3.1 (a) if the skull and crossbones applies, the exclamation mark should not appear. According to 1.410.5.3.2 if the signal word "Danger" applies, the signal word "Warning" should not appear.

3. IDENTIFIED USES

Intermediate for ethylene-propylene elastomers for resins, pesticides, flame retardants, adhesive, coatings.

4. DATA SOURCES

- ECHA's web-site: Search for Chemicals: CAS 77-73-6 http://echa.europa.eu/registration-dossier/-/registered-dossier/15412/1
- Data bank of environmental properties of chemicals - The Finnish Environment Institute (SYKE) http://wwwp.ymparisto.fi/scripts/Kemrek/Kemrek_uk.asp?Method=MAKECHEMdetailsform&txtChemId=2070
- US EPA Screening-level hazard characterization Document, December 2010. Available online at http://www.epa.gov/chemrtk/hpvis/hazchar/Category_Resin%20Oils_December_2010.pdf
- OECD SIDS Initial Assessment Report for Dicyclopentadiene (77-73-6). Available online at http://www.chem.unep.ch/irptc/sids/OECDSIDS/77736.pdf as of September 28, 2010.
- Hazardous Substances Data Bank (HSDB) of TOXNET Databases.
- Chemical Carcinogenesis Research Information System (CCRIS) of TOXNET Databases.
- Dow DCPD Product Handling Guide. Available online at http://msdssearch.dow.com/PublishedLiteratureDOWCOM/dh_0957/0901b803809577d1.pdf?filepath=aromatics/pdfs/noreg/778-04301.pdf&fromPage=GetDoc

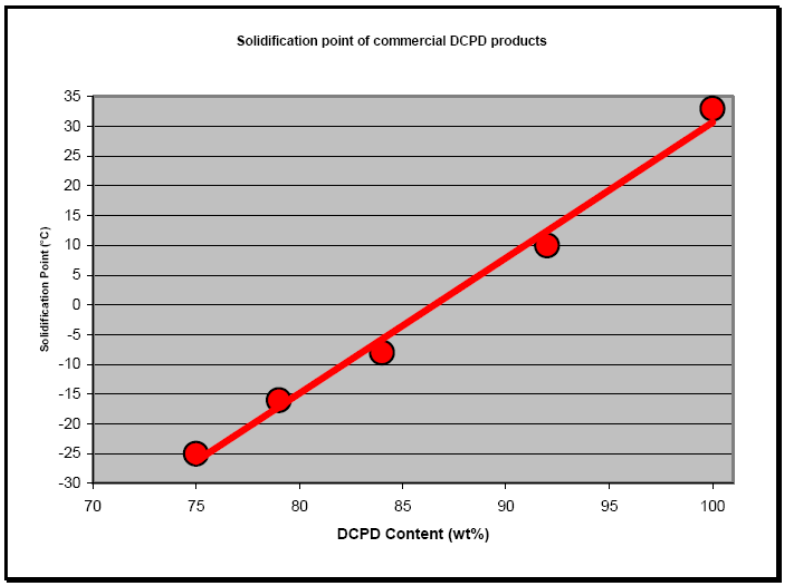
5. PHYSICOCHEMICAL PROPERTIES

Table 7: Summary of physicochemical properties

Property	Value	Reference	Comment (e.g. measured or estimated)
Physical state at 20°C and 101,3 kPa	Colorless crystalline solid which became a liquid above 90° F (32.2°C) Waxy solid at room temperature. However the degree of solidity will depend on the impurities.	(1) HSDB ECHA website, unnamed publication 1991	Based on additional information provided by industry, the physical state of DCPD is dependent on the purity. The pure substance is a waxy solid at room temperature. Commercial grades with purity < 97% are liquid at room temperature.
Melting/freezing point	32.2°C 33.6°C 32°C (-25)°C - 32.2°C 32.5 °C 32 - 34 °C 10.6 °C -25 - 10 °C	(1) ECHA website (2)OECD SIDS (3) US EPA Dow DCPD product handling guide (12) ECHA website (13) ECHA website ECHA website. Proprietary data (Shell 2016) ECHA website. Proprietary data (2016).	measured measured measured measured. It illustrated that the melting point of DCPD is dependent on the purity. *see Note 1 measured according to ASTM 1493 for 94% DCPD measured for DCPD with purity 75 - <95%.
Boiling point	172.2°C at 760mmHg 170.7°C 170-172°C 80 - 190 °C	(1) ECHA website (2)OECD SIDS (13) ECHA website ECHA website. Proprietary data (2016).	measured measured The test substance decomposes at this temperature range (170-172°C) measured for DCPD with purity >80%.
Density	0.977 g/m^3 at 35 °C 0.93 g/cm^3 at 35 °C 975-989 kg/m3 at 20°C	(4) OECD SIDS (5) ECHA website ECHA website. Proprietary data (Shell 2016)	 measured measured according to ASTM D4052 for 94% DCPD
Relative density	1.049 g/cm^3 (20°C)	ECHA website	
Vapour pressure	1.3 x 10^3 Pa at 37.7 °C 1.86 hPa at 20 °C	(6) OECD SIDS (7) ECHA website	measured measured
Surface tension	Not applicable		
Water solubility	20 mg/l at 25 °C 0.020 lb/100 lb water at 68.02 deg F (20°C) In water, 26.5 mg/L at 25 deg C	(8) OECD SIDS (9) HSDB (10) HSDB	Slightly soluble, measured Estimated
Partition coefficient n-octanol/water	2.78	(11) OECD SIDS	measured
Flash point	32.2°C at 1013.5 hPa 41°C 23 - 32°C	(1) ECHA website (4) (12) ECHA website ECHA website.	measured measured for DCPD with purity

		Proprietary data (2016).	>80%.
Flammability	flammable	ECHA website: Internal data of Shell International Chemical Company Ltd.,|May 1994	
Auto flammability	503 °C	(13) ECHA website	measured
Explosive properties	Lower and upper explosion limits are 0.8% and 6.3% vol, respectively	(1) ECHA website (4)	measured
Self-ignition temperature	No data available		
Oxidising properties	None	OECD SIDS	Study scientifically unjustified
Granulometry	No data available		
Stability in organic solvents and identity of relevant degradation products	Soluble Very soluble in ethyl ether, ethanol Readily soluble in acetone, dichloromethane, ethyl acetate, n-hexane, and toluene.	(14) HSDB (15) HSDB	Study scientifically unjustified
Dissociation constant	Not applicable		Study scientifically unjustified - no ionizable functional group
Viscosity	0.736 cP (est) at 70 deg F 2.811mm²/s at 40°C 1-5 mPa.s at 20°C	HSDB (9) ECHA website. Proprietary data (2016). ECHA website. Proprietary data (2016).	Purity unknown. Based on information provided by industry, the pure substance is a waxy solid at room temperature. However commercial grades with purity < 97 % are liquid at room temperature and typically have a viscosity of < 2 cP. measured according to ASTM 445 for 94% DCPD measured for DCPD with purity >80%.
Henry's Law Constant	0.020 atmm3/mol 830 Pa * mE+3 * molE-1 6.25X10-2 atm-cum/mol at 25 deg C (est) 1 229.6 Pa m³/mol 6340 Pa.m3/mole.	(16) (4) OECD SIDS (16) HSDB ECHA website ECHA website	Estimated Estimated QSAR calculation (EPISiute v4.00)

**Note 1.* Based on Dow internal measurements it has been shown that the melting point is ranging from approximately -25 °C to 32.2°C with increasing purity, as illustrated in the graph below



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(6) The Sigma-Aldrich Library of Reguratory and Safety Data

(7) Kinkead, E.R. et al. (1971): Toxicol. Appl. Pharmacol. 20, 552- 561.

(8) MITI, Japan (1997) Test was performed by CITI, Japan. Protocol OECD TG 105

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(10) US EPA; Estimation Program Interface (EPI) Suite. Ver.3.12. Nov 30, 2004. Available from, as of Oct 26, 2006: http://www.epa.gov/oppt/exposure/pubs/episuitedl.htm

(11) MITI, Japan (1997) Test was performed by CITI, Japan. Protocol OECD TG 107

(12) Ullmann's Encyclopedia of Industrial Chemistry. Fifth, Completely Revised Edition, Vol. A8 (1987), S. 227-228.

(13) WHO International Programme on Chcemical Safety, Chemical Safety Card: Dicyclopentadiene, ICSC-0873 (2005)

(14) HSDB: Lide, D.R. CRC Handbook of Chemistry and Physics 86TH Edition 2005-2006. CRC Press, Taylor & Francis, Boca Raton, FL 2005, p. 3-162

(15) HSDB: Hartley, D. and H. Kidd (eds.). The Agrochemicals Handbook. 2nd ed. Lechworth, Herts, England: The Royal Society of Chemistry, 1987., p. A716/Aug 87

(16) U.S. EPA. 2010. Estimation Programs Interface Suite™ for Microsoft® Windows, v4.00. U.S. Environmental Protection Agency, Washington, DC, USA. Available

online at http://www.epa.gov/opptintr/exposure/pubs/episuitedl.htm as of September 15, 2010.

6. EVALUATION OF PHYSICAL HAZARDS

6.1 Explosives

Table 8: Summary table of studies on explosive properties

Method	Results	Remarks	Reference
-	-	-	-

Short summary and overall relevance of the provided information on explosive properties

Study scientifically unjustified: there are no chemical groups associated with explosive properties present in the molecule.

Comparison with the GHS criteria

According to item 2.1.4.2.2 (a) of the GHS a substance is not classified as explosive if there are no chemical groups associated with explosive properties present in the molecule.

Conclusion on classification and labelling for explosive properties

Not classified.

6.2 Flammable gases

Table 9: Summary table of studies on flammable gases

Method	Results	Remarks	Reference
-	-	-	-

Short summary and overall relevance of the provided information on flammable gases

Study is not applicable: DCPD is a solid or liquid (commercial grades with purity <97%) at 20°C and 101,3 kPa.

Comparison with the GHS criteria

Not applicable.

Conclusion on classification and labelling for flammable gases

Not classified.

6.3 Aerosols

Table 10: Summary table of studies on aerosols

Method	Results	Remarks	Reference
-	-	-	-

Short summary and overall relevance of the provided information on aerosols

Study scientifically unjustified: DCPD is not aerosol products.

Comparison with the GHS criteria

Not applicable.

Conclusion on classification and labelling for aerosols

Not classified.

6.4 Oxidising gases

Table 11: Summary table of studies on oxidising gases

Method	Results	Remarks	Reference
-	-	-	-

Short summary and overall relevance of the provided information on oxidising gases

Study is not applicable: DCPD is a solid or liquid (commercial grades with purity <97%) at 20°C and 101,3 kPa.

Comparison with the GHS criteria

Not applicable.

Conclusion on classification and labelling for oxidising gases

Not classified.

6.5 Gases under pressure

Table 12: Summary table of studies on gases under pressure

Method	Results	Remarks	Reference
-	-	-	-

Short summary and overall relevance of the provided information on gases under pressure

Study is not applicable: DCPD is a solid or liquid (commercial grades with purity <97%) at 20°C and 101,3 kPa.

Comparison with the GHS criteria

Not applicable.

Conclusion on classification and labelling for gases under pressure

Not classified.

6.6 Flammable liquids

Table 13: Summary table of studies on flammable liquids

Method	Results	Remarks	Reference
Unknown	Flash point: 32.2 °C at 1013.5 hPa		NIOSH. Pocket Guide to Chemical Hazards (2005). National Institute for Occupational Safety & Health
Unknown	Flash point: 32 °C		WHO International Programme on Chemical Safety, 2005. Chemical Safety Card: Dicyclopentadiene ICSC-0873
Open cup	Flash point: 32 °C		Fire Protection Guide to Hazardous Materials. 13 ed. Quincy, MA: National Fire Protection Association, 2002., p. 325-41
Unknown	Flash point: 32.2°C		Sax, N.I. (1979): Dangerous Properties of Industrial|Materials, Fifth Edition, Van Nostrand Reinhold Comp. Inc., New York, S. 569
Unknown	Flash point: 41°C		Ullmann"s Encyclopedia of Industrial Chemistry. Fifth, Completely Revised Edition, Vol. A8 (1987), S. 227-228
Unknown	Flash point: >23°C, typically 25-32°C at 1013 hPa	Tested substance: commercial DCPD (>80% purity)	Data taken from ECHA dissemination website with reference to proprietary data: results (2016) are taken from company specific pro-forma

Short summary and overall relevance of the provided information on flammable liquids

No information on the primary sources of this data or the methods used for most studies is available. However, most of the data are taken from a reliable government source and is therefore considered to be suitable for use. The lowest flash point was measured for commercial DCPD (>80%) as >23 °C The highest flash point was reported as 41°C. Apart from company data, the study reports don't provide information on physical state of the tested substances and its purity which also affects the physical state: the pure substance is a waxy solid at room temperature. Commercial grades with purity < 97% are liquid at room temperature. For the purpose of this exercise it is proposed to be assumed that flash points were obtained by testing a liquid substance: DCPD with purity < 97%.

Comparison with the GHS criteria

In comparison with the GHS criteria all data on flash point of DCPD is within the range of Category 3: 23°C ≤ (23°C ÷ 41°C) ≤ 60°C.

Conclusion on classification and labelling for flammable liquids

According to the GHS criteria Category 3 for flammable liquids is proposed for liquid DCPD, including DCPD with purity < 97% based on the flash point.
Symbol: Flame.
Signal word: Warning.
Hazard statement: H226: Flammable liquid and vapour.

6.7 Flammable solids

Table 14: Summary table of studies on flammable solids

Method	Results	Remarks	Reference
Unknown	Melting and flash point: 32.2 °C at 1013.5 hPa	A liquid above 90 F (32.2°C)	NIOSH Pocket Guide to Chemical Hazards(2005)
No studies of burning rate are available.			

Short summary and overall relevance of the provided information on flammable solids

No studies are available.

Comparison with the GHS criteria

It is not possible to compare with the GHS criteria because of data lacking.

Conclusion on classification and labelling for flammable solids

Not classified.

6.8 Self-reactive substances

Table 15: Summary table of studies on self-reactivity

Method	Results	Remarks	Reference
-	-	-	-

Short summary and overall relevance of the provided information on self-reactive substances

Study scientifically unjustified: there are no chemical groups associated with explosive properties present in the molecule.

Comparison with the GHS criteria

According to item 2.8.4.2 (a) of the GHS the classification procedures for self-reactive substances need not be applied if there are no chemical groups present in the molecule associated with explosive or self-reactive properties.

Conclusion on classification and labelling for self-reactive substances

Not classified.

6.9 Pyrophoric liquids

Table 16: Summary table of studies on pyrophoric liquids

Method	Results	Remarks	Reference
-	-	-	-

Short summary and overall relevance of the provided information on pyrophoric liquids

Study is not applicable for solid DCPD. Regarding liquid DCPD (commercial grades with purity <97%) study scientifically unjustified: liquid DCPD is stable at room temperature for prolonged periods of time.

Comparison with the GHS criteria

According to item 2.9.4.2 of the GHS the classification procedures for pyrophoric liquids need not be applied when experience in production or handling shows that the substance does not ignite spontaneously on coming into contact with air at normal temperatures (i.e. the substance is known to be stable at room temperature for prolonged periods of time (days)).

Conclusion on classification and labelling for pyrophoric liquids

Not classified.

6.10 Pyrophoric solids

Table 17: Summary table of studies on pyrophoric solids

Method	Results	Remarks	Reference
-	-	-	-

Short summary and overall relevance of the provided information on pyrophoric solids

Study scientifically unjustified: DCPD is a stable solid at room temperature for prolonged periods of time.

Comparison with the GHS criteria

According to item 2.10.4.2 of the GHS the classification procedures for pyrophoric solids need not be applied when experience in production or handling shows that the substance does not ignite spontaneously on coming into contact with air at normal temperatures (i.e. the substance is known to be stable at room temperature for prolonged periods of time (days)).

Conclusion on classification and labelling for pyrophoric solids

Not classified.

6.11 Self-heating substances

Table 18: Summary table of studies on the hazard class self-heating substances

Method	Results	Remarks	Reference
No data	Melting point: 32.2°C	a liquid above 90° F (32.2°C)	NIOSH. NIOSH Pocket Guide to Chemical Hazards & Other Databases CD-ROM. Department of Health & Human Services, Centers for Disease Prevention & Control. National Institute for Occupational Safety & Health. DHHS (NIOSH) (2005)
No data	The test substance decomposes at boiling temperature range (170-172°C)		WHO International Programme on Chemical Safety, Chemical Safety Card: dicyclopentadiene, ICSC-0873 (2005)
No data	Auto flammability: 503 °C		WHO International Programme on Chemical Safety, Chemical Safety Card: dicyclopentadiene, ICSC-0873 (2005)

Short summary and overall relevance of the provided information on self-heating substances

Study is not applicable based on the data in the Table above.

Comparison with the GHS criteria

The GHS criteria for self-heating substances based on the ability of a substance to undergo oxidative self-heating determined by exposure of it to air at temperatures of 140°C in a 25 mm or 100 mm wire mesh cube (test N.4 of UN Manual of Tests and Criteria). The DCPD is a liquid at 140°C, therefore it is not possible to perform the test.
According to the GHS definition a self-heating substance is a solid or liquid other than a pyrophoric liquid or solid, which, by reaction with air and without energy supply, is liable to self-heat; this substance or mixture differs from a pyrophoric liquid or solid in that it will ignite only when in large amounts

(kilograms) and after long periods of time (hours or days). As DCPD is stable solid at room temperature for prolonged periods of time DCPD is not predicted to be a self-heating.

Conclusion on classification and labelling for self-heating substances

Not classified.

6.12 Substances which in contact with water emit flammable gases

Table 19: Summary table of studies on substances which in contact with water emit flammable gases

Method	Results	Remarks	Reference
-	-	-	-

Short summary and overall relevance of the provided information on substances which in contact with water emit flammable gases

Study scientifically unjustified: DCPD does not contain metals or metalloids.

Comparison with the GHS criteria

According to item 2.12.4.2 (a) of the GHS the classification procedures for this class need to be applied if the chemical structure of the substance does not contain metals or metalloids.

Conclusion on classification and labelling for substances which in contact with water emit flammable gases

Not classified.

6.13 Oxidising liquids

Table 20: Summary table of studies on oxidising liquids

Method	Results	Remarks	Reference
-	-	-	-

Short summary and overall relevance of the provided information on oxidising liquids

Study scientifically unjustified: DCPD does not contain oxygen, fluorine or chlorine.

Comparison with the GHS criteria

According to item 2.13.4.2.3 (a) of the GHS the classification procedures for this class need to be applied to organic substances if the substance does not contain oxygen, fluorine or chlorine.

Conclusion on classification and labelling for oxidising liquids

Not classified.

6.14 Oxidising solids

Table 21: Summary table of studies on oxidising solids

Method	Results	Remarks	Reference
-	-	-	-

Short summary and overall relevance of the provided information on oxidising solids

Study scientifically unjustified: DCPD does not contain oxygen, fluorine or chlorine.

Comparison with the GHS criteria

According to item 2.14.4.2.2 (a) of the GHS the classification procedures for this class need to be applied to organic substances if the substance does not contain oxygen, fluorine or chlorine.

Conclusion on classification and labelling for oxidising solids

Not classified.

6.15 Organic peroxides

Table 22: Summary table of studies on organic peroxides

Method	Results	Remarks	Reference
-	-	-	-

Short summary and overall relevance of the provided information on organic peroxides

Study scientifically unjustified: DCPD does not contain the bivalent -O-O- structure.

Comparison with the GHS criteria

DCPD is not organic peroxides in comparison with the GHS definition (organic peroxides are liquid or solid organic substances which contain the bivalent -O-O-), therefore shall not be considered for classification in this class.

Conclusion on classification and labelling for organic peroxides

Not classified.

6.16 Corrosive to metals

Table 23: Summary table of studies on the hazard class corrosive to metals

Method	Results	Remarks	Reference
No data	Non-corrosive		Hartley, D. and H. Kidd (eds.). The Agrochemicals Handbook. 2nd ed. Lechworth, Herts, England: The Royal Society of Chemistry, 1987., p. A716/Aug 87

Short summary and overall relevance of the provided information on the hazard class corrosive to metals

No information on the primary source of this data or the method used is available. However, this information is suitable for use for this endpoint because it is taken from a reliable peer reviewed database: HSDB.

Comparison with the GHS criteria

The comparison with the GHS criteria is not possible because of the lack of study details.

Conclusion on classification and labelling for corrosive to metals

Not classified.

6.17 Desensitized explosives

Table 24: Summary table of studies on desensitized explosive properties

Method	Results	Remarks	Reference
-	-	-	-

Short summary and overall relevance of the provided information on desensitized explosive properties

Study scientifically unjustified: there are no chemical groups associated with explosive properties present in the molecule.

Comparison with the GHS criteria

Not applicable.

Conclusion on classification and labelling for desensitized explosive properties

Not classified.

7. TOXICOKINETICS (ABSORPTION, METABOLISM, DISTRIBUTION AND ELIMINATION)

Table 25: Summary table of toxicokinetic studies

Method	Results	Remarks	Reference
No guideline available Principles of method: Rates of absorption, tissue distribution, metabolism and rate of excretion of 14C labelled DCPD rat, Sprague-Dawley, male, Single dose, 100 mg/kg bw by gavage, vehicle: corn oil	Absorption was rapid, Cp_{max} was 23.28 µg/ml at 6 h. Concentrations were greater in plasma than blood. Elimination from plasma was biphasic, the terminal half life was 27h. Radioactivity was widely distributed, C_{max} at 2-6 hours, highest concentrations were in the fat, adrenals and urinary bladder. Radioactivity was still detectable in all tissues at 72 hours. The primary route of excretion of 14C was via urine. 94% of radioactivity was recovered within 72 h with approximately 75% in urine. Metabolites identified. Urine contained 7 radioactive components; the major polar component accounted for 41% of the total radioactivity. No DCPD was detected. Conjugates were present.		Author not specified. Report date 1976-06-24 Data source: ECHA web-site - Exp Key Basic toxicokinetics.002
No guideline available Principles of method: Rates of absorption, tissue distribution, metabolism and rate of excretion of 14C labelled DCPD dog, Beagle, male, Single dose, 100 mg/kg bw.; oral; vehicle: corn oil	Absorption was rapid, Cp_{max} was 39.9 µg/ml at 2 h. Concentrations were greater in plasma than blood. Elimination from plasma was biphasic with half lives of 10 and 18h. Radioactivity was widely distributed, C_{max} at 4-24 hours, highest concentrations were in the bile, gall bladder, bladder and stomach. Radioactivity was still detectable in most tissues at 7 days. The primary route of excretion of 14C was via urine. 85% of radioactivity was recovered within 72 h with approximately 81% in urine. Metabolites identified. Urine contained 6 radioactive components; the major polar component accounted for 81% of the total radioactivity. No DCPD was detected. Conjugates were present. The distribution of radioactivity in the eye was assessed. The highest levels were in all parts of the eye at 4 h. After that time, radioactivity was greatly reduced but was still detected in all parts of the eye at 7 days.		Author not specified. Report date 1976-06-24 Data source: ECHA web-site - Exp Key Basic toxicokinetics.003

No guideline available Principles of method: Rates of absorption, tissue distribution, metabolism and rate of excretion of 14C labelled DCPD mouse, Swiss Webster, male, Single dose, 40 mg/kg bw. by gavage, vehicle: corn oil	Absorption was rapid, Cp_{max} was 11.36µg/ml at 2 h. Concentrations were greater in plasma than blood. Elimination from plasma was biphasic with half lives of 4 and 18 h. Radioactivity was widely distributed, C_{max} at 1-2 hours, highest concentrations were in the bladder, gall bladder and fat. Radioactivity was still detectable in most tissues at 72 hours. The primary route of excretion of 14C was via urine. 92% of radioactivity was recovered within 48 h with approximately 70% in urine. Metabolites identified. Urine contained 7 radioactive components; the major polar component accounted for 56% of the total radioactivity. No DCPD was detected. Conjugates were present		Author not specified. Report date 1976-06-24 Data source: ECHA web-site - Exp Key Basic toxicokinetics.001
No guideline available Principles of method: Blood samples, urine, faeces and milk were collected at intervals. The cow was killed 96 hours after dosing with [14C] DCPD and several tissues were taken. Excretion and tissue retention were determined. cattle, Jersey, female, single dose, 10 mg/kg bw, oral: capsule Vehicle: no	Radiocarbon was quite rapidly excreted following oral dosing of [14C] DCPD (c.a. 81% of administered [14C] eliminated in urine, c.a. 4% in faeces, <0.1% secreted into milk). Radiocarbon in whole blood reached maximum levels (290 dpm/g) within 2 hr of dosing. Blood radiocarbon levels then declined rapidly, residues were not detectable (<20 dpm/g) in samples collected more than 24 hr after treatment. None of the tissue samples collected contained detectable radiocarbon residues. Metabolites identified. In urine, glucuronide conjugates possibly formed through epoxidation of one or both of the DCPD double bonds followed by hydrolysis of the epoxides to diols (or possibly epoxy diols or tetraols), then ultimately conjugation with glucuronic acid. Bioaccessibility: Only exceedingly low levels of radiocarbon appeared in milk, and residues were not detected in samples collected more than 48 hr post-treatment. Little was learned about the chemical nature of DCPD metabolites except that, in urine, they are primarily in the form of glucuronide conjugates. It may well be that these metabolites in the cow arose, at least in part, through epoxidation of one or both of the DCPD double bonds followed by hydrolysis of the epoxides to diols (or possibly epoxy diols or tetraols), then ultimately conjugation with glucuronic acid.	Blood samples, urine, faeces and milk were collected at intervals. The cow was killed 96 hours after dosing with [14C] DCPD and several tissues were taken. Excretion and tissue retention were determined.	Publication of Ivie GW and Oehler DD: Fate of dicyclopentadiene in a lactating cow. Bull. Environm. Contam. Toxicol. 24, 662-670 (1980 year) Data source: ECHA web-site - Exp Supporting Basic toxicokinetics.004

Unknown	In general, although some DCPD can be exhaled unchanged, most of that absorbed is hydroxylated in the liver, undergoes glucuronide conjugation, and is excreted in the urine.		Bingham, E.; Cohrssen, B.; Powell, C.H.; Patty's Toxicology Volumes 1-9 5th ed. John Wiley & Sons. New York, N.Y. (2001)., p. 2:39 Data source: HSDB
Unknown	DCPD is predicted to be rapidly absorbed and distributed following any route of administration. It is extensively absorbed from the GI tract.		Bingham, E.; Cohrssen, B.; Powell, C.H.; Patty's Toxicology Volumes 1-9 5th ed. John Wiley & Sons. New York, N.Y. (2001)., p. 4:203 Data source: HSDB
Unknown	The substance can be absorbed into the body by inhalation and by ingestion.		IPCS, CEC; International Chemical Safety Card on Dicyclopentadiene. (October 2005). Available from, as of October 03, 2006 Data source: HSDB

Short summary and overall relevance of the provided toxicokinetic information on the proposed classification(s)

Several studies on toxicokinetics of DCPD in different species are available. In all studies via oral route it was reported that DCPD was rapidly absorbed and radioactivity was widely distributed into tissues. The terminal elimination half life from plasma was 27 hours in male Sprague-Dawley rats. In male Beagle dogs and male Swiss Webster mice the elimination from plasma was biphasic with half lives of 10 and 18 hours respectively. Excretion was primarily in urine. The urine of mice and rats each had seven components. Six components were found in the urine of dogs. These included conjugates but no DCPD.
DCPD undergoes rapid and extensive metabolism in the lactating cow following oral exposure. Of the total radiolabelled dose administered about 86% was recovered in the urine and faeces, and only trace amounts were secreted into milk. The fact that more than 80% of the administered dose was ultimately excreted in the urine and only about 4% in faeces indicates that the orally administered DCPD was extensively absorbed from the gastrointestinal tract. Little was learned about the chemical nature of the metabolites during this study except that, in urine, they are primarily in the form of glucuronide conjugates.

There is also available information that DCPD can be absorbed following any route of administration including inhalation and by ingestion. In general, although some DCPD can be exhaled unchanged, most of that absorbed is hydroxylated in the liver, undergoes glucuronide conjugation, and is excreted in the urine.

8. EVALUATION OF HEALTH HAZARDS

8.1 Acute toxicity

Acute toxicity - oral route

Table 26a: Summary table of animal studies on acute oral toxicity

Method, test guideline, and deviation(s) if any	**Species, strain, sex, no/group**	**Test substance, reference to table 5**	**Dose levels, duration of exposure**	**Value LD_{50}**	**Reference**
OECD Guideline 401 GLP compliant	Sprague Dawley rats, male/female; Groups: 5 rats per sex per dose	75% DCPD Physical state: liquid	500, 794, 1260 and 2000 mg/kg bw. Observed 1 and 4 hours after dosing and once daily thereafter during 14 days	LD_{50} (male/female) = 590 mg/kg bw LD_{50} (male) = 512 mg/kg bw LD_{50} (female) = 676 mg/kg bw	Author not specified. Report date 1989-01-17 Data source: ECHA web-site, Exp Key Acute toxicity: oral.001
equivalent or similar to OECD Guideline 401 Non-GLP	Sprague Dawley rats, male/female; Groups: 10 rats per sex per dose	98-99% pure DCPD Physical state: waxy solid, liquefied on slight warning	278, 360, 464, 600 and 793 mg/kg bw Observations on day of dosing and daily thereafter during 14 days	LD_{50} (male/female) = 449 mg/kg bw LD_{50} (male) = 520 mg/kg bw LD_{50} (female) = 378 mg/kg bw	Author not specified. Report date 1976-06-24 Data source: ECHA web-site, Exp Supporting Acute Toxicity: oral.002
equivalent or similar to OECD Guideline 401 Non-GLP	Swiss Webster mice, male/female; Groups: 10 mice per sex per dose	98-99% pure DCPD Physical state: waxy solid, liquefied on slight warning	167, 215, 278, 360, 464 and 600 mg/kg bw Observations on day of dosing and daily thereafter during 14 days	LD_{50} (male/female) = 220 mg/kg bw LD_{50} (male) = 190 mg/kg bw LD_{50} (female) = 250 mg/kg bw	Author not specified. Report date 1976-06-24 Data source: ECHA web-site, Exp Supporting Acute Toxicity: oral.003
Unknown Non-GLP	Wistar rat, male Groups: 5 rats per dose	DCPD high purity Physical state: no data	Dose levels unknown, Obsevations during 14 days after exposure	LD_{50} (male) = 410 mg/kg bw	Smyth et al., 1962 Data source: US EPA Screening-level hazard characterization Document, 2010

Unknown Non-GLP	Rat; strain, sex and no/group are not specified	DCPD high purity Physical state: no data	Unknown	LD_{50} = 353 mg/kg bw	Kinkead et al., 1971 Data source: US EPA Screening-level hazard characterization Document, 2010
Unknown	Rat; strain, sex and no/group are not specified	DCPD No data on analytical purity and physical state	Unknown	LD_{50} = 0.35 mL/kg = approximately 350 mg/kg bw	American Conference of Governmental Industrial Hygienists. Documentation of the TLV's and BEI's with Other World Wide Occupational Exposure Values. CD-ROM Cincinnati, OH 45240-1634 2005., p. 1. Data source: HSDB
Unknown	Cattle; strain, sex and no/group are not specified	DCPD No data on analytical purity and physical state	Unknown	LD_{50} = 1200 mg/kg bw	Bingham, E.; Cohrssen, B.; Powell, C.H.; Patty's Toxicology Volumes 1-9 5th ed. John Wiley & Sons. New York, N.Y. (2001)., p. 2:39 Data source: HSDB

Table 26b: Summary table of human data on acute oral toxicity

Type of data/report	**Test substance, reference to table 5**	**Relevant information about the study (as applicable)**	**Observations**	**Reference**
No data available.				

Table 26c: Summary table of other studies relevant for acute oral toxicity

Type of study/data	**Test substance, reference to table 5**	**Relevant information about the study (as applicable)**	**Observations**	**Reference**
No data available.				

Short summary and overall relevance of the provided information on acute oral toxicity

There are a number of studies reported on the acute oral toxicity of DCPD, but the majority lack study details. The oral toxicity of DCPD was evaluated in one OECD TG 401 GLP compliant study in rats and two studies (in rats and in mice) conducted with methods equivalent or similar to OECD TG 401. Methods of other studies were not reported. In all studies according or similar to OECD TG 401, a difference in toxicity between male and female was observed, but in the first study in rat and in the study in mice males being more sensitive than females. Other study in rats showed that females were more sensitive than males. In report 1989 in rats, gross pathology effects include haemorrhagic lungs, dark liver and sloughing of the non-glandular gastric epithelium. The LD_{50} was calculated to be 590 mg/kg bw (male/female), 512 mg/kg bw (male) and 676 mg/kg/bw (female).

In other an acute oral toxicity study in fasted Sprague Dawley rats (report date 1976-06-24), gavage administration of DCPD (98-88% pure) caused signs of toxicity including red stains around the mouth and nose, decreased activity, occasional ataxia and prostration 1-4 hours after dosing. Hyperaemia of the lungs was observed at necropsy in some animals that died during the study but there were no gross abnormalities in rats which survived to the end of the study. The acute LD_{50} in fasted rats was calculated to be 449 mg/kg bw (male/female), 520 mg/kg bw (male) and 378 mg/kg bw (female).

In an acute oral toxicity study in fasted Swiss Webster mice, gavage administration of DCPD (in corn oil) at doses of between 167 and 600 mg/kg bw, caused signs of toxicity including decreased activity and prostration within 1-4 hours after dosing. Hyperaemia of the lungs, distension of the bladder, yellow fluid in the stomach and small intestines and black discolouration of areas of the liver and spleen were observed at necropsy in some animals that died during the study, but there were no gross abnormalities in mice which survived to the end of the study. The acute LD_{50} in fasted mice was calculated to be 220 mg/kg bw (male/female), 190 mg/kg bw (male) and 250 mg/kg bw (female), that represent the most sensitive result within available study reports. Thus, the study 1976-06-24 in Swiss Webster mice is considered as a key study for the pilot exercise purposes.

Comparison with the GHS criteria

The LD_{50} value of 220 mg/kg bw (male/female), 190 mg/kg bw (male) and 250 mg/kg bw (female) in Swiss Webster mice is within the range of values ($50 \leq ATE < 300$ mg/kg bw) supporting a classification in Category 3 for acute oral toxicity according to the GHS criteria.

Conclusion on classification and labelling for acute oral toxicity

Classification with Category 3 is proposed for acute toxicity via the oral route.
Symbol: Skull and crossbones
Signal word: Danger
Hazard statement: H301: Toxic if swallowed.

Acute toxicity - dermal route

Table 27a: Summary table of animal studies on acute dermal toxicity

Method, test guideline, and deviation(s) if any	**Species, strain, sex, no/group**	**Test substance, reference to table 5**	**Dose levels, duration of exposure**	**Value LD_{50}**	**Reference**
OECD Guideline 402 GLP compliant	Sprague-Dawley rat, male/female; No. of animals per sex per dose: 5	75% DCPD Physical state: liquid	2.06 mL/kg bw; Duration of exposure: 24 hours	LD_{50} (male/female) > 2000 mg/kg bw	Author not specified. Report date 1989-01-17 Data source: ECHA web-site, Exp Key Acute toxicity: dermal.001
equivalent or similar to OECD Guideline 402 Non-GLP	New Zealand White rabbit, male; No. of animals per sex per dose: 4	DCPD No data on analytical purity and physical state	Doses: Not reported; Duration of exposure: 24 hours	LD_{50} (male) = 4.46 mL/kg bw = 4460 mg/kg bw	Author not specified. Publication (1962) Data source: ECHA web-site, Exp Supporting Acute toxicity: dermal.002
equivalent or similar to OECD Guideline 402; Deviations: yes, study pre-dates guideline Non-GLP	New Zealand White rabbit, male; No. of animals per sex per dose: 4	DCPD No data on analytical purity and physical state	Doses: up to 20 mL/kg Duration of exposure: 24 hours	LD_{50} (male) = 6.72 mL/kg bw = 6720 mg/kg bw	Smyth HF, Carpenter CP, Weil CS and Pozzani UC, "Range-Finding Toxicity Data List V" Arch Ind Hyg Occup. 1954 Vol 10 pp 61-68 Data source: ECHA web-site, Exp Supporting Acute toxicity: dermal.003
Unknown	Rabbit; strain, sex and no/group are not specified	DCPD No data on analytical purity and physical state	Unknown	LD_{50} = 5080 mg/kg bw	Toxicol. Appl. Pharmacol., 20, 552, (1971); Data source: OECD SIDS

Table 27b: Summary table of human data on acute dermal toxicity

Type of data/report	Test substance, reference to table 5	Relevant information about the study (as applicable)	Observations	Reference
Signs and symptoms	DCPD	No data	Skin-redness and pain	IPCS, CEC; International Chemical Safety Card on Dicyclopentadiene. (October 2005). Available from, as of October 03, 2006 Data source: HSDB

Table 27c: Summary table of other studies relevant for acute dermal toxicity

Type of study/data	Test substance, reference to table 5	Relevant information about the study (as applicable)	Observations	Reference
No data available.				

Short summary and overall relevance of the provided information on acute dermal toxicity

The dermal toxicity of DCPD was evaluated in one OECD Guideline 402 study in rats (GLP compliant) and two studies in rabbits conducted with methods equivalent or similar to OECD Guideline 402, non-GLP. Another study lacks of details and is not considered sufficiently reliable for classification. Human data on acute dermal toxicity has insufficient details on conditions of exposure and can be used only as a supportive data.

The study 1989-01-17 is well performed and most reliable (OECD Guideline 402, GLP compliant) for classification purposes, but the result gives the range of values without upper limit: the acute dermal LD_{50} of 75% DCPD in the rat was greater than 2000 mg/kg bw. To consider the possibility of assigning the substance to Category 5 (2000 ≤ ATE < 5000 mg/kg bw), the additional data and confirmation is needed. Thus, the study from publication (1962) conducted with methods equivalent or similar to OECD Guideline 402 in New Zealand White rabbits (male) with the LD_{50} value of 4460 mg/kg is considered as a key study for the pilot exercise purposes.

Comparison with the GHS criteria

The LD_{50} value of 4460 mg/kg bw (New Zealand White rabbit, male) is within the range of values (2000 ≤ ATE < 5000 mg/kg bw) supporting a classification in Category 5 for acute dermal toxicity according to the GHS criteria.

Conclusion on classification and labelling for acute dermal toxicity

Classification with Category 5 for acute dermal toxicity is proposed.

Symbol: No symbol
Signal word: Warning
Hazard statement: H313: May be harmful in contact with skin.

Acute toxicity - inhalation route

Table 28a: Summary table of animal studies on acute inhalation toxicity

Method, test guideline, and deviation(s) if any	**Species, strain, sex, no/group**	**Test substance, reference to table 5, form and particle size (MMAD)**	**Dose levels, duration of exposure**	**Value LC_{50}**	**Reference**
equivalent or similar to OECD Guideline 403 Deviations: yes, 6 hour exposure GLP compliant	B6C3F1 mouse, male/female; No. of mice per sex per dose: 6	DCPD ~97% endo- and ~1% cyclopentadiene, Physical state: liquid at room temperature	46, 130, 260 and 557 ppm; Duration of exposure: 6 h Route of administration: inhalation: vapour	LC_{50} (male) = 143 ppm; Remarks = 774 mg/m^3 air (analytical) Calculated LC_{50} on 4 hour using Haber laws and n=3: LC_{50} = 0.886 mg/L LC_{50} (female) = 130 ppm; Remarks = 703 mg/m^3 (analytical) Calculated LC_{50} on 4 hour using Haber laws and n=3: LC_{50} = 0.804 mg/L LC_{50} (male/female) = 738.5 mg/m^3 air (analytical)=0.738 mg/L Calculated LC_{50} on 4 hour using Haber laws and n=3: LC_{50} =0.845 mg/L	Author not specified. Report date 1981-04-29 Data source: ECHA web-site, Exp Key Acute toxicity: inhalation.004

equivalent or similar to OECD Guideline 403 Deviations: yes, 6 hour exposure GLP compliant	Fischer 344 rat, male/female; No. of rats per sex per dose: 6	DCPD ~97% endo- and ~1% cyclopentadiene, Physical state: liquid at room temperature	46, 130, 260 and 557 ppm; Duration of exposure: 6 h Route of administration: inhalation: vapour	LC_{50} (male) = 284 ppm Remarks = 1536 mg/m³ air (analytical) Calculated LC_{50} on 4 hour using Haber laws and n=3: LC_{50} = 1.587 mg/L LC_{50} (female) = 353 ppm Remarks = 1910 mg/m³ air (analytical) Calculated LC_{50} on 4 hour using Haber laws and n=3: LC_{50} = 2.186 mg/L LC_{50} (male/female) = 1723 mg/m³ air (analytical) = 1.723 mg/L Calculated LC_{50} on 4 hour using Haber laws and n=3: LC_{50} = 1.972 mg/L	Author not specified. Report date 1981-04-29 Data source: ECHA web-site, Exp Key Acute toxicity: inhalation.002
equivalent or similar to OECD Guideline 403 Non-GLP	Albino rat, male/female; No. of rats per sex per dose: 6	98.3% DCPD, Isomeric mixture of endo/exo form in a 95:5 ratio Physical state: liquid	Dose levels not specified; Duration of exposure: 4 h Route of administration: inhalation: vapour	LC_{50} (male) = 359.4 ppm = 1943 mg/m^3 = 1.943 mg/L LC_{50} (female) = 385.2 ppm = 2083 mg/m^3 = 2.083 mg/L	Author not specified. Publication (1971) Data source: ECHA web-site, Exp Supporting Acute toxicity: inhalation.001
equivalent or similar to OECD Guideline 403 Deviations: yes, 1 dog/group Non-GLP	Beagle dog, female No. of animals per sex per dose: 1	98.3 % DCPD, Isomeric mixture of endo/exo form in a 95:5 ratio Physical state: liquid	68, 272, 458 and 773 ppm (measured); Duration of exposure: ca. 1 ca. 4 h Route of administration: inhalation: vapour	LC_{50} (female) = 458 - 773 ppm LC_{50} (female) = 2478 - 4181 mg/m³ air	Author not specified. Publication (1971) Data source: ECHA web-site, Exp Supporting Acute toxicity: inhalation.003

equivalent or similar to OECD Guideline 403 Non-GLP	Mouse, male; strain not specified; No. of animals per sex per dose: 6	DCPD, 98.3 %; Isomeric mixture of endo/exo form in a 95:5 ratio Physical state: liquid	Dose levels not specified; Duration of exposure: 4 h Route of administration: inhalation: vapour	LC_{50} (male) = 145.5 ppm LC_{50} (male) = 787 mg/m³ air (analytical)= 0.787 mg/L	Author not specified. Publication (1971) Data source: ECHA web-site, Exp Supporting Acute toxicity: inhalation.006
equivalent or similar to OECD Guideline 403 Deviations: yes, rabbit Non-GLP	Rabbit, male; strain not specified; No. of animals per sex per dose: 4	DCPD, 98.3 %; Isomeric mixture of endo/exo form in a 95:5 ratio Physical state: liquid	Dose levels not specified; Duration of exposure: 4 h Route of administration: inhalation: vapour	LC_{50} (male) = 771 ppm Remarks = 4171 mg/m^3 (analytical)	Author not specified. Publication (1971) Data source: ECHA web-site, Exp Supporting Acute toxicity: inhalation.005
Unknown	Rat; strain, sex and no/group are not specified	DCPD No data on analytical purity and physical state	Dose levels not specified; Duration of exposure: 4 h Route of administration: inhalation: unspecified	LC_{50} = 1000 ppm/4H	Brit.J. Industr. Med., 27,1 (1970); Data source: OECD SIDS
Unknown	Rat; strain, sex and no/group are not specified	DCPD No data on analytical purity and physical state	Dose levels not specified; Duration of exposure: 4 h Route of administration: inhalation: unspecified	LC_{50} = 660 mg/L	Hartley, D. and H. Kidd (eds.). The Agrochemicals Handbook. 2nd ed. Lechworth, Herts, England: The Royal Society of Chemistry, 1987., p. A716/Aug 87 Data source: HSDB

Unknown	Rat; strain, sex and no/group are not specified	DCPD No data on analytical purity and physical state	Dose levels not specified; Duration of exposure: 4 h Route of administration: inhalation: unspecified	LC_{50} = 500 ppm	Bingham, E.; Cohrssen, B.; Powell, C.H.; Patty's Toxicology Volumes 1-9 5th ed. John Wiley & Sons. New York, N.Y. (2001)., p. 2:39 Data source: HSDB
Unknown	Mouse; strain, sex and no/group are not specified	DCPD No data on analytical purity and physical state	Dose levels not specified; Duration of exposure: 4 h Route of administration: inhalation: unspecified	LC_{50} = 145 ppm	Bingham, E.; Cohrssen, B.; Powell, C.H.; Patty's Toxicology Volumes 1-9 5th ed. John Wiley & Sons. New York, N.Y. (2001)., p. 2:39 Data source: HSDB
Unknown	Guinea pig; strain, sex and no/group are not specified	DCPD No data on analytical purity and physical state	Dose levels not specified; Duration of exposure: 4 h Route of administration: inhalation: unspecified	LC_{50} = 770 ppm	Bingham, E.; Cohrssen, B.; Powell, C.H.; Patty's Toxicology Volumes 1-9 5th ed. John Wiley & Sons. New York, N.Y. (2001)., p. 2:39 Data source: HSDB

Table 28b: Summary table of human data on acute inhalation toxicity

Type of data/report	Test substance, reference to table 5	Relevant information about the study (as applicable)	Observations	Reference
Signs and symptoms	DCPD	No data	Inhalation – cough, sore throat, and headache	IPCS, CEC; International Chemical Safety Card on Dicyclopentadiene. (October 2005). Available from, as of October 03, 2006 Data source: HSDB

Table 27c: Summary table of other studies relevant for acute inhalation toxicity

Type of study/data	Test substance, reference to table 5	Relevant information about the study (as applicable)	Observations	Reference
No data available.				

Short summary and overall relevance of the provided information on acute inhalation toxicity

The acute inhalation toxicity of DCPD (vapour) was evaluated in six studies conducted with methods equivalent or similar to OECD Guideline 403 in different species. Two of these studies have a deviations in time exposure and, thus, these are not directly applicable to evaluation of acute inhalation, but it is possible to calculate LC_{50}'s for 4 h exposures using Haber's law with recommended n=3 as the extrapolation is to shorter duration. The calculated LC_{50} values for 4 h in mice are 0.886 mg/L (male), 0.804 mg/L (female) and 0.845 mg/L (male/female). The calculated LC_{50} values for 4 h in rats are 1.587 mg/L (male), 2.186 mg/L (female) and 1.972 mg/L (male/female). In the most reliable study among the studies performed by the method equivalent or similar to OECD Guideline 403 without deviations in time exposure the LC_{50} in Albino rats (male/female) was 359.4 ppm (male) and 385.2 ppm (female) equivalent to 1.943 and 2.083 mg/L, respectively.

Comparison with the GHS criteria

The calculated 4-hour LC_{50} values from the most reliable studies (equivalent or similar to OECD Guideline 403, GLP compliant) dated 1981-04-29 conducted with mice and rats are 0.804 mg/L (mice, female) and 1.587 mg/L (rats, male) warrant classification in Category 2 for acute inhalation toxicity according to the GHS criteria (the range of values for classification in Category 2 for vapour is $0.5 \leq ATE < 2.0$ mg/L). The LC_{50} value of 1.943 mg/L (Albino rat, male) provides further support for classification in Category 2.

Conclusion on classification and labelling for acute inhalation toxicity

Classification with Category 2 for acute inhalation toxicity is proposed.
Symbol: Skull and crossbones
Signal word: Danger
Hazard statement: H330: Fatal if inhaled.

8.2 Skin corrosion/irritation

Table 29a: Summary table of animal studies on skin corrosion/irritation

Method, test guideline, and deviation(s) if any	**Species, strain, sex, no/group**	**Test substance, reference to table 5**	**Dose levels, duration of exposure**	**Results** **-Observations and time point of onset** **-Mean scores/animal** **-Reversibility**	**Reference**
OECD Guideline 404 GLP compliant	New Zealand White rabbit, sex not specified; Number of animals: 3	75% DCPD Physical state: liquid	Type of coverage: semi-occlusive Amount/ concentration applied: 0.5 mL Duration of treatment / exposure: 4 hours	Observation period: 7 days. Irritation parameter: erythema score Basis: mean Time point: 24, 48 & 72 h Score: 2 Max. possible score: 4 Reversibility: fully reversible within: 7 days. Remarks: possible hyperkeratinisation at 7 days in all 3 animals. Irritation parameter: edema score Basis: mean Time point: 24, 48 & 72 h Score: 2.3 Max. possible score: 4 Reversibility: fully reversible within: 7 days.	Author not specified. Report date 1989-01-17 Data source: ECHA web-site, Exp Key Skin irritation/corrosion.002

equivalent or similar to OECD Guideline 404 Deviations: yes, study pre-dates guideline. Principles of method if other than guideline: Primary skin irritation Non-GLP	New Zealand White rabbit, sex not specified; Number of animals: 5	DCPD No data on analytical purity and physical state	Type of coverage: non-occlusive Amount/concentration applied: 0.01 mL (not stated if undiluted or solution) Duration of treatment / exposure: 24 hours	Irritation parameter: overall irritation score Basis: mean Time point: 24 h Score: 5 Max. possible score: 10 Remarks: moderate irritant Grade 1 indicated no irritation and Grade 2, the least visible capillary injection from the undiluted chemical. Responses above grade 6 indicated necrosis.	Author not specified. Publication (1962) Data source: ECHA web-site, Exp Supporting Skin irritation/corrosion.001
Unknown	New Zealand White rabbit, sex not specified; Number of animals: 3	75% DCPD No data on physical state	Type of coverage: semi-occlusive Amount/ concentration applied: 0.5 mL Duration of treatment / exposure: 4 hours	Observation period: 14 days Well-defined erythema was observed within 3 days of exposure in all animals. Signs of keratinization were observed on day 7. Moderate edema was observed at 24 hours in all animals, and regressed to slight by day 3. The primary irritation index was 4.7	TSCATS OTS0558246; Data source: US EPA Screening-level hazard characterization Document
Test method: Open irritation test Non-GLP	Rabbit, sex, strain and no/group not specified	DCPD No data on analytical purity and physical state	Not specified	No details; Result: Highly irritating	Achiev. Ind. Hyg. Occp. Med., 10, 61 (1954) Data source: OECD SIDS
Standard Draize test Non-GLP	Rabbit, sex, strain and no/group not specified	DCPD No data on analytical purity and physical state	Amount/concentration applied: 20 mg Duration of treatment / exposure: 24 hours	No details; Result: Moderate irritating	RTECS Database (Prehled Prumyslove Toxikologie 50 (1986) Data source: OECD SIDS

Table 29b: Summary table of human data on skin corrosion/irritation

Type of data/report	Test substance, reference to table 5	Relevant information about the study (as applicable)	Observations	Reference
Not specified	DCPD	Not specified	DCPD causes mild to severe eye, skin, and respiratory tract irritation, and severe response of the eyes and skin result from 24-hour exposure	Bingham, E.; Cohrssen, B.; Powell, C.H.; Patty's Toxicology Volumes 1-9 5th ed. John Wiley & Sons. New York, N.Y. (2001)., p. 2:38 Data source: HSDB
Not specified	DCPD	Not specified	... Eye and skin irritation from the undiluted material is relatively minor	American Conference of Governmental Industrial Hygienists. Documentation of the TLV's and BEI's with Other World Wide Occupational Exposure Values. CD-ROM Cincinnati, OH 45240-1634 2005., p. 1 Data source: HSDB

Table 29c: Summary table of other studies relevant for skin corrosion/irritation

Type of study/data	Test substance, reference to table 5	Relevant information about the study (as applicable)	Observations	Reference
No data available.				

Short summary and overall relevance of the provided information on skin corrosion/irritation

In the most reliable study (OECD Guideline 404, GLP compliant) dated 1989-01-17 with 75% DCPD, well-defined erythema and slight to severe oedema was present at skin sites of all New Zealand White rabbits at 24, 48 and 72 hour observations. On day 7 no oedema was noted but there were signs of possible hyperkeratinisation. No other adverse dermal reactions were noted during the study. The overall mean scores (24, 48 & 72 hr) were 2 for erythema and 2.3 for oedema. Under the conditions of the test, the DCPD would be considered to be irritation to rabbit dermal tissue.

In another study conducted by a method equivalent or similar to OECD Guideline 404 in New Zealand White rabbits, the overall irritation score was 5 of 10 after 24 hours exposure that correspond to moderate irritation according to the provided grades explanation. However, the exposure period of 24 hours in this study exceeds the recommended exposure period considered for classification purposes according to GHS criteria.

The information on the study in New Zealand White rabbits (method is unknown) provided in US EPA Screening-level hazard characterization Document includes the similar signs of skin reaction as in report dated 1989-01-17 from ECHA web-site but with less details. At the same time the slight difference in details (Observation period: 7 days in entry 1 and 14 days) is presented. The US EPA refers to TSCATS OTS0558246, but this source is publicly unavailable and, thus, it is not possible to confirm that if this data duplicate information on ECHA web-site (report 1989-01-17, Author not specified) or not. Hence it

appears that the information from TSCATS OTS0558246 should be mentioned separately but it can be used only as supportive data for the classification purpose because of the low details.

The 1954 study reported in rabbits by open irritation test doesn't provide any details on method or findings, thus, the result of this study considered as not reliable for the classification purpose.

The 1986 study reported by Standard Draize test in rabbits provides low level of study details of method without any details of findings. Furthermore, the exposure period of 24 hours in this study exceeds the recommended exposure period for classification purposes according to GHS criteria.

Human data were obtained from the reliable peer reviewed sources, but the primary sources of these data are unavailable and, thus, the information should be used carefully. This information supports skin irritation potential of a DCPD, but it can not serve as a sole basis for classification.

Comparison with the GHS criteria

GHS criteria for skin irritation Category 2: Mean score of ≥ 2.3 and ≤ 4.0 for erythema/eschar or for oedema in at least 2 of 3 tested animals from gradings at 24,48 and 72 hours after patch removal or, if reactions are delayed, from grades on 3 consecutive days after the onset of skin reactions;
Based on defined edema with score 2.3 at skin sites of all New Zealand White rabbits at 24, 48 and 72 hour observations from the most reliable study (1989-01-17), classification with Category 2 is proposed for skin irritation.

Conclusion on classification and labelling for skin corrosion/irritation

Classification with Category 2 is proposed for skin irritation.
Symbol: Exclamation mark
Signal word: Warning
Hazard statement: H315: Causes skin irritation

8.3 Serious eye damage/eye irritation

Table 30a: Summary table of animal studies on serious eye damage/eye irritation

Method, test guideline, and deviation(s) if any	Species, strain, sex, no/group	Test substance, reference to table 5	Dose levels, duration of exposure	Results -Observations and time point of onset -Mean scores/animal -Reversibility	Reference
OECD Guideline 405 GLP compliant	New Zealand White rabbit; sex not specified. Number of animals: 3	75% DCPD Physical state: liquid	Amount/ concentration applied: 0.1 mL Single application	Observation period: 7 days Irritation parameter: cornea score Basis: mean Time point: 24- 72 h Score: 0 Max. possible score: 4 Irritation parameter: iris score Basis: mean Time point: 24- 72 h Score: 0 Max. possible score: 2 Irritation parameter: conjunctivae score Basis: mean Time point: 24- 72 h Score: 0.43 Max. possible score: 3 Reversibility: fully reversible within: 7 days Remarks: slight redness present in 1 animal at 72 h. Irritation parameter: chemosis score Basis: mean Time point: 24- 72 h Score: 0.1 Max. possible score: 4 Reversibility: fully reversible within: fully reversible within: 48 h Remarks: slight chemosis in 1 rabbit at 24 h	Author not specified. Report date 1989-01-17 Data source: ECHA web-site, Exp Key Eye irritation.002

Draize eye irritation test with irrigation after application Non-GLP	New Zealand White rabbit Number of animals:9	98-99% pure DCPD Physical state: waxy solid, liquefied on slight warming	Amount(s) applied (volume or weight with unit): 0.1 mL Duration of treatment / exposure: 3 rabbits : eye washed at 2 seconds after application 3 rabbits : eye washed at 4 seconds after application 3 rabbits: eyes not washed	Observation period: 14 days Irritation parameter: conjunctivae score Basis: mean Time point: 24, 48, 72 h Score: 0.89 Max. possible score: 3 Reversibility: fully reversible within: 3 days Remarks: eye not irrigated Irritation parameter: conjunctivae score Basis: mean Time point: 24, 48, 72 h Score: 0.22 Max. possible score: 3 Reversibility: fully reversible within: 3 days Remarks: eye irrigated at 2 seconds Irritation parameter: conjunctivae score Basis: mean Time point: 24, 48, 72 h Score: 0.78 Max. possible score: 3 Reversibility: fully reversible within: 3 days Remarks: eye irrigated at 4 seconds	Author not specified. Report date 1976-06-24 Data source: ECHA web-site, Exp Supporting Eye irritation.001
Open irritation test Non-GLP	Rabbit; strain, sex, no/group not specified	DCPD No data on analytical purity and physical state	Dose: 500 mg Duration of exposure not specified	Result: irritating	Smyth et al. Range finding toxicity data: List VI. Am. Med. Assoc. Archives of. Ind. Hyg. Occp. Med., 10, 61 (1954) Data source: OECD SIDS

Standard Draize test Non-GLP	Rabbit; strain, sex, no/group not specified	DCPD No data on analytical purity and physical state	Dose: 500 mg Duration of exposure: 24h	Result: moderate irritating.	RTECS Database (Prehled Prumyslove Toxikologie 50 (1986) Data source: OECD SIDS

Table 30b: Summary table of human data on serious eye damage/eye irritation

Type of data/report	**Test substance, reference to table 5**	**Relevant information about the study (as applicable)**	**Observations**	**Reference**
Study with volunteers Human sensory response	96.7% DCPD, isomeric mixture of endo/exo in a 95:5 ratio Physical state: liquid	Number of subjects exposed: 2 Age: 24-47 years Route of exposure: inhalation Exposure was in a glass-lined 12800 L room from which the vapour-air mixture was exhausted at 2500-3200 L/min.	During the 30-min exposure to 1 ppm, one subject experienced slight eye and throat irritation at 7 min and one subject reported olfactory fatigue after 24 min. No olfactory fatigue was reported by either subject during the 30-min exposure to 5.5 ppm DCPD vapour. Eye irritation was reported by one subject after 10 min at this concentration.	Author not specified. Publication 1971 Data source: ECHA web-site, Exposure related observations in humans: Direct observations: clinical cases, poisoning incidents and other
Not specified	DCPD No data on analytical purity and physical state	Not specified	DCPD causes mild to severe eye, skin, and respiratory tract irritation, and severe response of the eyes and skin result from 24-hour exposure	Bingham, E.; Cohrssen, B.; Powell, C.H.; Patty's Toxicology Volumes 1-9 5th ed. John Wiley & Sons. New York, N.Y. (2001)., p. 2:38 Data source: HSDB

Not specified	DCPD No data on analytical purity and physical state	Not specified	... Eye and skin irritation from the undiluted material is relatively minor	American Conference of Governmental Industrial Hygienists. Documentation of the TLV's and BEI's with Other World Wide Occupational Exposure Values. CD-ROM Cincinnati, OH 45240-1634 2005., p. 1 Data source: HSDB

Table 30c: Summary table of other studies relevant for serious eye damage/eye irritation

Type of study/data	Test substance, reference to table 5	Relevant information about the study (as applicable)	Observations	Reference
No data available.				

Short summary and overall relevance of the provided information on serious eye damage/eye irritation

Four studies in rabbit are available. The results of two of the studies (Open irritaition test 1954 and Standard Draize test 1986) support DCPD as an irritant to eyes. The dose and exposure reported in these two reports were 500 mg/24 hrs, other details of studies including scores were not available.

In GLP compliant OECD Guideline 405 study, eye irritation was assessed in 3 New Zealand white rabbits. 0.1 mL DCPD 75% was instilled into the conjunctival sac and the eyes were scored for irritation responses at 1, 24, 48 and 72 hours and at 7 days after instillation. At 1 hour, corneal dulling was present in 2 eyes, iridial inflammation and moderate conjunctival irritation were present in all 3 eyes, giving an overall mean score of 18.5 at 1 hour, which corresponds to moderate irritation (Kay and Callandra, 1962). Signs of irritation regressed to minimal in 2 eyes at 24 hours but persisted in 1 animal at 48 and 72 hours. All effects were fully reversible within 7 days. 75% DCPD was a moderate irritant to the rabbit eye at 1 hour but was practically non-irritating at 24, 48 and 72 hours.

In Draize eye irritation test with irrigation after application eye irritation was assessed in 3 New Zealand white rabbits. 0.1 mL DCPD was instilled into the conjunctival sac and the eyes were scored for irritation responses at 1, 2, 3, 4, 7 and 14 days after instillation. Some irritation of the conjunctivae was observed in 7 of the 9 rabbits following instillation. Irritation was reduced but not prevented by irrigation 2 or 4 seconds after application. In all cases, irritation was confined to the conjunctivae and all eyes were normal by the third day. DCPD was practically non-irritating at 24, 48 and 72 hours.

One of two human volunteers experienced slight eye irritation at 7 min of 30-min exposure to 1 ppm of 96.7% DCPD in human sensory response study 1971. After 10 min of 30-min exposure to 5.5 ppm DCPD vapour eye irritation was reported by one volunteer. Although these data are from a small number of

exposed people, the severity of effect was slight and there is no information that irritation was long lasting, thus these data are considered as reliable but not sufficient for classification purposes.

There is also human data with lack of details of exposure. According to Bingham, E.,Cohrssen, B. and Powell, C.H. (2001) DCPD causes mild to severe eye, skin, and respiratory tract irritation, and severe response of the eyes and skin result from 24-hour exposure. Documentation of the TLV's and BEI's with Other World Wide Occupational Exposure Values mentioned that "... Eye and skin irritation from the undiluted material is relatively minor". These data were obtained from the reliable peer reviewed sources, but the primary sources of these data are unavailable and, thus, the information should be used carefully. This information supports eye irritation potential of a DCPD, but it can not serve as a basis for classification.

Comparison with the GHS criteria

Table 3.3.2 of the GHS provides the following criteria for serious eye damage/eye irritation:

	GHS Criteria
	Substances that have the potential to induce reversible eye irritation
Category 2/2A	Substances that produce in at least 2 of 3 tested animals a positive response of: (a) corneal opacity ≥ 1; and/or (b) iritis ≥ 1; and/or (c) conjunctival redness ≥2; and/or (d) conjunctival oedema (chemosis) ≥ 2 calculated as the mean scores following grading at 24,48 and 72 hours after instillation of the test material, and which fully reverses within an observation period of normally 21 days.
Category 2B	Within category 2A an eye irritant is considered mildly irritating to eyes (Category 2B) when the effects listed above are fully reversible within 7 days of observation

Based on reliable GLP compliant OECD Guideline 405 study and Draize eye irritation test with irrigation after application as a supportive study it is proposed not to classify DCPD as serious eye damage/eye irritant.

Conclusion on classification and labelling for serious eye damage/eye irritation

Not classified.

8.4 Respiratory or skin sensitisation

Respiratory sensitisation

Table 31a: Summary table of animal studies on respiratory sensitisation

Method, test guideline, and deviation(s) if any	**Species, strain, sex, no/group**	**Test substance, reference to table 5**	**Dose levels, duration of exposure**	**Results**	**Reference**
No data available.					

Table 31b: Summary table of human data on respiratory sensitisation

Type of data/report	Test substance, reference to table 5	Relevant information about the study (as applicable)	Observations	Reference
No data available.				

Table 31c: Summary table of other studies relevant for respiratory sensitisation

Type of study/data	Test substance, reference to table 5	Relevant information about the study (as applicable)	Observations	Reference
No data available.				

Short summary and overall relevance of the provided information on respiratory sensitisation

No data available.

Comparison with the GHS criteria

It is not possible to compare with the GHS criteria because there is no data available.

Conclusion on classification and labelling for respiratory sensitisation

Not classified.

Skin sensitisation

Table 32a: Summary table of animal studies on skin sensitisation

Method, test guideline, and deviation(s) if any	Species, strain, sex, no/group	Test substance, reference to table 5	Dose levels, duration of exposure	Results	Reference
OECD Guideline 406 (Modified Buehler test) GLP compliant	Dunkin-Hartley guinea pig, female; No. of animals per dose: 12	75% DCPD Physical state: liquid	Dose level: undiluted liquid: A. INDUCTION EXPOSURE No. of exposures: 9 Exposure period: 6 hours Test groups: yes Control group: yes Site: an area on the shoulder Frequency of applications: on	Results of test: Reading: 1st reading Hours after challenge: 24 Group: test group Dose level: undiluted test material No. with + reactions: 0 Total no. in group: 12 Reading: 2nd reading Hours after challenge: 48 Group: test group Dose level: undiluted test material	Author not specified. Report date 1989-01-17 Data source: ECHA web-site, Exp Key Skin sensitisation. 002

			days 0, 2, 4, 7, 9, 11, 14 16 and 18 Concentrations: 0.5 mL of undiluted test material B. CHALLENGE EXPOSURE No. of exposures: 1 Day(s) of challenge: 10 Exposure period: 6 hours Test groups: yes Control group: yes Site: an area of flank Concentrations: 0.2 mL of undiluted test material Evaluation (hr after challenge): Approximately 24 and 48 hours after patch removal Route of exposure: epicutaneous, occlusive	No. with + reactions: 0 Total no. in group: 12 Reading: 1st reading Hours after challenge: 24 Group: negative control Dose level: blank patch No. with + reactions: 0 Total no. in group: 12 Reading: 2nd reading Hours after challenge: 48 Group: negative control Dose level: blank patch No. with + reactions: 0 Scattered mild redness was commonly seen at the induction sites during the induction phase. Other adverse skin reactions were fissuring, dry, thickened, straw-coloured skin (possible hyperkeratinisation), loss of skin suppleness, superficial cracking of the skin and small superficial scattered scabs. These reactions sometimes precluded evaluation of erythema. No signs of skin irritation were noted in control animals during induction. No skin responses were noted in test or control animals at 24 or 48 hours after challenge.	
Draize test Non-GLP Deviations: intracutaneous injection	Guinea pig; strain and sex are not specified. No. of animals per dose: 8	98-99% DCPD Physical state: waxy solid, liquefied on slight warming	Concentration: 0.1 % w/v A. Induction exposure: 3 weeks B. Challenge exposure: single dose	Results of test: Reading: 1st reading Hours after challenge: 24 Group: test group Dose level: 0.1% w/v No. with + reactions: 0 Total no. in group: 8 Clinical observations: mild erythema Reading: 2nd reading Hours after challenge: 48 Group: test group Dose level: 0.1% w/v No. with + reactions: 0 Total no. in group: 8 Clinical observations: mild erythema Reading: 1st reading Hours after challenge: 24 Group: positive control	Author not specified. Report date 1976-06-24 Data source: ECHA web-site, Exp Supporting Skin sensitisation. 001

				Dose level: 2,4-DNCB No. with + reactions: 4 Total no. in group: 4 Clinical observations: marked skin reactions Reading: 2nd reading Hours after challenge: 24 Group: positive control Dose level: 2,4-DNCB No. with + reactions: 4 Total no. in group: 4 Clinical observations: marked skin reactions	

Table 32b: Summary table of human data on skin sensitisation

Type of data/report	Test substance, reference to table 5	Relevant information about the study (as applicable)	Observations	Reference
No data available.				

Table 32c: Summary table of other studies relevant for skin sensitisation

Type of study/data	Test substance, reference to table 5	Relevant information about the study (as applicable)	Observations	Reference
No data available.				

Short summary and overall relevance of the provided information on skin sensitisation

In a modified (9 induction) Beuhler test (GLP compliant) in female guinea pigs, there were no skin responses following challenge with undiluted DCPD 75%w. 75% DCPD is therefore considered to be non-sensitising to guinea pig skin.

In a Draize test in guinea pigs, 0.1% DCPD was shown to be non-sensitising following intracutaneous challenge.

Comparison with the GHS criteria

There were no positive responses in studies with rabbits according to OECD Guideline 406. Human data is not available.

Conclusion on classification and labelling for skin sensitisation

Not classified.

8.5 Germ cell mutagenicity

Table 33a: Summary table of mutagenicity/genotoxicity tests in vitro

Method, test guideline, and deviation(s) if any	Test substance, reference to table 5	Relevant information about the study including rationale for dose selection (as applicable)	Observations	Reference
OECD Guideline 476 EU Method B.17 EPA OTS 798.5300 GLP compliant	95% DCPD Physical state: liquid	Species/strain/ cell line: mouse lymphoma L5178Y cells Metabolic activation: with and without Metabolic activation system: PB/BNF S9 fraction prepared in-house from the livers of male Sprague-Dawley rats following three consecutive daily doses of phenobarbital/ß-naphthoflavone (80/100 mg/kg bw/day). Test concentrations: 0, 5.16, 10.31, 20.63, 41.25, 82.5, 165, 330, 660, 1320 µg/mL (initial toxicity test) 10, 15, 20, 25, 30, 35 µg/mL (expt 1: 4h -S9) 10, 20, 30, 40, 50, 60 µg/mL (expt 1: 4h +S9) 5, 10, 20, 30, 40, 50 µg/mL (expt 2: 24h -S9) 10, 20, 30, 40, 45, 50 µg/mL (expt 2: 4h +S9) Vehicle: DMSO Exposure duration: 4 hours (24 hours in experiment 2 in the absence of S9) Expression time (cells in growth medium): 2 days Selection time (if incubation with a selection agent): 10-14 days Selection agent (mutation assays): 5-trifluorothymidine	Result: Genotoxicity: negative Cytotoxicity: yes There was evidence of marked toxicity following exposure to the test item in the absence and presence of S9. Near optimum levels of toxicity were achieved in the absence of S9, but not in the presence of S9, despite a narrow concentration selection, due to the steep toxicity curve. A dose level that exceeded the upper limit for toxicity was plated for viability and TFT resistance as sufficient cells were available. The vehicle controls had MF that were considered acceptable for the L5178Y cell line at the TK +/- locus. Both positive controls induced marked increases in mutant frequency. The test item did not induce any statistically significant or dose-related increases in the mutant frequency, either in the absence or presence of S9.	Study report 2014. Author not specified. Data source: ECHA website - Exp Key Genetic toxicity in vitro.004
equivalent or similar to OECD Guideline 471 (Bacterial	98-99% DCPD Physical state: liquid	Species/strain: other: S. typhimurium, TA98, TA100, TA1535, TA1537, TA1538 Metabolic activation: with and without	Genotoxicity: negative Cytotoxicity: yes toxic at 5 µL/plate	Author not specified. Report (1980) Data source: ECHA web-

Reverse Mutation Assay) with deviations: E.coli was not included in the test Non-GLP		Metabolic activation system: Aroclor induced rat liver S9 Non-activated: 0.001, 0.01, 0.1, 1.0 or 5.0 µL/plate Activated: 0.001, 0.01, 0.1, 1.0, 5.0 or 10 µL/plate The plates were incubated for 48 hours at 37°C, and scored for the number of colonies growing on each plate.		site, Exp Supporting Genetic toxicity in vitro.001
Bacterial reverse mutation assay acc. to OECD Guideline 471 acc. to EU Method B.13/14 GLP compliant	75% DCPD Physical state: liquid	Species/strain: - S. typhimurium TA 1535, TA 1537, TA 98 and TA 100; - E. coli WP2 uvr A. Metabolic activation: with and without Metabolic activation system: S9 from Arochlor 1254 induced rat liver. Dose range 1-666 µg/plate. Preincubation period: 30 minutes Exposure duration: 48 hours; Number of replications: 2	Species/strain: S. typhimurium TA 1535, TA 1537, TA 98 and TA 100 Metabolic activation: with and without Genotoxicity: negative Cytotoxicity: yes Species/strain: E. coli WP2 uvr A Metabolic activation: with and without Genotoxicity: negative Cytotoxicity: yes	Author not specified. Report date 2000-03-08 Data source: ECHA web-site, Exp Key Genetic toxicity in vitro.002
Japan Guidelines for Screening Mutagenicity Testing Of Chemicals GLP compliant	95% DCPD Physical state: unspecified	Species/strain: Chinese hamster lung (CHL/IU) cells. Metabolic activation: with and without Metabolic activation system: Rat liver (strain not specified). Phenobarbital and 5,6-benzoflavone induced (Treatment not specified). First experiment: 24 and 48 hour continuous treatment (-S9): 0.0, 0.014, 0.029, 0.057 mg/mL Second experiment: 24 hour continuous treatment (-S9): 0.0, 0.029, 0.043, 0.057 mg/mL Short-term treatment: (-S9): 0.0, 0.014, 0.029, 0.057 mg/mL (+S9): 0.0, 0.03, 0.05, 0.10 mg/mL Number of replications: 2 cultures per dose level	DCPD did not induce structural chromosomal aberrations or polyploidy in CHL/IU cells up to a concentration causing more than 50% cell growth inhibition with or without metabolic activation. Structural chromosomal aberrations were marginally induced at the highest dose –S9, 0.057mg/mL, after 24 hr continuous exposure. Result: Genotoxicity: negative Cytotoxicity: yes	1) Author not specified. Information sheet (1998) & Report date 1993-12-31 2) MHW, Japan (1997) Data source: 1) ECHA web-site, Exp Key Genetic toxicity in vitro.005; 2) OECD SIDS, MHW, Japan

equivalent or similar to OECD Guideline 480 (Genetic Toxicology: Saccharomyces cerevisiae, Gene Mutation Assay) Non-GLP	98-99% DCPD Physical state: liquid	Species/strain: Saccharomyces cerevisiae. Metabolic activation: with and without Metabolic activation system: Aroclor induced rat liver S9 Test concentrations: Non-activated: 0.001, 0.01, 0.1, 1.0 or 5.0 µL/plate Activated: 0.001, 0.01, 0.1, 1.0, 5.0 or 10 µL/plate. The plates were incubated for 48 hours at 37°C, and scored for the number of colonies growing on each plate.	Genotoxicity: negative Cytotoxicity: yes toxic at 5 µL/plate	Author not specified. Report (1980) Data source: ECHA web-site, Exp Supporting Genetic toxicity in vitro.003
Salmonella/ microsome preincubation assay Non-GLP	DCPD No data on analytical purity and physical state	Species/strain: Salmonella typhimurium strains (TA98, TA100, TA1535, and TA1537) Doses: 0, 3, 10, 33, 100, and 333 ug/plate Metabolic activation: with and without Metabolic activation system: Aroclor-induced rat or hamster liver S9	DCPD was negative in these tests and the highest ineffective dose level tested without clearing of the background lawn in any Salmonella tester strain was 100 ug/plate. Result: Genotoxicity: negative	1) Zeiger E et al; Environ Mutagen 9: 1-110 (1987) 2) US EPA Genetox Program (1988) Data source: 1) HSDB 2) OECD SIDS
Method preincubation Test unknown Non-GLP	DCPD No data on analytical purity and physical state	Species/strain: - S. typhimurium TA98, TA100, TA1535, TA1537, TA1538; - E. coli WP2UVRA. Metabolic activation: with and without Metabolic activation system: rat liver S-9, phenobarbital and beta-naphthoflavone. Dose range 1.56-400 µg/plate Vehicle(s)/solvent(s) used: DMSO.	Result: Genotoxicity: negative	Japan Chemical Industry Ecology-Toxicology And Information Center, Japan; mutagenicity test data of existing chemical substances based on the toxicity investigation of the Industrial Safety And Health Law; 1996 Data source: CCRIS

Table 33b: Summary table of mutagenicity/genotoxicity tests in mammalian somatic or germ cells in vivo

Method, test guideline, and deviation(s) if any	Test substance, reference to table 5	Relevant information about the study (as applicable)	Observations	Reference
Micronucleus assay acc. to OECD Guideline 474, EPA OPPTS 870.5395 and EU Method B.12 GLP compliant	Dicyclopentadiene/ Codimer Concentrate CAS: 68478-10-4 29.175 wt % endo- and exo-DCPD 18.726 wt % C4-MCPD and C5-MCPD codimers 13.210 wt % MCPD dimer 12.903 wt % CPD-MCPD codimer 8.129 wt % C8 aliphatic and aromatic hydrocarbons 7.144 wt % C4-CPD and C5-CPD codimers 3.625 wt % MCPD-C7 dimer 2.771 wt % Tetrahydroindene 1.917 wt % Trimers 0.927 wt % C7 cyclic hydrocarbon 0.697 wt % C5 acyclic hydrocarbon dimer 0.634 wt % MCPD monomer 0.078 wt % CPD monomer 0.063 wt % C6 acyclic hydrocarbons Physical state: liquid	Test animals: Crl:CD-1®(ICR)BR mouse, male/female Doses / concentrations: 0, 437.5, 875, or 1750 mg/kg body weight Two doses at an approximate 24-hour interval No. of animals per sex per dose: 5/sex/group (0, 437.5, or 875 mg/kg body weight and positive controls), 7/sex/group (1750 mg/kg body weight).	Test results: Genotoxicity: negative Clinical signs observed in male and female animals at 1750 mg/kg included ataxia, lethargy, and hyperactivity. In addition, male animals exhibited spasms, and female animals exhibited ruffled fur, prostration, and hyperreactivity. No clinical signs of toxicity were observed in male or female animals at 875 or 427.5 mg/kg. An 18% and 14% decrease in terminal body weight was observed for the high dose males and females, respectively, as compared with their initial body weights The terminal body weight loss for the high dose groups, as compared with the controls, was 18% for males and 13% for females. Both observed body weight reductions are considered test substance-related signs of systemic toxicity. The body weight loss in males is also considered biologically significant. No statistically significant or biologically relevant effects on micronuclei frequencies were observed in the bone marrow cells in any dose group treated with DCPD/Codimer Concentrate. Although not statistically significant, a depression of approximately 30% in the PCE/NCE ratio was seen at 1750 mg/kg in females The vehicle and positive control groups exhibited a response consistent with the laboratory's historical control data. The positive control, cyclophosphamide, induced a significant increase in the frequency of micronucleated PCEs ($p < 0.05$).	Author not specified. Report date 2004-07-25 Data source: ECHA web-site, Exp Supporting Genetic toxicity in vivo

Table 33c: Summary table of human data relevant for germ cell mutagenicity

Type of data/report	Test substance, reference to table 5	Relevant information about the study (as applicable)	Observations	Reference
No data available.				

Short summary and overall relevance of the provided information on germ cell mutagenicity

There are seven studies of mutagenicity or genotoxicity *in vitro* available. All of tests results are negative. Only one *in vivo* study with Dicyclopentadiene/ Codimer Concentrate (CAS: 68478-10-4) contained ~ 30% DCPD and ~70% similar hydrocarbon substances is available which shows negative result. DCPD did not demonstrate mutagenic activity with or without metabolic activation.

Comparison with the GHS criteria

GHS criteria for Categories of germ cell mutagens are based on positive evidence from human epidemiological studies, positive result(s) from *in vivo* or *in vitro* tests or positive evidence obtained from experiments in mammals and /or *in vitro* experiments.

There were no positive results reported in mutagenic tests with DCPD.

Conclusion on classification and labelling for germ cell mutagenicity

Not classified.

8.6 Carcinogenicity

Table 34a: Summary table of animal studies on carcinogenicity

Method, test guideline, and deviation(s) if any	Species, strain, sex, no/group	Test substance, reference to table 5	Dose levels, duration of exposure	Results	Reference
Unknown	Rat; strain, sex and no/group are not specified	DCPD No data on analytical purity and physical state	Unspecified. Route of administration – intramuscular	There were no findings of carcinogenic properties of DCPD	Rosenblatt et al. (1975): NTIS Rep. No. AD-AO 30 428, J1-8. Data source: ECHA website – NS NS Carcinogenicity. 001

Table 34b: Summary table of human data on carcinogenicity

Type of data/report	Test substance, reference to table 5	Relevant information about the study (as applicable)	Observations	Reference
No data available.				

Table 34c: Summary table of other studies relevant for carcinogenicity

Type of study/data	Test substance, reference to table 5	Relevant information about the study (as applicable)	Observations	Reference
No data available.				

Table 34d: Are the following factors taken into consideration in the hazard assessment? - No

Reference	Species and strain	Tumour type and background incidence	Multi-site responses	Progression of lesions to malignancy	Reduced tumour latency	Responses in single or both sexes	Confounding effect by excessive toxicity?	Route of exposure	MoA and relevance to humans
No applicable.									

Short summary and overall relevance of the provided information on carcinogenicity

There is only one study report on carcinogenicity of DCPD that is available. There were no findings of carcinogenic properties of DCPD in this study, but as there is no information of method used, GLP compliance, dose levels and other details, the result can't be used for evaluation and classification purposes.

Comparison with the GHS criteria

GHS criteria for Categories of carcinogens are based on positive evidence obtained from human and/or animal studies. There is only one study report on carcinogenicity of DCPD that is available and the results found no evidence of carcinogenic properties of DCPD. However, this study can't be used for classification purposes because of low details (unknown method, dose concentration etc). Based on absence data on carcinogenicity and absence of mutagenic activity of DCPD confirmed *in vivo* and *in vitro* studies (see section 8.5) no classification is warranted for DCPD on carcinogenicity.

Conclusion on classification and labelling for carcinogenicity

Not classified.

8.7 Reproductive toxicity

Adverse effects on sexual function and fertility

Table 35a: Summary table of animal studies on adverse effects on sexual function and fertility

Method, test guideline, and deviation(s) if any	Species Strain Sex no/group	Test substance, reference to table 5	Dose levels duration of exposure	Results	Reference
OECD Guideline 422 GLP compliant	Sprague-Dawley rat, male/ female; No. of animals per sex per dose: 10	94.65% DCPD Physical state: liquid	Doses / concentrations: 0, 4, 20 or 100 mg/kg/day Duration of exposure: Males 44 days; Females from 14 days before mating through gestation and parturition until day 3 of lactation	Effect levels: Endpoint: NOAEL Generation: F1 Effect level: 20 mg/kg bw/day (nominal) Clinical signs and mortality: yes, two females in the high dose (100 mg/kg bw) group died. The following major observations were noted: lung congestion, enlargement of the adrenal gland, and bleeding of the gastric mucosa and thymus. Body weight and food consumption: yes, males and surviving females showed slight suppression of body wt gain and decreased food consumption. Reproductive function: estrous cycle: not examined Reproductive function: sperm measures: not examined Reproductive performance : no effects Organ weights: yes, there were increased liver and kidney weights in male rats given 100 mg/kg Gross pathology: no effects Histopathology: yes, in male rats given 100 mg/kg, single cell necrosis in liver, and hyaline droplets and basophilic changes in tubular epithelium of kidneys was seen. Increase in fatty droplets in fascicular zone of	Author not specified. Information sheet date1998-03-30 Report date 1993-12-31 Data source: ECHA website - Exp Key Toxicity to reproduction.003

				adrenals was observed in both males and females in the 100 mg/kg bw group. Similar histopathological changes were seen in kidneys of 4, 20 mg/kg bw group male rats and in adrenals of 20 mg/kg bw group male rats. Other findings: Blood chemistry of high dose males showed increase in GOT and GPT; no test material related changes occurred in haematology parameters for any treatment group.	
equivalent or similar to OECD Guideline 416 Deviations: yes, three generation study Non-GLP	Sprague-Dawley rat, male/ female; No. of animals per sex per dose: 10 males, 20 females	98-99% DCPD	Doses / concentrations: 0, 80, 750 ppm (nominal in diet) 0, 69.3 or 693 ppm (analytical conc.) Duration of treatment / exposure: For 7 weeks prior to mating of the F0 parents through to study termination.	Effect levels: Endpoint: NOAEL Sex: male/female Effect level: 80 - 750 ppm (69 - 693 ppm actual concentration) equivalent to 60 mg/kg bw/day Clinical signs: no effect Body weight and food consumption: yes, mean food consumption at 20 weeks in the F1B parents was reduced in both sexes in a treatment-related manner, with statistical significance at the high level. Reproductive function: estrous cycle: not examined Reproductive function: sperm measures: not examined Reproductive performance: at high dose female fertility was reduced in the F2A and F2B generations, however, the differences from control were not statistically significant and this may have been due to one male in the 750 ppm group that failed to sire litters in either mating.Organ weights: not examined Gross pathology: no effects Histopathology: not examined No gross structural abnormalities /malformations were seen in pups of any generation	Author not specified. Report (1980) Data source: 1) ECHA website - Exp Supporting Toxicity to reproduction.002 2) ECETOC publication. JACC No. 19

Reproducti-ve Assessment by Continuous Breeding Protocol (NTP, 1989) GLP compliant	Sprague-Dawley rat, male/ female; No. of animals per sex per dose: 20	DCPD No data on analytical purity and physical state	Doses / concentrations: 10, 30, and 100 mg/kg bw/day Duration of treatment / exposure: from one week prior to mating through to study termination.	Reproductive toxicity was observed in the 100 mg/kg bw group females: 28% fewer F1 pups born live, 8% lower adjusted live F1 pup weights, higher F1 pup mortality, increased cumulative days to litter, and decreased F1 pup survival in the final litter. At 30 mg/kg there was a 4% decrease in the female pup weight. Result of crossover mating: pup weight was reduced (9%), in the DCPD-treated females, while no effects were observed in litters from DCPD-treated males. Necropsy: DCPD caused a 2%, 7%, and 17% increase in liver weights and a 16%, 15%, and 16% increase in kidney weights in males from the 10, 30, and 100 mg/kg bw groups, respectively. Microscopically: an increase in the incidence of clear cell foci was observed in the livers of 30 and 100 mg/kg bw rats. In the second generation, DCPD at 100 mg/kg bw caused a 12% reduction in F2 pup weight in the presence of increased F1 liver and kidney weights. The reproductive effects of DCPD were not greater than those observed in the first generation.	Jamieson, H.M., Delaney, J.C., Wolfe, G.W. and Chapin, R.E. (1995) "Reproductive effects of dicyclopentadiene in S-D rats assessed by a continuous breeding protocol." The Toxicologist. 15:166. Abstract No. 880 Data source: 1) HSDB2) ECHA website - Exp Supporting Toxicity to reproduction.001

Table 35b: Summary table of human data on adverse effects on sexual function and fertility

Type of data/report	Test substance, reference to table 5	Relevant information about the study (as applicable)	Observations	Reference
No data available.				

Table 35c: Summary table of other studies relevant for toxicity on sexual function and fertility

Type of study/data	Test substance, reference to table 5	Relevant information about the study (as applicable)	Observations	Reference
No data available.				

Short summary and overall relevance of the provided information on adverse effects on sexual function and fertility

According to report dated 1993-12-31 and information sheet dated 1998-03-30, in OECD Guideline 422 study, 94.65% DCPD induced systemic toxicity (slight suppression of body weight gain and decreased food consumption) in male and female rats at 100 mg/kg bw/day dose level. Lethality in 2/10 dams with evidence of lung congestion, enlargement of the adrenal gland, and bleeding of the gastric mucosa and thymus was reported at high dose level No compound-related effects were seen on reproductive parameters such as mating index, fertility index, gestation length, number of corpora lutea or implantations, implantation index, gestation index, delivery index or parturition. However two dams in the 100 mg/kg group had total litter loss during the lactation period. It is likely that these are the females that died, but not specified in report. A low viability index and tendency to lower birth wt and body wt gain was observed in neonates in the highest dose group (100 mg/kg bw) but not at lower dose levels. As these adverse effects were seen only at a dose level causing marked systemic toxicity, these are not considered relevant for classification purposes.

In OECD Guideline 416 study report (1980) dietary administration of DCPD at nominal concentrations of 80 and 750 ppm to three successive generations of male and female albino rats had no deleterious effects on reproductive performance or general condition of the animals, in comparison to performance of control rats maintained concurrently. However, DCPD was not devoid of reproductive or systemic effects at the high dietary level. Mean food consumption at 20 weeks in the F1B parents was reduced in both sexes in a treatment-related manner, with statistical significance at the 750 ppm level. At 750 ppm, female fertility was reduced in the F2A and F2B generations, however, the differences from control were not statistically significant, and this may have been due to one male in the 750 ppm group that failed to sire litters in either mating. No evidence of dose-related developmental effects was seen in pups of any generation.

In the reproductive assessment by continuous breeding protocol/oral gavage study conducted by NTP in rats, reproductive toxicity (increased days to litter, increased pup mortality, fewer pups born alive and lower pup weights) were noted in the presence of slight maternal toxicity (increased liver weight) at 100 mg/kg body weight/day indicating that DCPD affected intrauterine and post natal survival of the pups. Only limited information is available about the study and the full report could not be obtained.

Comparison with the GHS criteria

According to the GHS criteria the Category 2 for reproductive toxicity includes “substances for which there is some evidence from humans or experimental animals, possibly supplemented with other information, of an adverse effect on sexual function and fertility, or on development, in the absence of other toxic effects, or if occurring together with other toxic effects the adverse effect on reproduction is considered not to be a secondary non-specific consequence of the other toxic effects, and where the evidence is not sufficiently convincing to place the substance in Category 1”.

No classification is proposed for fertility as no clear effects on fertility (except for an increase in days to litter in the continuous breeding NTP study in rats) are available.

Adverse effects on development of the offspring

Table 36a: Summary table of animal studies on adverse effects on development of the offspring

Method, test guideline, and deviation(s) if any	**Species, strain, sex, no/group**	**Test substance, reference to table 5**	**Dose levels, duration of exposure**	**Results**	**Reference**
OECD Guideline 422 GLP compliant	Sprague-Dawley rat, male/ female; No. of animals per sex per dose: 10	94.65% DCPD Physical state: liquid	Doses / concentrations: 0, 4, 20 or 100 mg/kg bw/day Duration of exposure: Males 44 days; Females from 14 days before mating through gestation and parturition until day 3 of lactation	Viability: yes, reduced viability index in the pups in the high dose group Clinical signs (pups): no effects Clinical signs and mortality(parental animals): yes, two females in the high dose (100 mg/kg bw) group died. The following major observations were noted: lung congestion, enlargement of the adrenal gland, and bleeding of the gastric mucosa and thymus. Body weight (pups): yes, tendency to lower birth wt and body wt gain was observed in neonates in the high dose group Sexual maturation: not examined Organ weights (pups): not examined Gross pathology (pups): not examined Histopathology (pups): not examined	Author not specified. Information sheet date 1998-03-30. Report date 1993-12-31. Data source: ECHA website - Exp Key Toxicity to reproduction.003
equivalent or similar to EPA OPP 83-3 (Prenatal Developmental Toxicity Study) Non-GLP	Sprague-Dawley rat, female; No. of animals per sex per dose: 20	98-99% DCPD	Doses / concentrations: 0, 80, 250, 750 ppm Duration of treatment / exposure: Days 6-15 of gestation Duration of test: Days 0-19 of gestation	Effect levels: Endpoint: NOAEL Effect type: maternal toxicity Effect level: 750 ppm (nominal) Maternal toxic effects: no effects Embryotoxic / teratogenic effects: no effects Any other information on results incl. tables: 750 ppm equivalent to 60 mg/kg bw/day based on a 250 g rat consuming 20 g diet/day There was no evidence of teratogenicity or developmental toxicity at this dose.	Author not specified. Report (1978) Data source: ECHA website - Exp Key Developmental toxicity/ teratogenicity.003

Dose range finding study Non-GLP	New Zealand White rabbit, sex unspecified, No. of animals per sex per dose: 10	98% DCPD	Doses / concentrations: 0, 25, 100, 200, 300 or 400 mg/kg bw/day Duration of treatment / exposure: Days 6-19 of gestation Frequency of treatment: Daily Duration of test: 30 days	Effect levels: Endpoint: NOAEL Effect type: maternal toxicity Effect level: 25 mg/kg bw/day (nominal) Endpoint: NOAEL Effect type: developmental toxicity Effect level: 300 mg/kg bw/day Maternal toxic effects: yes, three of the 10 rabbits given 400 mg/kg bw/day and 1 given 300 mg/kg bw/day were found dead (days 21-23) in the post dosing period. Effects on dams:In the 100 mg/kg bw/day group, one rabbit aborted on day 18, another had bloody vaginal discharge beginning on day 26 of gestation but was pregnant at scheduled necropsy. In the 300 mg/kg group, 1 rabbit had a bloody vaginal discharge beginning on day 19 of gestation, aborted 4 kits on day 21 with an additional 9 masses on gestational day 22. Three animals in the 400 mg/kg bw/day group had blood vaginal discharges; 2 recovered over several days, one was dead on gestation day 23. Maternal body weight loss during the treatment period was dose-related and statistically significant for the 200, 300 and 400 mg/kg bw/day groups. Decreased food and water consumption were observed in all animals given 300 or 400 mg/kg bw/day.	Author not specified. Report date 1993-08-11 Data source: ECHA website - Exp Supporting Developmental toxicity/ teratogenicity.001; US EPA; HSDB
				Embryotoxic / teratogenic effects: yes, the number of resorptions and non-live implants/litter were higher, and the number of foetuses was lower, in the 400 mg/kg bw/day group compared to controls but were not statistically significant.	

				Two litters from this group showed gross deformities of foetuses – one with eyes open and 1 with eyes open and deformed hind limbs in one litter of 3 live pups, and eyes open in all foetuses from another 400 mg/kg bw /day litter. Dicyclopentadiene caused maternal lethality at 300 and 400 mg/kg/day, maternal toxicity at 200 mg/kg/day and possibly the abortion of 1 litter at 100 mg/kg. No developmental endpoints were affected by treatment at dose levels of 200 mg/kg/day or less although no foetal examination was conducted.	
Dose range finding study Non-GLP	Sprague Dawley CD(SD)BR rat, sex unspecified. No. of animals per sex per dose: 11	98% DCPD	Doses / concentrations: 0, 50, 200, 300, 400 or 500 mg/kg bw/day Duration of treatment / exposure: Days 6-15 of gestation. Duration of test: 20 days	Maternal toxic effects: yes, all animals in the 400 and 500 mg/kg bw/day groups were found dead by GD 9. Eight and 3 animals in the 300 and 200 mg/kg bw/day groups respectively, were found dead or were killed for humane reasons by GD 9. All animals in the 50 mg/kg bw/day group survived to scheduled termination. Signs of systemic toxicity were noted in all animals given 200 mg/kg bw/day group or more, from GD 7. Clinical signs included dried material around nose and mouth, rough hair coat, and lethargy increased in severity with increasing dose. Other signs included convulsions (1 rat given 200 mg/kg bw/day), hunched posture (6 rats given 300 mg/kg bw/day) and ataxia (5 rats given 300 mg/kg bw/day, 11 rats given 400 mg/kg bw/day and 9 rats given 500 mg/kg bw/day). Maternal body weights of the treated animals were decreased in a dose-related manner. These differences were statistically different ($p<0.05$) from the control group during the treatment period in the 50 mg/kg bw/day group and during the treatment and post-treatment period in the 200 mg/kg bw/day	Author not specified. Report date 1993-02-04 Data source: ECHA website - Exp Supporting Developmental toxicity/ teratogenicity.002

				group. Embryotoxic / teratogenic effects: yes, only the control, 50 and 200 mg/kg bw/day groups had litters with live foetuses at scheduled necropsy on day 20. Average foetal weight in the 200 mg/kg bw/day group was significantly decreased ($p<0.05$) compared to the control group; the mean number of live foetuses was unaffected by treatment. A NOAEL for maternal toxicity was not established in this study and is therefore, 50 mg/kg bw/day. However, this dose level was a NOAEL for developmental toxicity based on average foetal weight only. No foetal examination was included in this study.	

Table 36b: Summary table of human data on adverse effects on development of the offspring

Type of data/report	Test substance, reference to table 5	Relevant information about the study (as applicable)	Observations	Reference
No data available.				

Table 36c: Summary table of other studies relevant for adverse effects on development of the offspring

Type of study/data	Test substance, reference to table 5	Relevant information about the study (as applicable)	Observations	Reference
No data available.				

Short summary and overall relevance of the provided information on adverse effects on development of the offspring

One GLP compliant study on adverse effects on development of the Sprague-Dawley rats offspring are available. No significant differences in number of offspring, live offspring at birth, sex ratio or live birth index were found. No abnormal findings were observed in external features, clinical signs in offspring, or at necropsy of offspring.

Administration of DCPD by incorporation into the diet at 80, 250 and 750 ppm in EPA OPP 83-3 study (1980) produced no effect on pregnant SD rats when fed on days 6-15 of gestation. There was no evidence of teratogenicity or developmental toxicity at this dose.

In dose range finding study report dated 1993-08-11, in the 100 mg/kg bw/day dose group, two dams experienced either total litter abortion or bloody vaginal discharge that may indicate embryo/fetal death in

rabbits. Abortion and bloody vaginal discharge was also noted in the 300 and 400 mg/kg bw/day dose groups, although none were reported in the 200 mg/kg bw/day dose group. Within the 300 and 400 mg/kg bw/day dose groups, there was significant maternal toxicity, including death while minimal body weight effects were noted at 200 mg/kg bw/day dose group. There were no any maternal toxic effects in the 100 mg/kg bw/day dose group. The spontaneous incidence of abortion or bloody vaginal discharge in rabbits is relatively low, suggesting that these events were treatment related. Spontaneous abortion is a relatively rare event in control rabbits. Spontaneous abortion can be induced by severe maternal toxicity as the dam is unable to continue the pregnancy due to the decreases in feed and water consumption and changes in physiology that occur in response to severe toxicity. There were no such signs reported at 100 mg/kg bw/day dose group and, thus, it can be concluded that there were no maternal toxic effects in the 100 mg/kg bw/day dose group. Spontaneous abortion also occurs with no or minimal maternal toxicity when the conceptuses die *in utero*. The intrauterine death of the embryo or fetus results in a decreased signal to the dam that is required for the pregnancy to be maintained and the lack of this signal allows for changes in maternal physiology that results in the failure to maintain the pregnancy. In this instance, the increased incidence of spontaneous abortion forms a dose response curve extending into the dose range that includes a lack of evidence of maternal toxicity (100 mg/kg bw/day). This suggests a direct effect of the chemical on the survival of the embryo or fetus rather than an indirect effect through maternal toxic mechanisms. At the higher dose levels where significant maternal toxicity was present, it is certainly possible that the spontaneous abortions were due to a combination of maternal toxicity and a direct effect on the conceptus. It was reported that no developmental endpoints were affected by treatment at dose levels of 200 mg/kg bw/day or less although no foetal examination was conducted. Developmental effects at the high-dose level included increased numbers of resorptions and non-live implants/litter and decreased number of fetuses. Two litters from does treated with 400 mg/kg bw/day showed gross deformities of kits; 1 with eyes open and 1 with eyes open and deformed hind limbs in 1 litter of 3 total live kits, and eyes open in all 12 kits from another high-dose litter. But according to the GHS criteria (item 3.7.2.4.4 (a), "maternal mortality greater than 10% is considered excessive and the data for that dose level should not normally be considered for further evaluation" and provided above data on mortality (three of the ten rabbits given 400 mg/kg-day), adverse effect on development of the offspring are not relevant for classification purposes. There were no other effects on gravid uterine weight, number of implantation sites, resorptions, dead fetuses and live fetuses in the other treated groups.

In dose range finding study report dated 1993-02-04, dose levels of 200, 300, 400 and 500 mg/kg bw/day were lethal to pregnant rats when given from day 6 of gestation. Signs of systemic toxicity were noted in all animals given 200 mg/kg bw/day group or more, from GD 7. Clinical signs included dried material around nose and mouth, rough hair coat, lethargy, hunched posture and ataxia. Maternal body weights were decreased in a dose-related manner. All animals given 50 mg/kg bw/day survived to termination of the study; maternal bodyweights were significantly lower than the controls during the treatment period. Only the control, 50 and 200 mg/kg bw/day groups had litters with live foetuses at necropsy on GD20. Foetal weight in the 200 mg/kg bw/day group was significantly decreased but there was no similar effect of 50 mg/kg bw/day. The mean number of live foetuses was unaffected by treatment. A NOAEL for maternal toxicity was not established in this study and is therefore, 50 mg/kg bw/day. However, this dose level was a NOAEL for developmental toxicity based on average foetal weight only. No foetal examination was included in this study.

Comparison with the GHS criteria

According to the GHS criteria the Category 2 for reproductive toxicity includes "substances for which there is some evidence from humans or experimental animals, possibly supplemented with other information, of an adverse effect on sexual function and fertility, or on development, in the absence of other toxic effects, or if occurring together with other toxic effects the adverse effect on reproduction is

considered not to be a secondary non-specific consequence of the other toxic effects, and where the evidence is not sufficiently convincing to place the substance in Category 1".

A rabbit developmental toxicity dose range finding study found an increased incidence of pregnancy loss/spontaneous abortion in 2/10 dams at the dose levels of 100 mg/kg bw/day and above with maternal toxicity observed at the 200 mg/kg bw/day dose level and above. Based on these data and finding of reproductive toxicity (increased days to litter, increased pup mortality, fewer pups born alive and lower pup weights) noted in the presence of slight maternal toxicity (increased liver weight) at 100 mg/kg bw/day in the rapid assessment by continuous breeding protocol/oral gavage study conducted NTP in rats, the DCPD is proposed to classify as reproductive toxicant Category 2 for developmental toxicity.

Adverse effects on or via lactation

Table 37a: Summary table of animal studies on effects on or via lactation

Method, test guideline, and deviation(s) if any	**Species, strain, sex, no/group**	**Test substance, reference to table 5**	**Dose levels, duration of exposure**	**Results**	**Reference**
No data available.					

Table 37b: Summary table of human data on effects on or via lactation

Type of data/report	**Test substance, reference to table 5**	**Relevant information about the study (as applicable)**	**Observations**	**Reference**
No data available.				

Table 37c: Summary table of other studies relevant for effects on or via lactation

Type of study/data	**Test substance, reference to table 5**	**Relevant information about the study (as applicable)**	**Observations**	**Reference**
in vivo study	DCPD, purity unknown, and radiocarbon-labelled (uniform [14C], 62.6 mg/mCi) samples were used	Blood samples, urine, faeces and milk were collected at intervals. The cow was killed 96 hours after dosing with [14C] DCPD and several tissues were taken. Excretion and tissue retention were determined. cattle, Jersey, female, single dose, 10 mg/kg bw, oral: capsule Vehicle: no	Radiocarbon was quite rapidly excreted following oral dosing of [14C] DCPD. (c.a. 81% of administered [14C] eliminated in urine, c.a. 4% in faeces, <0.1% secreted into milk). Bioaccessibility: Only exceedingly low levels of radiocarbon appeared in milk, and residues were not detected in samples collected more than 48 hr post-treatment.	Publication of Ivie GW and Oehler DD: Fate of dicyclopentadiene in a lactating cow. Bull. Environm. Contam. Toxicol. 24, 662-670 (1980 year) Data source: ECHA web-site - Exp Supporting Basic toxicokinetics.004

Short summary and overall relevance of the provided information on effects on or via lactation

No relevant data available. The information provided in study with labeled DCPD in cattles noted that only exceedingly low levels of radiocarbon appeared in milk, but this information is insufficient to judge the ability of the substance to enter the breast milk.

Comparison with the GHS criteria

Comparison with the GHS criteria is not possible because there is no relevant data available.

Conclusion on classification and labelling for reproductive toxicity

Classification with Category 2 for developmental toxicity is proposed.
Symbol: Health hazard
Signal word: Warning
Hazard statement: H361: Suspected of damaging the unborn child.
Data are available only by oral route and the route of exposure cannot be specified in the hazard statement.

8.8 Specific target organ toxicity-single exposure (STOT SE)

Table 38a: Summary table of animal studies relevant for STOT SE

Method, test guideline, and deviation(s) if any	Test substance, reference to table 5	Species, strain, sex, no/group	Route of exposure	Dose levels, duration of exposure	Results	Reference
OECD Guideline 401 GLP compliant	DCPD 75% Physical state: liquid	Sprague-Dawley rat, male/ female; No. of animals per sex per dose: 5	oral: gavage	Doses: 500, 794, 1260 and 2000 mg/kg bw Duration of exposure: single dose Duration of observation period following administration: 14 days	Mortality: All deaths occurred one or two days following dosing. There were 2, 4, 5 and 5 male deaths and 1, 2, 5 and 5 female deaths in the 500, 794, 1260 and 2000 mg/kg bw/day groups respectively. Clinical signs: Hunched posture, piloerection, lethargy and decreased respiratory rate were present in all animals during the day of dosing. Ptosis was occasionally noted in animals dosed with 794 or 1260 mg/kg bw during this period. All rats dosed with 2000 mg/kg bw had ptosis 1 and 4 hours after dosing with occasional signs of ataxia at the 4 hour observation. Vocalisation was noted in one rat dosed with 1260 mg/kg bw at the 4 hour observation. Red/brown staining around the snout was present in surviving animals treated with 500 or 794 mg/kg bw one day after dosing. All survivors appeared normal 2 days after dosing. Body weight: All surviving animals showed expected body weight gain. Gross pathology: Haemorrhagic lungs, dark liver and sloughing of the non-glandular gastric epithelium were seen in decedents. No abnormalities were seen in animals killed at the end of the study.	Author not specified. Report date 1989-01-17 Data source: ECHA web-site, Exp Key Acute toxicity: oral.001

equivalent or similar to OECD Guideline 401 Non-GLP	98-99% pure DCPD Physical state: waxy solid, liquefied on slight warning	Swiss Webster mice, male/female No. of animals per sex per dose: 10	oral: gavage	Doses: 167, 215, 278, 360, 464 and 600 mg/kg bw Duration of exposure: single dose Duration of observation period following administration: 14 days	Mortality: All deaths occurred mainly one or two days following dosing. There were no female deaths reported at 165 mg/kg bw dose level. There were 5, 5, 6, 7, 8, and 10 male deaths and 0, 6, 3, 9, 5 and 9 female deaths in the 167, 215, 278, 360, 464 and 600 mg/kg bw groups respectively. Clinical signs: Decreased activity and prostration seen within 1-4 hours after dosing. Gross pathology: Gross findings in animals which died during the study included yellow fluid in the stomach and small intestines, distension of the bladder with pinkish-orange fluid, hyperaemia of the lungs and black discolouration of portions of the liver and spleen. There were no macroscopic abnormalities in animals that survived to the end of the study.	Author not specified. Report date 1976-06-24 Data source: ECHA website - Exp Supporting Acute Toxicity: oral.003
equivalent or similar to OECD Guideline 401 Non-GLP	98-99% pure DCPD Physical state: waxy solid, liquefied on slight warning	Sprague-Dawley rat, male/ female, No. of animals per sex per dose: 10	oral: gavage	Doses: 278, 360, 464, 600 and 793 mg/kg bw Duration of exposure: single dose Duration of observation period following administration: 14 days	Mortality: All deaths occurred mainly two days following dosing. There were 1, 2, 3, 8 and 8 male deaths and 0, 5, 7, 9 and 10 female deaths in the 278, 360, 464, 600 and 793 mg/kg bw groups respectively. Clinical signs: Red stains around the mouth and nose, decreased activity, occasional ataxia and prostration 1-4 hours after dosing. Some instances of convulsions and tremors were reported but not all of these rats later died. Gross pathology: Of those rats that died during the study, hyperaemia of the lungs was present in some but most showed no abnormalities. At necropsy of surviving rats, there were no gross abnormalities.	Author not specified. Report date 1976-06-24 Data source: ECHA website, Exp Supporting Acute Toxicity: oral.002

OECD Guideline 402 GLP compliant	75% DCPD Physical state: liquid	Sprague-Dawley rat, male/female No. of animals per sex per dose: 5	dermal: occlusive	Doses: >2000 mg/kg bw bodyweight Duration of exposure: 24 hours	Mortality: none Clinical signs: Vocalisation, lasting up to 30 minutes, noted in all animals after dosing. Hunched posture, lethargy, piloerection, erythema and oedema present in all animals on day 1. Isolated incidences of red/brown staining of snout and ptosis seen. All animals showed signs of eschar by day 3 which persisted until days 10 or 12. All treatment sites appeared normal by end of study. Body weight: All animals showed expected bodyweight gain. Gross pathology: No abnormalities were seen.	Author not specified. Report date 1989-01-17 Data source: ECHA website, Exp Key Acute toxicity: dermal.001
equivalent or similar to OECD Guideline 403 Deviations: yes 6 hour exposure GLP compliant	DCPD ~97% endo- and ~1% cyclopentadiene Physical state: liquid	B6C3F1 mouse, male/female No. of animals per sex per dose: 6	inhalation: vapour	Target concentration: 50, 150, 300 and 600 ppm. Actual exposure concentration: 46, 130, 260 and 557ppm.	NOAEC (male/female) for irregular breathing, stereotypic behaviour = 46 ppm Remarks = 248.74 mg/m3 Mortality: There were no deaths in males and females at 46 ppm exposure dose. There were 2 male deaths and 3 female deaths in 130 ppm groups. All animals were died in 260 and 557 ppm groups. Clinical signs: Male and female mice at 557 ppm showed loss of righting reflex, impaired gait, stereotypic behaviour, laboured breathing, clear nasal discharge and deaths. At 260 ppm, both sexes showed stereotypic behaviour, respiratory difficulty, impaired gait, loss of coordination and convulsions prior to death. At 130 ppm, mice displayed irregular breathing and stereotypic behaviour; females also showed loss of coordination and slight tremors. No treatment-related clinical signs were observed in mice exposed to 46 ppm. Gross pathology: There were no gross pathological effects noted at necropsy.	Author not specified. Report date 1981-04-29 Data source: ECHA web-site, Exp Key Acute toxicity: inhalation.004

equivalent or similar to OECD Guideline 403 Deviations: yes 6 hour exposure GLP compliant	DCPD ~97% endo- and ~1% cyclopentadiene Physical state: liquid	Fischer 344 rat, male/ female No. of animals per sex per dose: 6	inhalation: vapour	Target concentration: 50, 150, 300 and 600 ppm. Actual exposure concentration: 46, 130, 260 and 557 ppm. Duration of observation period following administration: 14 days	NOAEC (male/female) for irregular breathing, stereotypic behaviour = 46 ppm Remarks = 248.74 mg/m3 Mortality: There were no deaths in males and females in 46 and 130 ppm groups. Two males were found dead the day after exposure of 260 ppm. All animals were died in 557 ppm groups. Clinical signs: Male and female rats at 557 ppm showed loss of righting reflex, impaired gait, stereotypic behaviour, laboured breathing, nasal discharge, convulsions and death. At 260 ppm, both sexes showed stereotypic behaviour, respiratory difficulty and nasal discharge. In rats dying from exposure to dicyclopentadiene, convulsions were observed immediately before death. At 130 ppm, the only sign observed in both sexes, was a somewhat sluggish movement. No treatment-related clinical signs were observed in rats exposed to 46 ppm. In rats that did not die during the study, all clinical signs cleared by day 2. Gross pathology: There were no gross pathological effects noted at necropsy	Author not specified. Report date 1981-04-29 Data source: ECHA web-site, Exp Key Acute toxicity: inhalation.002
equivalent or similar to OECD Guideline 403 Non-GLP	98.3 % DCPD Physical state: liquid	Albino rat, male/ female, No. of animals per sex per dose: 6	inhalation: vapour	Concentrations: no data Duration of exposure: 4 h	Mortality: 1 male died at 272 ppm. Clinical signs: The lowest concentration at which effects were seen was 272 ppm where irritation of extremities was seen within 60 minutes in both males and females. Eye irritation, poor coordination and convulsions were generally observed prior to death. No other details were reported. Body weight: Survivors gained weight during the 14 day observation period. Gross pathology: No data	Author not specified. Publication (1971) Data source: ECHA web-site, Exp Supporting Acute toxicity: inhalation.001

equivalent or similar to OECD Guideline 403 Non-GLP	98.3 % DCPD Physical state: liquid	Beagle dog, female No. of animals per sex per dose: 1	inhalation: vapour	Concentrations: 68, 272, 458 and 773 ppm (measured concentrations) Duration of exposure: ca. 1 ca. 4 h	Mortality: After 1 hour exposure at 773 ppm one female died. Clinical signs: 773 ppm: irritation of eyes, nose and extremities within 30 minutes, followed by tonic and clonic convulsions preceding death within 60 minutes. 458 ppm: tremors within 15 minutes, with eye and nose irritation and lacrimation within 50 minutes, no death. 272 ppm: tremors within 180 minutes. 68 ppm (approximate): dog urinated small amounts, several times immediately following exposure. Body weight: No data Gross pathology: No data	Author not specified. Publication (1971) Data source: ECHA web-site, Exp Supporting Acute toxicity: inhalation.003

Table 38b: Summary table of human data relevant for STOT SE

Type of data/report	Test substance, reference to table 5	Route of exposure	Relevant information about the study (as applicable)	Observations	Reference
Study with volunteers Human sensory response test	DCPD 96.7%, isomeric mixture of endo/exo in a 95:5 ratio Physical state: liquid	inhalation	Exposure was in a glass-lined 12800 L room from which the vapour-air mixture was exhausted at 2500-3200 L/min. Number of subjects exposed: 3 (odour threshold), 2 (sensory response) Age: 24-47 years Subjects: blind to inhaled concentration	Clinical signs: Human sensory response test: During the 30-min exposure to 1 ppm, one subject experienced slight eye and throat irritation at 7 min and one subject reported olfactory fatigue after 24 min. No olfactory fatigue was reported by either subject during the 30-min exposure to 5.5 ppm DCPD vapour. Eye irritation was reported by one subject after 10 min at this concentration. One subject could taste DCPD for 1 hr after the 5.5 ppm exposure.	Author not specified. Publication (1971) Data source: ECHA website Direct observations: clinical cases, poisoning incidents and other

No data	DCPD No data on analytical purity and physical state	Inhalation	Unknown	Cough, sore throat, and headache	International Chemical Safety Card on Dicyclopentadiene. ICSC: 0873 (last update: July 1, 2014) Data source: IPCS providing by NIOSH

Table 38c: Summary table of other studies relevant for STOT SE

Type of study/data	Test substance, reference to table 5	Relevant information about the study (as applicable)	Observations	Reference
No data available.				

Short summary and overall relevance of the provided information on STOT SE

Oral route:

Based on LD_{50} value in Swiss Webster mice the DCPD is proposed to classify with Category 3 for acute toxicity via the oral route. There are three studies with useful information for STOT SE. Clinical signs provided in these studies like hunched posture, piloerection, lethargy, decreased activity and prostration, red stains around the mouth and nose are considered adaptive responses which are not relevant to classification. The gross findings in animals which died during the study include haemorrhagic lungs, dark liver and sloughing of the non-glandular gastric epithelium were seen in decedents this information, but no abnormalities were seen in animals killed at the end of the study. In the GLP compliant study performed according to OECD Guideline 401 all rats dosed with 2000 mg/kg bw of 75% DCPD had ptosis 1 and 4 hours after dosing with occasional signs of ataxia at the 4 hour observation. In other study (equivalent or similar to OECD Guideline 401, non-GLP) in rats with 98-99% DCPD clinical signs included occasional ataxia and prostration 1-4 hours after dosing. Some instances of convulsions and tremors were reported but not all of these rats later died. These evidences of transient effect on nervous system support classification for STOT SE 3 (narcotic effect)

Dermal route:

The DCPD is proposed to classify with Category 5 for acute dermal toxicity and Category 2 for skin corrosion/irritation. Available study (OECD Guideline 402, GLP compliant) did not provide any gross pathology in Sprague-Dawley rats. Clinical signs include vocalisation, lasting up to 30 minutes, noted in all animals after dosing. Hunched posture, lethargy, piloerection, erythema and oedema present in all animals on day 1. Isolated incidences of red/brown staining of snout and ptosis seen. All animals showed signs of eschar by day 3 which persisted until days 10 or 12. All treatment sites appeared normal by end of study. Thus there are no any significant evidences for specific organ toxicity which are not related to irritation properties and warrant classification for STOT SE 1 or STOT SE 2. The evidence of CNS depression in the absence of lethality support classification of DCPD for STOT SE 3 (narcotic effect)

Inhalation route:

The DCPD is proposed to classify with Category 2 for acute inhalation toxicity.

In the human sensory response test with the volunteers there is an evidence of throat irritation of one subject at 7 min. International Chemical Safety Card also provides information on cough, sore throat and

headache, but there are no details of exposure. Data from the animal study indicated an absence of gross pathology but the following clinical signs were observed: loss of righting reflex, impaired gait, stereotypic behavior, laboured breathing, nasal discharge, poor coordination. Evidence from human data and evidence of respiratory difficulty and CNS depression from animal study warrant DCPD classification with Category 3 for STOT SE (respiratory tract irritation and narcotic effect).

Comparison with the GHS criteria

The GHS criteria for respiratory tract irritation as Category 3 include respiratory irritant effects (characterized by localized redness, edema, pruritis and/or pain) that impair function with symptoms such as cough, pain, choking, and breathing difficulties are included. It is recognized that this evaluation is based primarily on human data.

Based on the evidence from human data and evidence of respiratory difficulty from animal study via inhalation it is proposed to classify DCPD with Category 3 for STOT SE (respiratory tract irritation).

The criteria for narcotic effects as Category 3 are narcotic effects observed in animal studies may include lethargy, lack of coordination righting reflex, narcosis, and ataxia. If these effects are not transient in nature, then they should be considered for classification as Category 1 or 2.

Based on the evidence of CNS depression in the absence of lethality reported in the acute toxicity studies it is proposed to classify DCPD with Category 3 for STOT SE (narcotic effect).

Conclusion on classification and labelling for STOT SE

Classification with Category 3 is proposed for STOT SE (respiratory tract irritation and narcotic effect).
Symbol: Exclamation mark
Signal word: Warning
Hazard statement: H335: May cause respiratory irritation.
H336: May cause drowsiness and dizziness.

8.9 Specific target organ toxicity-repeated exposure (STOT RE)

Table 39a: Summary table of animal studies relevant for STOT RE

Method, test guideline, and deviation(s) if any	Test substance, reference to table 5	Species, strain, sex, no/group	Route of exposure	Dose levels, duration of exposure	Results	Reference
equivalent or similar to OECD Guideline 422 GLP compliant	94.65% DCPD Physical state: liquid	Sprague Dawley Crj:CD(SD) rat, male/female No. of animals per sex per dose: 10	oral	Doses/concentrations: 0, 4, 20 or 100 mg/kg bw/day Duration of treatment / exposure: Males 44 days; Females from 14 days before mating through gestation and parturition until day 3 of lactation	NOAEL (males) = 4 mg/kg bw/day NOAEL (females) = 20 mg/kg bw/day *100 mg/kg bw/day:* - 2 females died; - transient salivation after for the initial 8 days of dosing was present in approximately half of the males and females; - blood chemistry of males showed increase in GOT and GPT; -increased weight of liver and kidneys of males (neither achieved statistical significance); - single cell necrosis in liver, and hyaline droplets and basophilic changes in tubular epithelium of kidneys under microscopic examination in males; -increase in fatty droplets in fascicular zone of adrenals in males/females - slightly decreased body weight and food consumption in males/females *20 mg/kg bw/day:* - histological changes in kidneys and adrenals in males; - occasionally salivation in males; - statistically significantly increased actual and relative liver weight in males	Author not specified. Information sheet date1998-03-30 Data source: ECHA website - Exp Key Repeated dose toxicity: oral.002

equivalent or similar to OECD Guideline 409 Non-GLP	98-99% DCPD Physical state: liquid	Beagle dog, male/ female, No. of animals per sex per dose: 4	oral: feed	Doses/concentrations: 0, 100, 300 and 1000 ppm Duration of treatment / exposure: 13 weeks	NOAEL (males/females) = 1000 ppm equivalent to 25 mg/kg bw/day There was no evidence of significant toxicity with the possible exception of minor indications of intestinal distress expressed as vomiting and soft stools among dogs of the treated groups, especially the highest dose. However, these signs were also occasionally observed among the control dogs. *Organ weights*: no effects *Gross pathology*: no effects	Author not specified. Report (1980) Data source: ECHA website - Exp Supporting Repeated dose toxicity: oral.001
Reproductive Assessment by Continuous Breeding Protocol (NTP, 1989) GLP compliant	DCPD No data on analytical purity and physical state	Sprague-Dawley rat, male/ female; No. of animals per sex per dose: 20	oral: gavage	Doses / concentrations: 10, 30, and 100 mg/kg bw/day Duration of treatment / exposure: from one week prior to mating through to study termination.	*Organ weights*: DCPD caused a 2%, 7%, and 17% increase in liver weights and a 16%, 15%, and 16% increase in kidney weights in males from the 10, 30, and 100 mg/kg bw/day groups, respectively. *Microscopically*: an increase in the incidence of clear cell foci was observed in the livers of 30 and 100 mg/kg bw/day rats.	Jamieson, H.M., Delaney, J.C., Wolfe, G.W. and Chapin, R.E. (1995) "Reproductive effects of dicyclopentadiene in S-D rats assessed by a continuous breeding protocol." The Toxicologist. 15:166. Abstract No. 880 Data source: HSDB

equivalent or similar to OECD Guideline 413 GLP compliant	DCPD 95% endo-DCPD, 0.5% exo-DCPD with several impurities of which only cyclopentadiene and isoprene were present at =0.5% Physical state: liquid	Fischer 344 rat, male/ female, No. of animals per sex per dose: 51	inhalation: vapour	Doses/concentrations: 0, 1, 5.1, or 51 ppm Frequency of treatment: 6 hours/day, 5 days/week for up to 13 weeks	NOAEC (females) = 50 ppm equivalent to 0.28 mg/L/ 6 hr/day NOAEC (males) Not established because of male rats-specific effects (protein accumulation, tubular hyperplasia (regeneration), tubular proteinosis, interstitial nephritis and glomerular basement thickening) which is presented in all exposed and control groups No evidence of systemic toxicity	Study report (1982) and publication Bevan C, Snellings W, Dodd D and Egan G "Subchronic Toxicity Study Of Dicyclopentadiene Vapour In Rats", 1992, Toxicol. Ind. Health Vol 8 (6) 353-367 Data source: ECHA website - Exp Key Repeated dose toxicity: inhalation.001

equivalent or similar to OECD Guideline 413 GLP compliant	DCPD 95% endo-DCPD, 0.5% exo-DCPD with several impurities of which only cyclopentadiene. and isoprene were present at =0.5% Physical state: liquid	B6C3F1 mouse, male/female No. of animals per sex per dose: 45	inhalation: vapour	Doses/concentrations: 0, 1, 5.1, 51 ppm Duration of treatment / exposure: 13 weeks Frequency of treatment: 6 hours/day, 5 days/week	NOAEC (males/females) = 5.1 ppm equivalent to 0.028 mg/L/ 6 hr/day *51 ppm:* -20 % mortality (10 males and 9 females) occurred in the high-dose mice during the study (not specified after what exposure period) - a few of the mice showed coordination loss and/or decreased activity (no further details) - significant elevation in body wt gain in males/females that returned to parity with control values during recovery - slight liver dysfunction and increased absolute and relative liver weights without morphological changes in females given 64 exposures *5.1 ppm:* - no more than 2 mice died - a few of the mice showed coordination loss and/or decreased activity (no further details) - slight liver dysfunction and increased absolute and relative liver weights without morphological changes in females given 64 exposures *1 ppm:* - no more than 2 mice died	Author not specified. Report (1982) Data source: ECHA website - Exp Key Repeated dose toxicity: inhalation.002

equivalent or similar to EPA OTS 798.2450 Non-GLP	96.7% DCPD, Isomeric mixture of endo/exo DCPD in a 95:5 ratio Physical state: liquid	Wistar rat, male/ female No. of animals per sex per dose: 12	inhalation: vapour	Doses/concentrations: 0, 19.7, 35.2 or 73.8 ppm Duration of treatment: 89 days Frequency of treatment: 7 hours/day, 5 days/week	NOAEC (male/female) < 19.7 ppm equivalent to < 0.107 mg/L/ 7 hr/day *73.8 ppm:* - one female had convulsions for about 5 min immediately after the exposure on day 19; - kidney lesions in males and in females (with less severity and frequency) with no further details - chronic pneumonia and bronchiectasis in 3 males *35.2 ppm:* - no convulsions were noted - kidney lesions in males and in females (with less severity and frequency) *19.7ppm:* - one female had convulsions for 5 min upon removal from the chamber on day 45	Author not specified. Publication (1971); Data source: ECHA website - Exp Supporting Repeated dose toxicity: inhalation.003
Unknown	DCPD No data on analytical purity and physical state	Beagle dog, male, No. of animals per sex per dose: unknown	inhalation: vapour	Doses/concentrations: 0, 8.9, 23.5, 32.4 ppm Duration of treatment: 89 days Frequency of treatment: 7 hours/day, 5 days/week.	Endpoint: NOAEC Effect level: 32.4 ppm = 0.19 mg/L No significant signs of toxicity were seen during or after the exposure period.	Kinkead, E.R. et al., Toxicol. Appl. Pharmacol., 20, 552 (1971) Data source: OECD SIDS

Table 39b: Summary table of human data relevant for STOT RE

Type of data/report	Test substance, reference to table 5	Route of exposure	Relevant information about the study (as applicable)	Observations	Reference
No data available.					

Table 39c: Summary table of other studies relevant for STOT RE

Type of study/data	Test substance, reference to table 5	Relevant information about the study (as applicable)	Observations	Reference
No data available.				

Short summary and overall relevance of the provided information on STOT RE

Three 90-day studies are considered reliable and relevant for STOT RE assessment.

In the first OECD Guideline 413 GLP compliant study Fischer 344 rats were exposed by inhalation to 0, 1, 5 or 50 ppm DCPD vapour 6 hr/day, 5 days/week for 13 weeks, followed by a 13-week recovery period. Animals were euthanized following completion of exposure at 2, 6, or 13 weeks and at post exposure weeks 4 or 13. No mortality, overt signs of toxicity, body weight changes, haematological or clinical chemistry values were related to exposure.

At 50 ppm, relative liver weights were significantly increased in males but with no accompanying histopathological changes. Males at this exposure level also showed alterations in renal function during the study (reduced urine specific gravity and urine osmolality, changes in sodium and potassium excretion rates and increased urine volume) which were not present during the recovery period.
The only histopathological findings were in the kidney, in male rats only, particularly those exposed to 5.1 or 51 ppm. Hyaline droplets accumulated in the proximal convoluted tubule during the exposure period and resolved during the recovery period. Males at 5.1 and 51 ppm also had protein accumulation, tubular hyperplasia (regeneration), tubular proteinosis, interstitial nephritis and glomerular basement thickening. These changes did not resolve by the end of the recovery period and were also seen in some males in the control and 1 ppm groups; they are consistent with a male, rat-specific, glomerulonephropathy, which is seen spontaneously in older male rats. The NOAEC for males and females was reviewed by Bevan et al, 1992 and was concluded to be 5.1 ppm (27.6 mg/m^3) for males (excluding the Hyaline droplet effect) and 51 ppm (276 mg/m^3) for females. However it is more likely that the NOAEC values for male rats couldn't be established because of the male rats-specific effects (protein accumulation, tubular hyperplasia (regeneration), tubular proteinosis, interstitial nephritis and glomerular basement thickening) which is presented in all exposed and control groups.

In the second OECD Guideline 413 GLP compliant study groups of 45 male and 45 female B6C3F1 mice were exposed by inhalation, 6 hr/day, 5 days/week, for 13 weeks (64 exposures) to DCPD vapour at concentrations of 0 (air control), 1, 5.1 or 51 ppm (analyzed concentrations). Animals were sacrificed after 10, 30 and 64 inhalation exposures and post exposure sacrifices were made at 29 and 92 days following the last exposure. Clinical observations, body weights, blood clinical chemistry and haematology, ophthalmology, organ weights and histopathology evaluations were made during the study. A number of statistically significant alterations were reported in this study but the aetiology and association with DCPD exposure are unclear and no further details were provided. Approximately 20 percent of mice (10 males and 9 females) exposed to 51 ppm (0.28 mg/L) died during the exposure regimen, however it is not reported after what certain exposure. According to the acute inhalation toxicity GLP compliant study (1981) performed equivalent or similar to OECD Guideline 403 there were no mice mortality following single 6-hour inhalation exposure at 46 ppm (0.25 mg/l) indicating that the mortalities in this study could be related to the repeated exposure rather than acute exposure. The cause of death was pulmonary congestion and possible renal failure, at the same time these effects were not found in animals terminated during the study. A potential effect of DCPD was seen in the female mice given 64 exposures to 51 or 5.1 ppm was a decrease in serum albumin indicative of slight liver dysfunction (7% difference from control);

absolute and relative liver weights were also increased. No morphological changes were found to indicate any effect of DCPD exposure. Thus any effect of DCPD on the livers of female mice was considered to be minimal in severity. The NOAEC is concluded to be 5.1 ppm (27.6 mg/m3).

In the third EPA OTS 798.2450 study groups of 12 male and 12 female Wistar rats were exposed by inhalation 7 hours/day, 5 days/week for 89 days to DCPD vapour at concentrations of 0, 19.7, 35.2 or 73.8 ppm. One female rat given 73.8 ppm had convulsions for about 5 min immediately after the exposure on day 19. Another female rat from the 19.7 ppm group had convulsions for 5 min upon removal from the chamber on day 45. No convulsions were observed among the 35.2 ppm rats. The 73.8 ppm concentration and, to a lesser degree, 35.2 ppm caused kidney effects such as round cell accumulations, dilated tubules, casts, and tubular degeneration; these kidney lesions were more frequent and of greater severity in the male than in the female rats.

There were chronic pneumonia and bronchiectasis reported in 3 males in the 73.8 ppm group with none in the controls; this is not a statistically significant finding (but may suggest some lung involvement associated with repeated inhalation of DCPD at this concentration). Other pathologic changes in the lungs were sporadic and not dose-related.

No dose-related pathologic changes of note were found in the heart, spleen, adrenal, trachea, prostate, testis, colon, and mesentery of rats from any dose group. Protein concretions were noted in the urinary bladder of males of all treatment groups and in controls, but none was found in females.

In a combined repeat dose toxicity study with reproduction/developmental toxicity screening according to OECD Guideline 422, groups of 10 male and 10 female rats were dosed by oral gavage with solutions of 0, 4, 20 or 100 mg/kg bw/day DCPD in olive oil. Animals were dosed for 2 weeks prior to mating and during mating (approximately 2 weeks). Males and females were then dosed through gestation until day 3 of lactation. Females were killed on day 4 of lactation and males were killed on day 45 of the study. Two out of ten females at 100 mg/kg bw/day died during the study (not reported at what day exactly) with evidence of lung congestion, enlargement of the adrenal gland, and bleeding of the gastric mucosa and thymus. Notwithstanding that there are no data on what day of study the mortality occurred, the effects is considered as related to repeated exposure based on the result of study (1976-06-24) performed equivalent or similar to OECD Guideline 401 and showed 5% mortality (1/20 rat on second day) at dose of 278 mg/kg bw/day. At the same time the lung congestion as repeated exposure related effect is questionable because hyperaemia of the lungs was also present in some rats died during the acute oral toxicity study on second/third day of exposure.

Surviving males and females in this study showed decreased food consumption and bodyweight gain at this dose level. Pathological changes in the liver and kidney were seen in males dosed at 100 mg/kg bw/day (single cell necrosis in the liver, hyaline droplet formation and basophilic changes in the tubular epithelium of the kidney) and an increase in fatty droplets in the adrenals was observed in both males and females in the 100 mg/kg bw/day group. Similar changes were seen in the kidney and adrenals of some male rats dosed at 20 mg/kg bw/day group male rats. As far as the result in kidney observed in OECD Guideline 413 GLP compliant study in Fischer 344 male rats is considered as rat-specific, the pathological changes in the kidney noticed in males during this study could be also rat-specific and not relevant for classification purpose.

In the assessment of reproductive toxicity by continuous breeding protocol/oral gavage study conducted by NTP in rats the autopsy showed that DCPD caused a 2%, 7%, and 17% increase in liver weights and a 16%, 15%, and 16% increase in kidney weights in males from the 10, 30, and 100 mg/kg groups, respectively. Microscopically, an increase in the incidence of clear cell foci was observed in the livers of 30 and 100 mg/kg bw/day rats. However, it is not clear from the data if these foci were induced by

treatment or occured spontaneously. The primary source of the report is unavailable and, thus, this information can be used with restriction.

Comparison with the GHS criteria

The found effects in kidney were recognized as rat-specific which were also seen spontaneously in older male rats and thus not sufficient for classification purposes. Any effect of DCPD on the livers of female mice was considered to be minimal in severity, but there was evidence of single cell necrosis in liver of male rats given 100 mg/kg of DCPD. An increase in the incidence of clear cell foci was observed in the livers of 30 and 100 mg/kg bw/day rats in continuous breeding protocol/oral gavage study conducted by NTP. However section 3.9.2.7 of the GHS doesn't include the single cell necrosis or the evidence of clear cell foci as effects considered to support classification.

The 20% mortality in mice by cause of pulmonary congestion and possible renal failure at 51 ppm (0.28 mg/L) reported in OECD Guideline 413 GLP compliant study is considered as related to repeated exposure that confirmed by absence of mice mortality following single 6-hour inhalation exposure at 46 ppm (0.25 mg/l) in GLP compliant study following OECD Guideline 403. The level of 51 ppm (0.28 mg/L) caused these effects is within recommended guidance values for classification (see Table 3.9.2) via inhalation (vapour) route of exposure: $0.2 < C \leq 1.0$ mg/litre/6h/d and warranted Category 2 for STOT RE.

The exposure dose of 100 mg/kg DCPD in a combined repeat dose toxicity study with reproduction/developmental toxicity screening caused 20% mortality (2/10) in female rats with evidence of lung congestion, enlargement of the adrenal gland, and bleeding of the gastric mucosa and thymus. Mortality in rats reported at 100 mg/kg bw/day that is the upper limit of the recommended guidance values ($10 < 100 \leq 100$ mg/kg bw/d via oral route of exposure) supporting the classification as Category 2 of STOT RE via oral and inhalation routes of exposure.

Thus, based on mortality in mice and rats it is proposed to classify DCPD with Category 2 for STOT RE.

Conclusion on classification and labelling for STOT RE

Classification with Category 2 is proposed for DCPD via oral and inhalation routes of exposure
Symbol: Health hazard
Signal word: Warning
Hazard statement: H373: May cause damage to organs through prolonged or repeated exposure via oral and inhalation routes of exposure

8.10 Aspiration hazard

Table 40: Summary table of evidence for aspiration hazard

Type of study/data	Test substance, reference to table 5	Relevant information about the study (as applicable)	Observations	Reference
	DCPD Purity unknown		0.736 cP (est) at 70 deg F (21.11 °C)	U.S. Coast Guard, Department of Transportation. CHRIS - Hazardous Chemical Data. Volume II. Washington, D.C.: U.S. Government Printing Office, 1984-5.
	DCPD Purity unknown		0.93 g/cm³ at 35 °C	CRC Press, Boca Raton, Handbook of Chemistry and Physics, 2008
Proprietary data	DCPD (>80%)		1-5 mPa.s at 20°C	2016 Data source: ECHA website
Proprietary data	DCPD with purity of 94%	The study is not GLP but followed guideline ASTM 445.	2.811 mm^2/s at 40°C	2016 Data source: ECHA website

Short summary and overall relevance of the provided information on aspiration hazard

There is one report available with data on kinematic viscosity of 94% DCPD measured at 40°C. The study is not GLP but followed guideline ASTM 445 and considered to be suitable to use. Comparison with the GHS criteria.

The GHS provides the following criteria for Category 1 for aspiration hazard: if it is hydrocarbon and has a kinematic viscosity ≤ 20.5 mm^2/s, measured at 40°C. The kinematic viscosity value of 2.811 mm^2/s at 40°C is within the criteria ≤ 20.5 mm^2/s at 40°C warranting a classification of liquid DCPD in Category 1 for aspiration hazard.

Conclusion on classification and labelling for aspiration hazard

Classification with Category 1 is proposed for DCPD
Symbol: Health hazard
Signal word: Danger
Hazard statement: H304: May be fatal if swallowed and enters airways.

9. EVALUATION OF ENVIRONMENTAL HAZARDS

9.1 HAZARDOUS TO THE AQUATIC ENVIRONMENT

9.1.1 Rapid degradability of organic substances

Table 41: Summary of relevant information on rapid degradability

Method, test guideline, and deviation(s) if any	**Results**	**Remarks**	**Reference**
OECD Guideline 301 C (Ready Biodegradability : Modified MITI Test (I)) GLP compliant	The results were 0% biodegradation in 2 weeks.	Test substance: DCPD 99% Oxygen conditions: aerobic Details on inoculums: water Duration of test (contact time): 2 wk	M.I.T.I. Test was performed in CITI, Japan; National Institute of Technology and Evaluation. 2002. Biodegradation and Bioaccumulation of the Existing Chemical Substances under the Chemical Substances Control Law. Data source: ECHA website, OECD SIDS, US EPA
Unknown	1.6% after 21 days Not readily biodegradable	Test substance: DCPD, purity unknown Inoculum or test system: from surface water, adapted Initial test substance concentration: 5 mg/L based on test mat.	Spangoord, R.J. et a. (1979): NTIS Report No. AD AO 78236,|SRI International (contract no. DAMD 17-78-C-8053) Data source: ECHA website, OECD SIDS
OECD Guideline 301 F with the exception of the inoculum preparation which was performed ASTM D5864 GLP compliant	% Degradation of test substance: 0% after 28 days Parameter: O_2 consumption No measurable biodegradation observed over a 28 day testing period. DCPD/Codimer Concentrate cannot be considered readily biodegradable.	Substance DCPD/ Codimer Concentrate, Naphtha CAS number: 68478-10-4 Inoculum or test system: other: Activated Slude supernatant Details on inoculum: activated sludge from the Clinton Sanitary Wastewater Treatment Plant, Annandale New Jersey Duration of test (contact time): 28d Parameter followed for biodegradation estimation: O_2 consumption	Author not specified. Report date 2004-04-18 Data source: ECHA website

QSAR: Biowin v4.1 in EPISuite 4 (2009)	The results of the BIOWIN 1, 2, 3, 5 and 6 predictions are that 3a,4,7,7a-tetrahydro-4,7-methanoindene is not readily biodegradable: Biowin 5 and 6 models contain the most molecular fragment predictors that are relevant to 3a,4,7,7a-tetrahydro-4,7-methanoindene (4 x alkenyl hydrogen, 2 x -CH2- [cyclic] and 4 x -CH - [cyclic]. The results of Biowin 1,2,3 and 4 are based on the molecular mass and equation constants for 3a,4,7,7a-tetrahydro-4,7-methanoindene. Biowin 1-2 predict a probability of between 0.75 and 0.76 for ready biodegradability. Biowin 3 predicts a probability of 2.91 (weeks-months) for ultimate biodegradability. Biowin 5 predicts a probability of 0.4328 for ready biodegradability. Biowin 6 predicts a probability of 0.2276 for ready biodegradability	The Biodegradation Probability Program (Biowin) estimates the probability for the rapid aerobic biodegradation of an organic chemical in the presence of mixed populations of environmental microorganisms. Estimates are based upon fragment constants that were developed using multiple linear and non-linear regression analyses.	Howard, P.H., Boethling, R.S., Stiteler, W.M., Meylan, W.M., Hueber, A.E., Beauman, J.A., and M.E. Larosche. Predictive model for aerobic biodegradability developed from a file of evaluated biodegradation data. 1992. Environ. Toxicol. Chem. 11: 593-603. Data source: ECHA website
QSAR: BioCHwin v1.01 in EPISuite 4 (2009).	% primary degradation of test substance: 50% in 21.4 days Remark: Predicted on the basis of the presence of an alkenyl hydeogen and cyclic hydrogen functional groups.	BioHCwin is a predictive model for determining quantitative primary biodegradation half-lives for individual petroleum hydrocarbons. A half-life in days is estimated using a multiple linear regression against counts of 31 distinct molecular fragments.	Howard, P.H., W.M., Meylan, Aronson, D., Stiteler,W.M., Tunkel, J., Comber, M. and Parkerton, F. A New Biodegradation Prediction Model Specific to Petroleum Hydrocarbons. 2005. Environ. Toxicol. Chem. 24(8): 1847-1860. Data source: ECHA website
Unknown	BOD5/ThOD =< 4 %		ECETOC Bericht No. 19, Dicyclopentadiene. Data source: ECHA website
QSAR: AOPWIN (v1.92a)	OVERALL OH Rate Constant = 119.1993 E-12 cm^3/molecule-sec HALF-LIFE = 0.090 Days (12-hr day; 1.5E6 OH/cm^3) HALF-LIFE = 1.077 Hrs OVERALL OZONE Rate Constant = 40.000000 E-17 cm^3/molecule-sec	The estimation methods used by AOPWIN are based upon the structure-activity relationship (SAR) methods developed by Dr. Roger Atkinson and co-workers. AOPWIN incorporates updated fragment and	Publication: Atkinson, R., Kinetics and mechanisms of the gas-phase reactions of the hydroxyl radical with organic compounds under atmospheric conditions, 1985, Chem. Rev. 85: 69-201

	HALF-LIFE = 0.029 Days (at 7E11 mol/cm^3) HALF-LIFE = 41.256 Min	reaction values as cited in Kwok and Atkinson (1995)	Data source: ECHA website
Unknown	Degradation in % (for indirect photolysis): > 50 after 0.1 day(s)	Sensitiser: O_3, OH	ECETOC Bericht No. 19, Dicyclopentadiene. Data source: ECHA website

Ready biodegradability

Two studies on biodegradation performed with DCPD are available.
The first one was conducted with 99% DCPD according to OECD Guideline 301 C (Ready Biodegradability: Modified MITI Test (I)), GLP compliant and indicates 0% biodegradation in 2 weeks. Despite the fact that original report is unavailable, the data are considered as appropriate for classification purposes as taken from the reliable source (OECD SIDS). Other available data on biodegradability of DCPD support these results even though limited information is available from this study.

The second study reported 1.6% after 21 days, but provides a low level of details (among them method and purity of test substance are unknown). Thus, this data can be used as a supportive information.

No measurable biodegradation was observed over a 28 day testing period in the GLP compliant read-across study with DCPD/Codimer concentrate consisted of DCPD (29%), methylcyclopentadiene dimer (13%), cyclopentadiene/methylcyclopentadiene codimer (13%), other codimers of cyclopentadiene - e.g. with 1,3-butadiene or isoprene (7%), other similar codimers of ethycyclopentadiene (22%), balance (16%). The study was conducted under OECD Guideline 301 F with the exception of the inoculum preparation which was performed ASTM D5864.

There are two QSAR estimations of DCPD degradation are available which in the presence of experimental data can be used as an additional information.

The Biowin (Biodegradation Probability Program) estimates the probability for the rapid aerobic biodegradation of an organic chemical in the presence of mixed populations of environmental microorganisms. Estimates are based upon fragment constants that were developed using multiple linear and non-linear regression analyses. The results of the BIOWIN 1, 2, 3, 5 and 6 predictions are that 3a,4,7,7a-tetrahydro-4,7-methanoindene is not readily biodegradable.

BioHCwin estimation predicts 50% primary degradation in 21.4 days on the basis of the presence of an alkenyl hydeogen and cyclic hydrogen functional groups.

BOD_5/COD

The only data with low level of study details is available: BOD_5/ThOD =< 4 %.

Other convincing scientific evidence

No data available.

Aquatic simulation tests

No data available.

Field investigations and monitoring data (if relevant for C&L)

No data available.

Inherent and Enhanced Ready Biodegradability tests

No data available.

Soil and sediment degradation data

No data available.

Hydrolysis

No data available.

Photochemical degradation

The overall OH rate constant was calculated to be 119.1993E-12 cm³ molecule-1 s-1 based upon the structure-activity relationship (SAR) methods developed by Dr. Roger Atkinson and co-workers. The half-life in air was calculated to be 1.08 hours for DCPD based on an OH concentration of 1.5 x 10^6 OH/cm3 and a 12 hour day, using AOPWIN (v1.92a) in EPI Suite (v4.0). Long range transport in air for DCPD is not expected.
ECETOC Bericht No. 19 provides data on > 50% after 0.1 day(s) for indirect photolysis.

9.1.2 Environmental transformation of metals or inorganic metal compounds

Table 42: Summary of relevant information on rapid environmental transformation

Method, test guideline, and deviation(s) if any	**Results**	**Key or Supportive study**	**Remarks**	**Reference**
No applicable.				

Summary of data/information on environmental transformation

No applicable.

9.1.3 Environmental fate and other relevant information

Not considered in this document.

9.1.4 Bioaccumulation

Table 43: Summary of relevant information on bioaccumulation

Method, test guideline, and deviation(s) if any	Species	Results	Remarks	Reference
equivalent or similar to OECD Guideline 305 Deviations: yes slightly lower test temperature, design non-GLP	*Lepomis macrochirus*	A BCF of 53 was reported in Bluegill for DCPD.	Test substance: DCPD, purity unknown	Author not specified. Review article or handbook dated 1976. Data source: ECHA website – Exp Key Bioaccumulation: aquatic/sediment.001
OECD Guideline 305 C GLP compliant	*Cyprinus carpio*	BCF reported: Concentration (1) 0.3 mg/l BCF (1) 112 -330; concentration (2) 0.03 mg/l BCF (2) 58.9 -384	Test substance: DCPD 99%	MITI, Japan (1997) Data source: ECHA website, OECD SIDS
Unknown	*Lepomis macrochirus*	BCF = 53 at concentration 1 mg/l over 96h	Test substance: DCPD, purity unknown	ECETOC Bericht No. 19, Dicyclopentadiene Data source: ECHA website– NS Disregarded Bioaccumulation: aquatic/sediment.005

Estimated bioaccumulation

Not available.

Measured partition coefficient and bioaccumulation test data

In the most reliable study a BCF of 53 was reported in Bluegill for DCPD. Bluegill exposed to 1.0 mg/l 14C-DCPD during bioconcentration study appeared normal, fed readily and generally showed no signs of stress due to chemical toxicity. Mean measured concentration of 14 C-DCPD in the water through 14 days of exposure was 0.98 ± 0.25 mg/l. Estimated BCF for bluegill exposed to 14C-DCPD is 53. Report states "it appears that the potential of DCPD to bioconcentrate is slight".

Other reliable study (OECD Guideline 305 C, GLP compliant, however with low level of details and unavailable primary source) provides BCF of range 58.9 -384 at concentration 0.03 mg/l and of range 112 - 330 at 0.3 mg/l DCPD.

9.1.5 Acute aquatic hazard

Table 44: Summary of relevant information on acute aquatic toxicity

Method, test guideline, and deviation(s) if any	Species	Test material	Results[1]	Remarks	Reference
Fish					
equivalent or similar to Macroinvertebrate and fish toxicity tests followed the recommended bioassay procedures as described in the "Methods for Acute Toxicity Tests with Fish, Macro invertebrates, and Amphibians" (US EPA 1975) Non-GLP	*Ictalurus punctatus*	DCPD	The 96 hr LC_{50} was 15.7 mg/l based on nominal concentrations	Stock solution for fish ration of 1.5 parts DCPD :98.5 parts acetone (volume:volume)	Author not specified. Publication, 1976 Data source: ECHA website – Exp WoE Short-term toxicity to fish.005
equivalent or similar to Macroinvertebrate and fish toxicity tests followed the recommended bioassay procedures as described in the "Methods for Acute Toxicity Tests with Fish, Macro invertebrates, and Amphibians" (US EPA 1975) Non-GLP	*Lepomis macrochirus*	DCPD	The 96 hr LC_{50} was 23.3 mg/l based on nominal concentrations	Stock solution for fish ration of 1.5 parts DCPD :98.5 parts acetone (volume:volume)	Author not specified. Publication, 1976 Data source: ECHA website – Exp WoE Short-term toxicity to fish.008
equivalent or similar to Macroinvertebrate and fish toxicity tests followed the recommended bioassay procedures as described in the "Methods for Acute Toxicity	*Salmo gairdneri (*new name: *Oncorhynchus mykiss)*	DCPD	The 96 hr LC_{50} was 15.9 mg/l based on nominal concentrations	Stock solution for fish ration of 1.5 parts DCPD: 98.5 parts acetone (volume:volume)	Author not specified. Publication, 1976 Data source: ECHA website – Exp WoE Short-term toxicity to fish.010

Tests with Fish, Macro invertebrates, and Amphibians" (US EPA 1975) Non-GLP					
equivalent or similar to Macroinvertebra-te and fish toxicity tests followed the recommended bioassay procedures as described in the "Methods for Acute Toxicity Tests with Fish, Macro invertebrates, and Amphibians" (US EPA 1975) Non-GLP	*Pimephales promelas*	DCPD	The 96 hr LC_{50} was 31.1 mg/l based on nominal concentrations	Stock solution for fish ration of 1.5 parts DCPD :98.5 parts acetone (volume:volume)	Author not specified. Publication, 1976 Data source: ECHA website – Exp WoE Short-term toxicity to fish.007
OECD Guideline 203 (Fish, Acute Toxicity Test) Non-GLP	*Oryzias latipes (Himedaka)*	DCPD, 94,9%	The 96 hr LC_{50} was 4.3 mg/l based on nominal concentrations The 24 hr LC_{50} was 11 mg/l based on nominal concentrations The 48 hr LC_{50} was 6.7 mg/l based on nominal concentrations The 72 hr LC_{50} was 6.7 mg/l based on nominal concentrations	This study is unavailable for review, but it has been used in the OECD SIDS	Environment Agency of JAPAN (1995) Data source: ECHA website – Exp WoE Short-term toxicity to fish.006 and OECD SIDS
Method: Unknown Non-GLP	*Salmo gairdneri (*new name: *Oncorhynch us mykiss)*	DCPD, purity unkno wn	The 96 hr LC_{50} was 16 mg/l		ECETOC Bericht No. 19, Dicyclopentadiene. Data source: ECHA website – NS Disregarded Short-term toxicity to fish.003
Method: Unknown Non-GLP	*Ictalurus punctatus*	DCPD, purity unkno wn	The 96 hr LC_{50} was 16 mg/l		ECETOC Bericht No. 19, Dicyclopentadiene. Data source: ECHA website – NS Disregarded

					Short-term toxicity to fish.002, OECD SIDS
Method: Unknown Non-GLP	*Oryzias latipes*	DCPD, purity unknown	The 48 hr LC_{50} was 25 mg/l	Not relevant for classification purposes	Spangoord, R.J. et a. (1979): NTIS Report No. AD AO 78236,|SRI International (contract no. DAMD 17-78-C-8053). Data source: ECHA website – NS Disregarded Short-term toxicity to fish.009
Method: Unknown Non-GLP	*Lepomis macrochirus*	DCPD, purity unknown	The 96 hr LC_{50} was 23 mg/l		ECETOC Bericht No. 19, Dicyclopentadiene Data source: ECHA website – NS Disregarded Short-term toxicity to fish.004
QSAR Ecosar v1.00	*fish*	DCPD	The estimated 96 hr LC_{50} for fish is 9.765 mg/L		Ecosar v1.00. Nabholz V and Mayo-Bean K. 2009 US Environmental Protection Agency Data source: ECHA website – QSAR WoE Short-term toxicity to fish.001
Invertebrates					
OECD Guideline 202 GLP compliant	*Daphnia magna*	DCPD 92%	The 48h EC_{50} calculated to be 0.62 mg/l with 95% confidence limits of 0.52-0.72 mg/l based on nominal concentrations The 48h NOEC was 0.22 mg/l based on nominal concentrations		Author not specified. Report date 1995-06-18 Data source: ECHA website – Exp Key Short-term toxicity to aquatic invertebrates.002

ASTM (1980) E728-80 Non-GLP	*Daphnia pulex*	DCPD, 94-99%	The 48h EC_{50} was 4.2 mg/L based on nominal concentrations		Publication: Passino-Reader DR, Hickey JP, Ogilvie LM/ Toxicity to Daphnia pulex and QSAR Predictions for Polycyclic Hydrocarbons Representatvie of Great Lakes Contaminants, Bull. Environ. Contam. Toxicol (1997) 59:834-840 Data source: ECHA website – Exp Supporting Short-term toxicity to aquatic invertebrates.001
OECD Guideline 202 Non-GLP	*Daphnia magna*	DCPD, 94.9%	The 48 hour EC_{50} was 8 mg/l based on nominal concentrations The 24 hour EC_{50} was 8.6 mg/l based on nominal concentrations The 48 hour NOEC was <1.8 mg/l based on nominal concentrations	This study is unavailable for review, but it has been used in the OECD SIDS	Environment Agency of JAPAN (1997) Data source: ECHA website – Exp Supporting Short-term toxicity to aquatic invertebrates.006 and OECD SIDS
Method: Unknown Non-GLP	*Daphnia magna*	DCPD	The 48 hour EC_{50} was 11 mg/l		ECETOC Bericht No. 19, Dicyclopentadiene Data source: ECHA website – NS Disregarded Short-term toxicity to aquatic invertebrates.007

Unknown	*Unknown*	DCPD	The 3 hour LC_{50} was 40 mg/l	Not relevant for classification purposes	Yoshioka, Y. et al. (1986): Ecotoxicol. Environ. Safety 12,|15- 21 Data source: ECHA website – NS Disregarded Short-term toxicity to aquatic invertebrates.004
QSAR Ecosar v1.00	*Daphnia magna*	DCPD	The estimated 48 hr LC_{50} is 6.444 mg/l		Computer programme US Environmental Protection Agency, Nabholz V and Mayo-Bean K, Ecosar v1.00, 2009 Data source: ECHA website – QSAR Supporting Short-term toxicity to aquatic invertebrates.005
Algae and aquatic plants					
equivalent or similar to Phytoplankton assay procedures followed the Algal Assay Procedure: Bottle Test (US EA 1971) Non-GLP	*Anabaena flos-aquae*	DCPD	The 96 hour EC_{50} was 22 mg/l	The stock solutions prepared in the ratio of 1 part DCPD:99 parts acetone (volume:volume)	Author not specified. Publication, 1976 Data source: ECHA website – Exp WoE Toxicity to aquatic algae and cyanobacteria.003
equivalent or similar to Phytoplankton assay procedures followed the Algal Assay Procedure: Bottle Test (US EA 1971) Non-GLP	*Microcystis aeruginosa*	DCPD	The 96 hour EC_{50} was 31 mg/l	The stock solutions prepared in the ratio of 1 part DCPD:99 parts acetone (volume:volume)	Author not specified. Publication, 1976 Data source: ECHA website – Exp WoE Toxicity to aquatic algae and cyanobacteria.006
equivalent or similar to Phytoplankton assay procedures followed the Algal Assay Procedure: Bottle Test (US EA 1971) Non-GLP	*Selenastrum capricornutum (*new name: *Pseudokirchnerella subcapitata)*	DCPD	The 96 hour EC_{50} was >100 mg/l	The stock solutions prepared in the ratio of 1 part DCPD:99 parts acetone (volume:volume)	Author not specified. Publication, 1976 Data source: ECHA website – Exp WoE Toxicity to aquatic algae and cyanobacteria.002
OECD Guideline 201	*Selenastrum capricornutu*	DCPD, 94,9%	The 72 hour EC_{50} (growth rate) was	This study is unavailable for	Environment Agency of JAPAN (1995)

Non-GLP	*m (*new name: *Pseudokirchnerella subcapitata)*		27mg/l and a NOEC of 18 mg/l was reported	review, but it has been used in the OECD SIDS	Data source: ECHA website – Exp WoE Toxicity to aquatic algae and cyanobacteria.004, OECD SIDS
Method: Unknown Non-GLP	*Anabaena flos-aquae*		The 96 hour LC_{50} was 22 mg/l		ECETOC Bericht No. 19, Dicyclopentadiene ECHA website – NS Disregarded Toxicity to aquatic algae and cyanobacteria.005
Method: Unknown Non-GLP	*Selenastrum capricornutum (*new name: *Pseudokirchnerella subcapitata)*	DCPD	The 96 hour EC_{50} was >100 mg/l		ECETOC Bericht No. 19, Dicyclopentadiene ECHA website – NS Disregarded Toxicity to aquatic algae and cyanobacteria.001
QSAR: Ecosar v1.00	*Green Algae*	DCPD	Estimated 96 hour EC_{50} for Green Algae is 7.175 mg/L and the ChV is 2.387 mg/L, which corresponds to a NOEC of 1.688 mg/L.		US Environmental Protection Agency, computer programme, Nabholz V and Mayo-Bean K, Ecosar v1.00, 2009 Data source: ECHA website – QSAR WoE Toxicity to aquatic algae and cyanobacteria.007

[1] Indicate if the results are based on the measured or on the nominal concentration.

Acute (short-term) toxicity to fish

Nine studies are available on acute toxicity of DCPD to fish. Four of them were equivalent or similar to Macroinvertebrate and fish toxicity tests followed the recommended bioassay procedures as described in the "Methods for Acute Toxicity Tests with Fish, Macro invertebrates, and Amphibians" (US EPA 1975) performed with different species. The values of 96h LC_{50} of all these studies is in the range between 15.7-31.1 mg/l.

One study in *Oryzias latipes (Himedaka)* conducted under OECD Guideline 203 with 94.9% DCPD is available. The 96 hour LC_{50} was 4.3 mg/l with confidence level of 3.1 mg/l to 5.8 mg/l. According to item 4.1.1.3 of the GHS, for determination of acute aquatic toxicity a fish 96 hour LC_{50} (OECD Test Guideline 203 or equivalent) is normally used. Thus, the 24, 48 and 72 hour LC_{50} values obtained from this study are not relevant for classification purposes and were disregarded. In spite of the fact that the study has low level of details it was taken from the reliable source (OECD SIDS) and is considered as reliable for the purpose of these exercise.

Three studies reported 96 hour LC_{50} in range 16-23 mg/l with reference to ECETOC Bericht No. 19 are available. All these studies have very low level of details and performed under unknown method. Thus, they are cannot be used as a basis for classification purpose.

The study provided the 48 hr LC_{50} in *Oryzias latipes* is not relevant for classification purposes and, thus, was disregarded.

The 96 hr LC_{50} for fish was estimated at 9.765 mg/L using QSAR calculation. The use of ECOSAR to predict the acute aquatic toxicity is an appropriate technique to use as DCPD is in the chemical class of neutral organics.

Acute (short-term) toxicity to aquatic invertebrates

There are six studies available on acute (short-term) toxicity to aquatic invertebrates. In the most reliable study performed according to OECD Guideline 202 and GLP complient, the 48h EC_{50} of 92% DCPD in *Daphnia magna* calculated to be 0.62 mg/l with 95% confidence limits of 0.52-0.72 mg/l based on nominal concentrations. As the volatilisation of the substance is not expected to be critical, based on the low vapour pressure, the reporting of the results as nominal concentrations was considered to be adequate. The test material was prepared as a solvent stock solution: 400 mg of test material dissolved in 10ml dimethylformamide containing 1% (v/v) Tween 80. 200 ul of this stock solution dispersed in reconstituted water and volume adjusted to 2 litres to give test concentration of 4.0 mg/l. There is no any evidence that solvent could leads to a higher toxicity compared to pure DCPD or may alter the uptake of test material by aquatic invertebrates.

Other two reliable studies provide the 48h EC_{50} = 4.2 mg/L for *Daphnia pulex* and EC_{50}= 8 mg/l for *Daphnia magna*. The estimated (QSARs in the ECOSAR program) value of 48 hr LC_{50} was 6.444 mg/l for *Daphnia magna*. The use of ECOSAR to predict the acute aquatic toxicity is an appropriate technique to use as DCPD is in the chemical class of neutral organics.

Acute (short-term) toxicity to algae or aquatic plants

Seven studies are available on acute (short-term) toxicity of DCPD to algae or aquatic plants. In the most reliable study equivalent or similar to Phytoplankton assay procedures followed the Algal Assay Procedure: Bottle Test (US EA 1971) the 96 hour EC_{50} was 22 mg/l in *Anabaena flos-aquae*.

Other available studies provide 96 hour or 72 hour EC_{50} in the range >22 mg/l and can be considered as supportive for classification purposes.

The only one study performed data lower than 10 mg/L: estimated (QSARs in the Ecosar program) 96 hr EC_{50} for *Green Algae* is 7.175 mg/l. The use of ECOSAR to predict the acute aquatic toxicity is an appropriate technique to use as DCPD is in the chemical class of neutral organics. However, as far as the experimental data are available, QSAR calculation cannot be used as a basis for classification purposes.

Acute (short-term) toxicity to other aquatic organisms

No data available.

9.1.6 Long-term aquatic hazard

Table 45: Summary of relevant information on chronic aquatic toxicity

Method, test guideline, and deviation(s) if any	Species	Test material	Results	Remarks	Reference
Fish					
equivalent or similar to OECD Guideline 204 Deviations: yes Length of fish, temperature, water hardness, design Non GLP	*Lepomis macrochirus*	DCPD	No effect concentration of 0.98±0.25 mg/l was reported in the study over 14 days. As this was the highest tested concentration, in the bioaccumulation study it was not able to determine whether this is an actual NOEC.		Author not specified. Review article or handbook dated 1976 Data source: ECHA website – Exp WoE Long-term toxicity to fish.002
QSAR ECOWIN v1 ECOSAR Classes	*Fish*		The estimated 30d ChV value of 1.084 mg/L corresponds to 30d long-term fish NOEC of 0.767 mg/L.	Based on a log Kow: 3.165	ECOWIN v1 ECOSAR Classes for Microsoft Windows. Nabholz V and Mayo-Bean K. 2009 Data source: ECHA website – QSAR WoE Long-term toxicity to fish.001
Invertebrates					
OECD TG 202 (1984) Non GLP	*Daphnia magna*	DCPD 94.9%	Chronic toxicity to *daphnia magna* from DCPD over 21 days showed EC_{50} 4.0 mg/l, NOEC 3.2 mg/l and LOEC 10 mg/l using OECD TG 202 (1984)	This study is unavailable for review, but it has been used in the OECD SIDS	Environment Agency of JAPAN (1997) Data source: ECHA website – Exp Disregarded Long-term toxicity to aquatic invertebrates.003 and OECD SIDS
QSAR ECOWIN v1 ECOSAR	*Daphnia sp.*		The estimated 21d ChV for *Daphnia* is 0.812 mg/L, which corresponds to a 21d NOEC of 0.574 mg/L.	Based on a log Kow of 3.165	ECOWIN v1 ECOSAR Classes for Microsoft Windows. Nabholz V and Mayo-Bean K. 2009 Data source: ECHA website – QSAR WoE Long-term toxicity to aquatic invertebrates.001

Algae and aquatic plants					
OECD Guideline 201 Non-GLP	*Selenastrum capricornutum (*new name: *Pseudokirchnerella subcapitata)*	DCPD	NOEC of 18 mg/l was reported		Environment Agency of JAPAN (1995) Data source: ECHA website – Exp WoE Toxicity to aquatic algae and cyanobacteria.004 and OECD SIDS

[1] Indicate if the results are based on the measured or on the nominal concentration.

Chronic toxicity to fish

The only one experimental study (equivalent or similar to OECD Guideline 204, non GLP) relevant for chronic toxicity to fish is available for DCPD. No effect concentration of 0.98±0.25 mg/l over 14 days with 7 day depuration period was reported. As this was the highest tested concentration in the bioaccumulation study it was not able to determine whether this is an actual NOEC, and therefore this value cannot be considered relevant for classification purposes.

The 30d ChV value of 1.084 mg/L for fish was estimated using QSAR calculation. This value is corresponds to 30d long-term fish NOEC of 0.767 mg/L. The use of ECOSAR to predict the chronic aquatic toxicity is an appropriate technique as DCPD is in the chemical class of neutral organics and thus, the obtained data can be considered as supportive.

Chronic toxicity to aquatic invertebrates

One study performed according to OECD Guideline 202 with *Daphnia magna* is available. In this study chronic toxicity from DCPD over 21 days showed EC_{50} 4.0 mg/l, NOEC 3.2 mg/l and LOEC 10 mg/l.

ECOSAR estimates 21d ChV for *Daphnia sp.* of 0.812 mg/L, which corresponds to a 21d NOEC of 0.574 mg/L. The use of ECOSAR to predict the chronic aquatic toxicity is an appropriate technique as DCPD is in the chemical class of neutral organics. However, the experimental data for this trophic level are available and preferred for classification purposes.

Chronic toxicity to algae or aquatic plants

NOEC value of 18 mg/l is available for one study followed OECD Guideline 201 with *Selenastrum capricornutum (*new name: *Pseudokirchnerella subcapitata).*

Chronic toxicity to other aquatic organisms

No data available.

Comparison with the GHS criteria for hazardous to the aquatic environment

Acute aquatic hazard

There are several acute toxicity studies available for all three trophic levels. The following data are considered reliable and relevant for classification:

Fish: 96-hour LC_{50} = 4.3 mg/L (nominal concentration, *Oryzias latipes*)
Aquatic invertebrates: 48-hour EC_{50} = 0.62 mg/L (nominal concentration, *Daphnia magna*)
Algae: 96-hour EC_{50} = 22.0 mg/L (nominal concentration, *Anabaena flosaquae*).

The most sensitive species for acute toxicity of DCPD was aquatic invertebrates, providing the lowest EC_{50} of 0.62 mg/L in *Daphnia magna*. This value is below the classification threshold value of 1 mg/L for Category Acute 1 and warrant value of the M factor of 1 ($0.1 < EC_{50}=0.62$ mg/L ≤ 1).

Long-term aquatic hazard (including bioaccumulation and degradation)

Biodegradation
Based on the available data on ready biodegradability: 0% biodegradation in 2 weeks in OECD Guideline 301 C, GLP compliant test; no measurable biodegradation over a 28 day in the OECD Guideline 301 F, GLP compliant read-across study with DCPD/Codimer concentrate) it can be concluded that DCPD is non-rapidly degradable substances (according to the GHS, substances are considered rapidly degradable in the environment if 60% of theoretical maxima under tests based on oxygen depletion or carbon dioxide generation is reached).

Bioaccumulation
Two available studies provide BCF of range 53-384 in fish. Based on available data and in comparison with the GHS criteria (according to 4.1.2.10 a BCF in fish of < 500 is considered as indicative of a low level of bioconcentration) it can be concluded that the DCPD has low potential for bioaccumulation.

Chronic aquatic toxicity
Experimental data on chronic aquatic toxicity of DCPD for two following trophic levels are available: aquatic invertebrates and algae/aquatic plants, the most sensitive being invertebrates. As the DCPD is non-rapidly degradable substances Table 4.1.1 (b) (i) of GHS should be used.
The 21days NOEC = 3.2 mg/l in Daphnia magna is out of the range for Category Chronic 2 ($0.1 < NOEC \leq 1$ mg/l) and warrants no classification of DCPD for chronic aquatic toxicity.

There are no chronic data available for fish and, thus, the surrogate approach should be considered. Based on the acute toxicity in *Oryzias latipes (himedaka)* value the 96 hour $LC_{50}=4.3$ mg/l and non-rapid degradation, the classification based on Table 4.1.1 (b) (iii) applies and the substance should be classified in Category Chronic 2 (96 hr LC_{50} (for fish) > 1 but ≤ 10 mg/l and the substance is not rapidly degradable). The QSAR (ECOSAR) estimation available for this trophic level: 30d ChV value of 1.084 mg/L which corresponds to 30d long-term fish NOEC of 0.767 mg/L (based on a log Kow 3.165). This value is also support the classification of DCPD as Category 2 of chronic aquatic toxicity.

Thus, based on the most stringent outcome (the surrogate approach), the DCPD is proposed to classify as Category 2 for long term (chronic) aquatic hazard according to the GHS.

Conclusion on classification and labelling for hazardous to the aquatic environment

Classification with Category 1 for short-term (acute) aquatic hazard.
Symbol: Environment
Signal word: Warning
Hazard statement: H400: Very toxic to aquatic life.

Classification with Category 2 for long-term (chronic) aquatic hazard.
Symbol: Environment
Signal word: No signal word
Hazard statement: H411: Toxic to aquatic life with long lasting effects.

9.2 HAZARDOUS TO THE OZONE LAYER

Conclusion on classification and labelling for hazardous to the ozone layer

DCPD is not included in *The Montreal Protocol on Substances that Deplete the Ozone Layer* and therefore it is not proposed to be classified in this hazard class.

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