



Extended Safety Data Sheet

Section 1. Identification of the substance/mixture and of the company/undertaking			
Product Identity / Trade Name	Chlorendic Anhydride PE1+	REACH registration number	01-2119911956-30-0000
EINECS #	204-077-3	CAS#	115-27-5
Chemical Name	1,4,5,6,7,7-Hexachloro-8,9,10-trinorborn-5-ene-2,3-dicarboxylic anhydride	Chemical Formula	C ₉ H ₂ Cl ₆ O ₃
Synonym	4,5,6,7,8,8-Hexachloro-3a, 4,7,7a-tetrahydro-4, 7-methanoiso benzofuran-1, 3-dione	Chemical Family	Chlorinated bicyclical Anhydride
Supplier	Velsicol Chemical Ireland Limited Regus House Harcourt Centre Harcourt Road Dublin 2 Republic of Ireland Phone: 353 1 477 3143 Fax: 353 1 402 9587 Email: sfriedman@velsicol.com	In Case of Emergency	In the continental U.S.A. call CHEMTREC 800-424-9300 (24 hours) Outside the continental U.S.A. call CHEMTREC 703-527-3887 (24 hours)
Relevant identified uses	Industrial applications: Hardener for epoxy resins, paints, and coatings. Other non-specified industry: Flame Retardant in unsaturated polyester resins In compliance with the conditions described in the Annex to this safety data sheet.	Uses advised against	No recommendations at this stage. See section 16 for a general overview.

Section 2. Hazards identification			
Potential Acute Health Effects	Inhalation and skin contact are expected to be the primary routes of occupational exposure to chlorendic anhydride. This material is irritating to the eyes, skin and respiratory tract. Allergic skin reaction may occur in susceptible individuals. Chlorendic anhydride is considered, on the basis of single exposure (acute) animal tests, to be slightly toxic after ingestion (swallowing), practically non-toxic after inhalation and skin contact, severely irritating to eyes and practically non-irritating to skin.		
Regulation (EC) No 1272/2008	Classification: Skin Irritation 2 Skin Sensitization 1 Eye Irritation 2A Carcinogen 2 STOT Repeated Exposure 2 Aquatic Acute 3	Labeling: H315, H317, H319, H351, H373, H413 P260, P262, P273, P280, P332, P305+P351+P338 Signal Word: Warning	Pictograms:   Health Hazard Exclamation
Directive 67/548/EEC	Classification: Xi; Xn; T; R/20/21/22, R36/37/38, R42/43, R45, R48, R52/53		
Potential Chronic Health Effects	Chlorendic anhydride will slowly degrade to chlorendic acid in the presence of water and/or sunlight. The National Toxicology Program (NTP) has concluded that there is clear evidence of carcinogenicity (cancer) in a feeding study of rats and mice using chlorendic acid. International Agency for Research on Cancer (IARC) has given chlorendic acid an overall evaluation of 2B (possibly carcinogenic).		

Section 3. Composition/information on ingredients					
Name	CAS#	EC Number	% by Weight	R Phrases	Symbol
1) Chlorendic Anhydride	115-27-5	204-077-3	> 95.0	R20/21/22, R/36/37/38, R48	Xn
2) Chlorendic Acid	115-28-6	204-078-9	< 3.0	R45	T
3) Maleic anhydride	108-31-6	203-571-6	< 1.0	R42/43	
4) Chlorobenzene	108-90-7	203-628-5	< 5.0	R10, R52/53	

Section 4. First aid measures	
Eye Contact	Immediately flush with plenty of water for at least 15 minutes. Get medical attention immediately.

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Skin Contact	Immediately wash skin with soap and plenty of water. Remove contaminated clothing and shoes. Get medical attention if symptoms occur. Wash clothing before reuse. Destroy contaminated shoes.
Inhalation	If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.
Ingestion	If swallowed, induce vomiting as directed by medical personnel. Get medical attention. NEVER GIVE ANYTHING BY MOUTH TO AN UNCONSCIOUS PERSON.

Section 5. Firefighting measures

Fire Fighting Media and Instructions	Non-Flammable. Not considered to present risks of explosion. However, contains up to 5% occluded volatiles, which can present a fire hazard if sufficient oxygen and a source of ignition is present. Ground containers and equipment to avoid static charge accumulation and/or use an inert atmosphere to prevent combustion.
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Section 6. Accidental release measures

Small Spill	Use appropriate tools to put the spilled solid in a convenient waste disposal container.
Large Spill	Stop the leak if possible. Ventilate the area involved. Sweep up the material and place in container for later disposal.

Section 7. Handling and storage

Handling	Do not handle until all safety precautions have been read and understood Do not breathe dust/fumes/gas/mist/vapors/spray Do not get in eyes, on skin, or on clothing Wear suitable protective clothing, gloves and eye/face protection. Avoid release to the environment. Dispose of contents/container in accordance with local/regional/national/international regulation
Storage	Store in well ventilated area away from sources of ignition. Keep container tightly closed.

Section 8. Exposure controls/personal protection

Exposure Controls	Investigate engineering techniques to reduce exposures. Provide ventilation if necessary to minimize exposure. If practical use local mechanical exhaust ventilation at sources of air contamination such as open process equipment.	
Personal Protection	In compliance with the conditions described in the Annex to this safety data sheet.	
Personal Protection in Case of a Large Spill	Chemical resistant coveralls, gloves and boot covers. Shoes/boots. A full-face piece respirator with dual organic vapor and particulate matter cartridge is recommended.	
DNEL-values	Chemical resistant coveralls, gloves and boot covers. Shoes/boots. A full-face piece respirator with dual organic vapor and particulate matter cartridge is recommended. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.	
	Chlorendic Anhydride: DNEL (Derived No Effect Level) for Worker	
	DNEL type	DNEL value
	DNEL acute dermal, short-term (local)	1 mg/cm ³
	DNEL acute dermal, short-term (systemic)	43 mg/kg bw/day
	DNEL long-term dermal (systemic)	3.7 mg/kg bw/day
	DNEL long-term dermal (local)	0.56 mg/cm ³
	DNEL acute inhalation (local)	299 mg/m ³
	DNEL acute inhalation (systemic)	299 mg/m ³
	DNEL long-term inhalation (local)	33.23 mg/m ³
	DNEL long-term inhalation (systemic)	15 mg/m ³
	Chlorendic Anhydride: DNEL (Derived No Effect Level) for the general population	
	DNEL type	DNEL value
	DNEL acute dermal, short-term (local)	0.5 mg/cm ³
	DNEL acute dermal, short-term (systemic)	21 mg/kg bw/day
	DNEL long-term dermal (systemic)	3 mg/kg bw/day
DNEL long-term dermal (local)	0.28 mg/cm ³	
DNEL acute inhalation (local)	0.042 mg/m ³	
DNEL acute inhalation (systemic)	149 mg/m ³	



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	DNEL long-term inhalation (local)	16.62 mg/m ³
	DNEL long-term inhalation (systemic)	12 mg/m ³
Exposure Limits	108 -31-6, <i>Maleic anhydride</i> : United Kingdom, WEL - TWA: 1 mg/m ³ TWA, WEL - STEL: 3 mg/m ³ STEL United States: TWA: 0.25 ppm from OSHA/NIOSH; TWA: 0.25 ppm from ACGIH. Consult local authorities for acceptable exposure limits.	

Section 9. Physical and chemical properties

Appearance	Fine, crystalline solid.	Odor	No distinctive odor.
Molecular Weight	371	Color	White to yellowish.
pH (1% soln/water)	Not Available.	Boiling Point	Not available.
Melting Point	235°C (455°F)	Critical Temperature	Not available.
Relative Density	1.73 (Water = 1)	Vapor Pressure	2 mm of Hg (@ 20°C)
Vapor Density	13 (Air = 1)	Volatility	Not available
Evaporation Rate	Not available.	Viscosity	Not available.
Ionicity (In Water)	Not available.	Dispersion Properties	Not available.
Flash Point	Not available.	Auto Ignition Temp.	Not available.
Partition Coefficient Log n-Octanol/Water	Octanol/water = 1.39; 1,2-dichlorobenzene/water = 0.49		
Solubility	Easily soluble in acetone. Soluble in methanol, diethyl ether, n-octanol. Insoluble in cold water, hot water		
Flammability	Non-flammable. However, contains up to 5% occluded chlorobenzene, which can present a fire hazard if sufficient oxygen and a source of ignition is present. Ground containers and equipment to avoid static charge accumulation and/or use an inert atmosphere to prevent combustion.		
Explosive Properties	Not considered to present risks of explosion.		
Oxidizing Properties	Not available.		

Section 10. Stability and reactivity

Stability	The product is stable.
Instability Temperature	Not available.
Conditions to Avoid	No additional remark.
Incompatibility with Various Substances	Highly reactive with oxidizing agents, organic materials. Slightly reactive to reactive with reducing agents, acids, alkalis. Very slightly to slightly reactive with metals.
Corrosivity	Non-corrosive in presence of glass.
Hazardous Polymerization	Not available.
Hazardous Decomposition Products	Not available.

Section 11. Toxicological information

Routes of Entry	Inhalation. Skin contact.
Toxicity to Animals:	<p><i>115-27-5, Chlorendic Anhydride</i>:</p> Acute oral toxicity (LD50): 1138-3130 mg/kg, Slightly toxic (Rat) Acute dermal toxicity (LD50): > 10000 < 20000 mg/kg (Rabbit), practically non-toxic. Acute inhalation toxicity (LC50): > 203 mg/l 1-hour exposure, > 65 mg/l 4-hour exposure (Rat), practically non-toxic. Eye Irritation: Severely irritating (Rabbit) Skin Irritation: Practically non-irritating 0.8/8.0 (Rabbit) <p>Allergic skin reaction was reported in guinea pigs after repeated skin application. Repeated skin contact produced skin irritation, stomach lesions, diarrhea, nasal and eye discharge, decreased activity, anorexia and dehydration in rats. Decreased body weights, decreased food consumption and changes in heart, liver, kidney and spleen weights were reported after repeated dietary administration to rats. Repeated inhalation of dust produced nasal and eye irritation, salivation, hair loss, decreased body weight gain, liver and thyroid changes, lesions in the lung and stomach and cellular changes in the respiratory tract and stomach. No birth defects were reported in the offspring of rats given Chlorendic anhydride orally during fetal development. No genetic changes were reported in standard tests using animals and animal and bacterial cells. Genetic changes were reported in a standard test using human cells.</p>

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108-31-6, Maleic anhydride in RTECS (#ON3675000):

Dermal, guinea pig: LD50 = >20 gm/kg;
Draize test, rabbit, eye: 1% Severe;
Oral, mouse: LD50 = 465 mg/kg;
Oral, rabbit: LD50 = 875 mg/kg;
Oral, rat: LD50 = 400 mg/kg;
Skin, rabbit: LD50 = 2620 mg/kg.

115-28-6, Chlorendic Acid in RTECS (#RB9000000):

Draize test, rabbit, eye: 250 ug/24H Severe;
Draize test, rabbit, skin: 500 mg/24H Mild.

The National Toxicology Program (NTP) has concluded that there is clear evidence of carcinogenicity (cancer) in a feeding study of rats and mice using Chlorendic acid. International Agency for Research on Cancer (IARC) has given Chlorendic acid an overall evaluation of 2B (possibly carcinogenic).

108-90-7, Chlorobenzene:

Oral, LD50, Rat: 1110 mg/kg;
Oral, LD50, Mouse: 2300 mg/kg.

Section 12. Ecological information

Ecotoxicology	115-27-5, Chlorendic Anhydride: 48-hour LC50: 110.7 ppm Daphnia magna, practically non-toxic 96-hour LC50: 422.7 ppm Bluegill sunfish, practically non-toxic 96-hour LC50: 422.7 ppm Rainbow trout, practically non-toxic 72-hour EC50/LC50: >97.2 mg/L freshwater Algae							
PNEC-values	Chlorendic Anhydride: Predicted No Effect Concentration (PNEC)							
	Fresh water	Marine water	Intermittent release	Sediment (fresh water)	Sediment (marine water)	Soil (Terrestrial)	STP (sewage treatment plant)	Oral (mammals)
	0.097 mg/L	0.0097 mg/L	0.97 mg/L	0.097 mg/kg dw	0.0097 mg/kg dw	0.106 mg/kg dw	16.23 mg/L	2.51 mg/kg food
Chemical Fate	While Chlorendic anhydride is regarded as toxic, due to its Chlorendic acid content it may be considered to be persistent. However it is clearly not bioaccumulative. Therefore it is not regarded as PBT / vPvB.							

Section 13. Disposal considerations

Waste Disposal	Recycle to process, if possible. Consult your local or regional authorities for disposal options.
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Section 14. Transport information

ADR	IMDG	IATA	Special Provisions for Transport
Not controlled.			
Customs Classification	International HTS# 2917.20.0000		

Section 15. Regulatory information

Global Inventories	In Compliance with the following regulations: Europe (EINECS, ELINCS, NLP), Australia (AICS), Canada (DSL, NDSL), China (IECSC), Japan (ENCS), Korea (KECI), New Zealand (NZIoC), Philippines (PICCS), United States (TSCA)
Other Regulations	Germany: Ordinance on the Classification of Water-Endangering Substances. This substance has been assigned WGK Class: 2 (water endangering); WGK Identification Number: None; assigned by Velsicol Chemical LLC, pending further evaluation. REACH: chemical safety assessment has been carried out by the supplier.

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Section 16. Other information		
Regulation (EU) No 1272/2008	Classification	Hazard Statement
	Skin Irritation 2	H315: Causes skin irritation
	Skin Sensitization 1	H317: May cause an allergic skin reaction
	Eye Irritation 2A	H319: Causes serious eye irritation
	Carcinogen 2	H351: Suspected of causing cancer through oral exposure
	STOT Repeated Exposure 2	H373: May cause damage to lungs, stomach, heart and liver through prolonged or repeated exposure to oral, dermal and inhalation.
Aquatic Acute 3	H413: May cause long lasting harmful effects to aquatic life.	
Precautionary statements		
	<p>P202: Do not handle until all safety precautions have been read and understood. P260: Do not breathe dust/fume/gas/mist/vapors/spray. P262: Do not get in eyes, on skin, or on clothing. P264: Wash ... thoroughly after handling. P272: Contaminated work clothing should not be allowed out of the workplace. P273: Avoid release to the environment. P280: Wear protective gloves/protective clothing/eye protection/face protection. P332: If skin irritation occurs: wash affected area with soap and water and seek medical advice. P308 + P313: IF exposed or concerned: Get medical advice/attention. P305+P351+P338: IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. P314: Get medical advice/attention if you feel unwell. P363: Wash contaminated clothing before reuse. P403+P233: Store in a well-ventilated place. Keep container tightly closed. P405: Store locked up. P501: Dispose of contents/container in accordance with local/regional/national/international regulation EUH401: To avoid risks to human health and the environment, comply with the instructions for use.</p>	
Directive 67/548/EEC	<p>Risk Phases: R10 – Flammable. R20/21/22 – Harmful by inhalation, in contact with skin and if swallowed R36/37/38 – Irritating to eyes, respiratory system and skin. R42/43 – May cause sensitization by inhalation and skin contact. R45 – May cause cancer R48 – Danger of serious damage to health by prolonged exposure R52/53 – Harmful to aquatic organisms, may cause long-term adverse effects in the aquatic environment.</p> <p>Safety Statements: S22 – Do not breathe dust. S24/25 – Avoid contact with skin and eyes. S26 – In case of contact with eyes, rinse immediately with plenty of water and seek medical advice. S36/37/39 – Wear suitable protective clothing, gloves and eye/face protection. S45 – In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible). S61 – Avoid release to the environment. Refer to special instructions/Safety data sheets.</p>	
References	<ul style="list-style-type: none"> -REGISTRY Database, Chemical Abstract Service -CHEMLIST Database, Chemical Abstract Service -Registry of Toxic Effects of Chemical Substances (RTECS) -Hazardous Substance Data Bank (HSDB), National library of Medicine, #2920 -LOLI Database -ICRMS North American Database, Ariel Research Corporation -ICRMS European Database, Ariel Research Corporation -ICRMS Inventories Database, Ariel Research Corporation -Product Information Bulletin, Velsicol Chemical LLC 	



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	-Material Safety Data Sheet, Velsicol Chemical LLC -Velsicol Chemical LLC, unpublished studies	
Prepared By	Dawei Li, 05/01/2012	
Amendments	08/23/2011, Section 2, 16	
Contact Information	SDS or Regulatory information, contact: Dawei Li Velsicol Chemical LLC 1199 Warford Street Memphis, TN 38108 Phone: 901-323-6226, ext. 124 Fax: 901-324-5897 dli@velsicol.com	Technical or Product Support Information, contact: Sherman Friedman Velsicol Chemical LLC 10400 W. Higgins Road Rosemont, IL 60018 U.S.A. Phone: 847-635-3486 Fax: 847-298-9018 Email: sfriedman @velsicol.com
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Annex to extended safety data sheet (eSDS) of Chlorendic anhydride

Annex I. Identified Uses (IU) of Chlorendic anhydride

IU number	Identified Use (IU) name	Substance supplied to that use	Use descriptors
1	Receipt and storage of raw materials	as such (substance itself)	<p>Process category (PROC): PROC 1: Use in closed process, no likelihood of exposure PROC 3: Use in closed batch process (synthesis or formulation) PROC 8b: Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities</p> <p>Market sector by type of chemical product: PC 32: Polymer preparations and compounds</p> <p>Environmental release category (ERC): ERC 2: Formulation of preparations</p> <p>Sector of end use (SU): SU 10: Formulation [mixing] of preparations and/or re-packaging (excluding alloys)</p> <p>Subsequent service life relevant for that use?: no</p> <p>Article category related to subsequent service life (AC): AC 0: Other: Not applicable</p>
2	Blending / dissolving of dispersion	as such (substance itself)	<p>Process category (PROC): PROC 2: Use in closed, continuous process with occasional controlled exposure PROC 4: Use in batch and other process (synthesis) where opportunity for exposure arises PROC 5: Mixing or blending in batch processes for formulation of preparations and articles (multistage and/or significant contact)</p> <p>Market sector by type of chemical product : PC 32: Polymer preparations and compounds</p> <p>Environmental release category (ERC):</p>

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			<p>ERC 2: Formulation of preparations</p> <p>Sector of end use (SU): SU 10: Formulation [mixing] of preparations and/or re-packaging (excluding alloys)</p> <p>Subsequent service life relevant for that use?: no</p> <p>Article category related to subsequent service life (AC): AC 0: Other: Not applicable AC 32: Scented eraser</p>
3	Filtering and filling	in a mixture	<p>Process category (PROC): PROC 8a: Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non-dedicated facilities PROC 9: Transfer of substance or preparation into small containers (dedicated filling line, including weighing)</p> <p>Market sector by type of chemical product: PC 32: Polymer preparations and compounds</p> <p>Environmental release category (ERC): ERC 2: Formulation of preparations</p> <p>Sector of end use (SU): SU 10: Formulation [mixing] of preparations and/or re-packaging (excluding alloys)</p> <p>Subsequent service life relevant for that use?: no</p> <p>Article category related to subsequent service life (AC): AC 0: Other: Not applicable</p>
4	Waste management	in a mixture	<p>Process category (PROC): PROC 3: Use in closed batch process (synthesis or formulation) PROC 8b: Transfer of substance or preparation (charging /discharging) from/to vessels/large containers at dedicated facilities</p> <p>Market sector by type of chemical product: PC 0: Other: Not applicable</p> <p>Environmental release category (ERC): ERC 2: Formulation of preparations</p> <p>Sector of end use (SU): SU 23: Electricity, steam, gas water supply and sewage treatment</p> <p>Subsequent service life relevant for that use?: no</p> <p>Article category related to subsequent service life (AC): AC 0: Other: Not applicable</p>
5	Use in closed batch process	as such (substance itself)	<p>Process category (PROC): PROC 3: Use in closed batch process (synthesis or formulation)</p> <p>Market sector by type of chemical product: PC 32: Polymer preparations and compounds</p> <p>Environmental release category (ERC): ERC 2: Formulation of preparations</p>

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			<p>Sector of end use (SU): SU 0: Other: SU 3: Industrial uses</p> <p>Subsequent service life relevant for that use?: no</p> <p>Article category related to subsequent service life (AC): AC 0: Other: Not applicable</p>
6	Mixing or blending batches	as such (substance itself)	<p>Process category (PROC): PROC 5: Mixing or blending in batch processes for formulation of preparations and articles (multistage and/or significant contact)</p> <p>Market sector by type of chemical product: PC 32: Polymer preparations and compounds</p> <p>Environmental release category (ERC): ERC 2: Formulation of preparations</p> <p>Sector of end use (SU): SU 0: Other: SU 3: Industrial uses</p> <p>Subsequent service life relevant for that use?: no</p> <p>Article category related to subsequent service life (AC): AC 0: Other: Not applicable</p>
7	Transfer of substance	in a mixture	<p>Process category (PROC): PROC 8b: Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities PROC 9: Transfer of substance or preparation into small containers (dedicated filling line, including weighing)</p> <p>Market sector by type of chemical product: PC 32: Polymer preparations and compounds</p> <p>Environmental release category (ERC): ERC 2: Formulation of preparations</p> <p>Sector of end use (SU): SU 0: Other: Industrial uses</p> <p>Subsequent service life relevant for that use?: no</p> <p>Article category related to subsequent service life (AC): AC 0: Other: Not applicable</p>
8	Research and development.	as such (substance itself)	<p>Process category (PROC): PROC 15: Use as laboratory reagent</p> <p>Market sector by type of chemical product: PC 32: Polymer preparations and compounds</p> <p>Environmental release category (ERC): ERC 2: Formulation of preparations</p> <p>Sector of end use (SU): SU 0: Other: n/a</p> <p>Subsequent service life relevant for that use?: no</p>

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			Article category related to subsequent service life (AC): AC 0: Other: n/a
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Annex II. Short description of all exposure scenarios for Chlorendic anhydride

Short description of all exposure scenarios with their use descriptors and life cycle chain:

IU No.	Name of ES	Volume (T/annum)	Identified uses				Life cycle stage			Sector of Use (SU)	Product Category (PC)	Process category (PROC)	Article category (AC)	Environmental Release Category (ERC)
			Manufacture	Formulation	Industrial use	Consumer use	Service life (for articles)	Waste stage						
IU 1 - 8	Blending/dissolving of dispersion	1200	--	X	--	--	--	--	SU 10	PC 32	PROC 1,2, 3, 4, 5, 8a, 8b, 9, 15.	--	ERC 2	

A total of 1200T/annum is to be imported, the environmental assessment was calculated with a 0.1 default for release to environment, the volume per formulation / polymerization is taken as 20T.

Annex III. Chlorendic anhydride in formulation and polymerization

1. Exposure Scenario

1.1. Title: Chlorendic Anhydride in formulation and polymerization	
Free short title	Formulation / polymerization – use in manufacture paints and Epoxy resins.
Systematic title based on use descriptor	SU 10 PROC 1, PROC 2, PROC 3, PROC 4, PROC 5, PROC 8a, PROC 8b, PROC 9, PROC 15. ERC 2.
Processes, tasks, activities covered	Covers the formulation / polymerization of Chlorendic Anhydride during the production of paints and resins. It includes the following processes or activities: Laboratory use for quality control, charging, mixing or blending of substances which will be bound to a matrix, transfer of material from vessel to vessel, waste treatment (wastewater, residue), transfer of formulated / polymerized material e.g. into small containers
Assessment Method	ECETOC-TRA stand-alone version for workers and environment
1.2. Operational conditions and risk management measures	
Process Categories: Generally accepted standards of occupational hygiene are maintained. Smoking, eating and drinking are prohibited at the workplace. Spills are cleaned immediately.	
Environmental Release Category: All risk management measures utilized must also comply with all relevant local regulations. The primary recommended risk management measure is • An on-site industrial sewage treatment plant (STP) is discharged to, resulting in a removal efficiency of 78.9%	
Alternative risk management measures are: • Discharge of all wastes to a municipal sewage treatment plant (WWTP); or • Incineration of all waste	
1.2.1 Control of workers exposure	
Product characteristics	Low dustiness (coarse granules)
Amounts used	No information

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Frequency and duration of use	Frequency of exposure (weekly)	2	
	Frequency of exposure(annual)	100	
	Duration of exposure	> 4 h	
Human factors not influenced by risk management	Potentially exposed body parts	Two hands	
	Exposed skin surface	960 cm ²	
Other given operational conditions affecting workers exposure	Room size	not specified	
	Setting (indoor / outdoor)	Indoor	
Technical conditions and measures at processing level (source) to prevent releases	Not specified		
Technical conditions and measures to control dispersion from source the towards work	Not specified		
Organizational measures to prevent/limit Release, dispersion and exposure Eases.	Not specified		
Conditions and measures related to personal protection, hygiene and health evaluation	General accepted occupational hygiene standards are maintained		
1.2.2 Control of environmental exposure			
Product characteristics	Physical state	Solid	
	Concentration of substance in product	10 - 40%	
Amounts used	Daily amount of Chlorendic Anhydride at point source	200 k g	
	Annually amount of Chlorendic anhydride used at point source	20 t/a (based on 100 release days /year)	
Environmental factors not influenced by risk management	Flow rate of the receiving surface water	unknown	
	Dilution factor	10 (freshwater), 100 (seawater)	
Other given operational conditions affecting environmental exposure	Formulating setting (indoor/outdoor)	INDOOR	
	Formulating temperature	n.a.	
	Formulating pressure	n.a.	
1.3. Environmental exposure estimation is based on EUSES v2. 1.			
Release times per year (day/year)	250	Local release to air (kg/d)	0.548
Fraction used at main local source	1	Local release to waste water (kg/d)	11
Amount used locally (kg/day)	200		
1.4. RMM related to environmental exposure - on-site sewage treatment plant (STP)			
Organizational measures to prevent/limit release from site	Size of STP		
	Availability of STP		
Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil	Conditions and measures related to an industrial sewage treatment plant	Chlorendic Anhydride readily hydrolyses to Chlorendic Acid which is not biodegradable	
	Conditions and measures related to treatment of waste		
	Conditions and measures related to treatment of air		

2. Risk management measure

2.1 Risk management measures related to workers
Generally accepted standards of occupational hygiene are maintained. Smoking, eating and drinking are prohibited at the workplace. Spills are cleaned immediately. Local exhaust ventilation is considered but gloves and respiratory protection are not considered.
Although not modeled it is recommended that PPE is worn when handling Chlorendic anhydride, as advised by the MSDS;
Chemical resistant coveralls, gloves and boot covers. Shoes/boots. A full-face piece respirator with dual organic vapor and particulate matter cartridge is recommended. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.
2.2 Risk management measures related to environment
All risk management measures utilized must also comply with local regulations.

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<p>The primary recommended risk management measure is</p> <ul style="list-style-type: none"> An on-site industrial sewage treatment plant (STP) is discharged to, resulting in a removal efficiency of 78.9%. <p>Alternative risk management measures are:</p> <ul style="list-style-type: none"> Discharge of all wastes to a municipal sewage treatment plant (WWTP); or Incineration of all waste
2.3 Waste related measures
Any wastes and solutions that can contain residues of Chlorendic Anhydride are disposed in accordance of national and international legislation

3. Exposure estimation

3.1. Worker exposure

Model calculations were performed using ECETOC TRA. LEV was considered as present, however PRE was not considered present. Daily work duration per task was greater than 4 h.

The exposure scenario categories formulation and polymerization of Chlorendic anhydride consist of a number of activities. An individual worker may conduct one or several of these activities during one shift. However, PROC 4 has been identified as worst-case activities for inhalation and dermal exposure (see Table 3.1). If parts of the worker's shift are spent conducting PROCs other than these worst-case activities, the daily exposure of this worker will be lower than estimated for the worst case. The following table summarizes the output of the ECETOC TRA exposure estimates:

Table 3.1 Chlorendic anhydride used in formulation and polymerization – Results from ECETOC TRA*

No.	Process Category according to descriptor system	Estimated dermal exposure [mg/kg bw/day]	Estimated inhalation exposure [mg/m ³]
1	1 – Used in closed process, no likelihood of exposure	0.0343	0.01
2	2 – Used in closed, continuous process with occasional controlled exposure	0.137	0.001
3	3 – Used in close batch process (synthesis or formulation)	0.0343	n/a
4	4 – Used in batch and other process (synthesis) where opportunity for exposure arises	0.686	0.05
5	5 –Mixing or blending in batch processes for formulation of preparation and articles (multistage and/or significant contact	0.0686	0.05
6	8a –Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non-dedicated facilities	0.137	n/a
7	8b - Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities	0.686	n/a
8	9 –Transfer of substance or preparation into small containers (dedicated filling line, including weighing)	0.686	n./a
9	15 –Use as laboratory reagent	0.0343	n/a

* Daily work duration per task was greater than 4h. PROC 4 has been identified as worst-case activities for inhalation and dermal exposure.

3.2 Consumer exposure

Exposure of consumers to Chlorendic anhydride can be excluded, due to its incorporation into matrices and no detection of resorcinol from final products.

3.3 Indirect exposure of humans via the environment

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Indirect exposure of humans to Chlorendic anhydride via the environment can be excluded, due to its extremely low level of release into the environment.

3.4. Environmental exposure

The calculation of the PEC values for different environmental compartments is summarized in Table 3.2.

Table 3.2: Local concentration in STP, surface water, seawater, soil, and sediment following the use in formulation and polymerization

On-site STP / Compartments	PEC value	Unit
STP effluent concentration in = PECSTP	0.0024	mg/L
Local concentration in surface water = PECSURFACE WATER	0.00024	mg/L
Local concentration in freshwater sediment = PECSSEDIMENT	0.00106	mg/kg dw
Local concentration in agricultural soil (total) averaged over 30 days = PECSOIL 30 days	0.596 E-8	mg/kg dw
Local concentration in seawater = PECSEDIMENT WATER	0.000024	mg/L
Local concentration in seawater sediment = PECSEDIMENT SEDIMENT	0.000106	mg/kg dw