

SECTION 1: Identification of the substance/mixture and of the company/undertaking

1.1. Product identifier

Product form	: Substance
Trade name	: Gamma butyrolactone
Chemical name	: γ -butyrolactone
IUPAC name	: dihydrofuran-2(3H)-one
EC-No.	: 202-509-5
CAS-No.	: 96-48-0
REACH registration No	: 01-2119471839-21

1.2. Relevant identified uses of the substance or mixture and uses advised against

1.2.1. Relevant identified uses

Main use category	: Industrial use
Use of the substance/mixture	: Use as binders and release agents; Cleaning agent; Laboratory chemicals; Uses in Coatings See exposure scenario

Title	Use descriptors
Industrial Use of Coatings Containing γ -Butyrolactone (ES Ref.: 1)	SU3, SU10, PROC1, PROC2, PROC4, PROC5, PROC7, PROC8b, PROC9, PROC10, PROC13, PROC14, PROC15, ERC4
Industrial Use of Cleaning Agents Containing γ -Butyrolactone (ES Ref.: 2)	SU3, SU10, PROC1, PROC2, PROC4, PROC7, PROC8b, PROC10, PROC13, ERC4
Industrial Use of Binders and Release Agents Containing γ -Butyrolactone (ES Ref.: 3)	SU3, PROC1, PROC2, PROC3, PROC4, PROC6, PROC7, PROC8b, PROC10, PROC14, ERC4
Industrial Use of γ -Butyrolactone in Laboratory (ES Ref.: 4)	SU3, SU10, PROC10, PROC15, ERC4

Full text of use descriptors: see section 16

1.2.2. Uses advised against

No additional information available

1.3. Details of the supplier of the safety data sheet

Supplier

www.gblcleaningsolutions.com
info@gbcleaningsolutions.com

1.4. Emergency telephone number

No additional information available

SECTION 2: Hazards identification

2.1. Classification of the substance or mixture

Classification according to Regulation (EC) No. 1272/2008 [CLP]

Acute toxicity (oral), Category 4	H302
Serious eye damage/eye irritation, Category 1	H318
Specific target organ toxicity — Single exposure, Category 3, Narcosis	H336

Full text of H statements : see section 16

2.2. Label elements

Labelling according to Regulation (EC) No. 1272/2008 [CLP]

Hazard pictograms (CLP)



GHS05

GHS07

Signal word (CLP)

: Danger

Hazard statements (CLP)

: H302 - Harmful if swallowed.
H318 - Causes serious eye damage.
H336 - May cause drowsiness or dizziness.

Precautionary statements (CLP)

: P280 - Wear Protective gloves, Protective clothing, Eye protection, face protection.
P264 - Wash hands, forearms and face thoroughly after handling.
P261 - Avoid breathing dust, fume, gas, mist, vapours, spray.
P305+P351+P338 - IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P310 - Immediately call a POISON CENTER, a doctor.
P501 - Dispose of contents and container to hazardous or special waste collection point, in accordance with local, regional, national and/or international regulation.

2.3. Other hazards

This substance/mixture does not meet the PBT criteria of REACH regulation, annex XIII

This substance/mixture does not meet the vPvB criteria of REACH regulation, annex XIII

SECTION 3: Composition/information on ingredients

3.1. Substances

Substance type : Mono-constituent

Name	Product identifier	%	Classification according to Regulation (EC) No. 1272/2008 [CLP]
γ-butyrolactone	(CAS-No.) 96-48-0 (EC-No.) 202-509-5 (REACH-no) 01-2119471839-21	98 - 100	Acute Tox. 4 (Oral), H302 Eye Dam. 1, H318 STOT SE 3, H336

Full text of H-statements: see section 16

3.2. Mixtures

Not applicable

SECTION 4: First aid measures

4.1. Description of first aid measures

First-aid measures general

: Remove contaminated clothing. If breathing stops, give artificial respiration.
First-aid personnel: Wear proper protective equipment.

First-aid measures after inhalation

: Move immediately to fresh air in case of accidental inhalation of vapours. Obtain medical attention.

First-aid measures after skin contact

: Remove immediately contaminated clothing. Wash skin with plenty of water and soap.

First-aid measures after eye contact

: Rinse immediately with plenty of water. Contact lenses should be removed. Ensure adequate flushing of eyes by separating eyelids with the fingers. Continue to rinse eye with clean water for 20-30 minutes, retracting eyelids often. Seek medical attention immediately.

First-aid measures after ingestion

: Rinse mouth thoroughly with water. Drink plenty of water. Obtain medical attention. Never give anything by mouth to an unconscious person. Do NOT induce vomiting.

4.2. Most important symptoms and effects, both acute and delayed

Symptoms/effects after inhalation

: May cause drowsiness or dizziness.

Symptoms/effects after skin contact

: Not known.

Symptoms/effects after eye contact

: May cause Blurred vision and serious damage to eyes.

Symptoms/effects after ingestion

: Harmful if swallowed.

4.3. Indication of any immediate medical attention and special treatment needed

Treat symptomatically.

SECTION 5: Firefighting measures

5.1. Extinguishing media

- Suitable extinguishing media : Water spray, Foam, Dry powder, Carbon dioxide.
 Unsuitable extinguishing media : Not known.

5.2. Special hazards arising from the substance or mixture

- Hazardous decomposition products in case of fire : Carbon oxides (CO and CO₂), Nitrogen oxides, Other toxic gases.

5.3. Advice for firefighters

- Firefighting instructions : Cool with water containers exposed to flames, even after the fire is extinguished. Do not allow run-off from fire fighting to enter drains or water courses.
 Protection during firefighting : Wear positive pressure self-contained breathing apparatus (SCBA) and suitable protective clothing

SECTION 6: Accidental release measures

6.1. Personal precautions, protective equipment and emergency procedures

- General measures : Ensure procedures and training for emergency decontamination and disposal are in place. No action shall be taken without appropriate training or involving any personal risk. Evacuate unnecessary personnel.

6.1.1. For non-emergency personnel

- Protective equipment : Wear recommended personal protective equipment.
 Emergency procedures : Prevent unauthorised access. Avoid breathing vapours, spray. Avoid contact with skin and eyes. Take precautionary measures against static discharge. No flames, no sparks. Eliminate all sources of ignition. Do not smoke.

6.1.2. For emergency responders

- Protective equipment : Do not attempt to take action without suitable protective equipment. For further information refer to section 8: "Exposure controls/personal protection".

6.2. Environmental precautions

- Do not allow product to spread into the environment. In the event of a spill or accidental release, notify relevant authorities in accordance with all applicable regulations.

6.3. Methods and material for containment and cleaning up

- Methods for cleaning up : Take up liquid spill into absorbent material, e.g.: sand, earth, vermiculite. Collect all waste in suitable and labelled containers and dispose according to local legislation.
 Other information : No naked flames, sparks, and do not smoke. Do not touch or walk on the spilled product. Stop leak if safe to do so.

6.4. Reference to other sections

- Concerning personal protective equipment to use, see section 8. Concerning disposal elimination after cleaning, see section 13.

SECTION 7: Handling and storage

7.1. Precautions for safe handling

- Precautions for safe handling : Avoid inhalation of vapours/spray. Avoid contact with skin and eyes. Take precautionary measures to prevent the formation of static electricity and sparks. Remove all sources of ignition. Provide adequate ventilation.
 Hygiene measures : Use good personal hygiene practices. Wash hands and other exposed areas with mild soap and water before eating, drinking or smoking and when leaving work.

7.2. Conditions for safe storage, including any incompatibilities

- Storage conditions : Store tightly closed in a dry, cool and well-ventilated place. Keep only in the original container. Earth the equipment used to transfer the product and container.
 Incompatible products : Store away from alkalis.

7.3. Specific end use(s)

- No additional information available

SECTION 8: Exposure controls/personal protection

8.1. Control parameters

Gamma butyrolactone (96-48-0)	
DNEL/DMEL (Workers)	
Long-term - systemic effects, dermal	19 mg/kg bodyweight/day
Long-term - systemic effects, inhalation	37 mg/m ³

Gamma butyrolactone (96-48-0)	
DNEL/DMEL (General population)	
Acute - systemic effects, inhalation	340 mg/m ³
Long-term - systemic effects, oral	8 mg/kg bodyweight/day
Long-term - systemic effects, inhalation	28 mg/m ³
Long-term - systemic effects, dermal	8 mg/kg bodyweight/day
PNEC (Water)	
PNEC aqua (freshwater)	0.056 mg/l
PNEC aqua (marine water)	0.0056 mg/l
PNEC aqua (intermittent, freshwater)	0.56 mg/l
PNEC (Sediment)	
PNEC sediment (freshwater)	0.24 mg/kg dwt
PNEC sediment (marine water)	0.02 mg/kg dwt
PNEC (Soil)	
PNEC soil	0.014683 mg/kg dwt
PNEC (STP)	
PNEC sewage treatment plant	452 mg/l

8.2. Exposure controls

Appropriate engineering controls:

Provide adequate general and local exhaust ventilation.

Hand protection:

Wear suitable gloves tested to EN374. Butyl rubber gloves, PVC gloves, natural rubber gloves

Eye protection:

Wear tight fitting safety glasses or facial screen. EN 166

Skin and body protection:

Wear suitable coveralls to prevent exposure to the skin

Respiratory protection:

In case of inadequate ventilation wear respiratory protection.

Environmental exposure controls:

Avoid release to the environment.

SECTION 9: Physical and chemical properties

9.1. Information on basic physical and chemical properties

Physical state	: Liquid
Colour	: Colourless.
Odour	: Mild.
Odour threshold	: No data available
pH	: 4 - 5 (100 g/l, 20°C)
Relative evaporation rate (butylacetate=1)	: No data available
Melting point	: -43.2 - -42 °C
Freezing point	: No data available
Boiling point	: 204.6 °C (1013 hPa)
Flash point	: 106 °C CC
Auto-ignition temperature	: 435 °C
Decomposition temperature	: No data available
Flammability (solid, gas)	: No data available
Vapour pressure	: 0.4 mbar (20°C)
Relative vapour density at 20 °C	: No data available
Relative density	: 1.13 (20°C)
Solubility	: Miscible with : organic solvents. Water: > 1000 g/l (20°C)
Log Pow	: No data available
Log Kow	: -0.566

Viscosity, kinematic	: No data available
Viscosity, dynamic	: 1.9 mPa.s (20°C)
Explosive properties	: No data available
It does not have oxidising properties	: No data available
Lower explosive limit (LEL)	: 2.75 vol %
Upper explosive limit (UEL)	: 17.5 vol %

9.2. Other information

No additional information available

SECTION 10: Stability and reactivity

10.1. Reactivity

May react violently with strong oxidising agents and strong alkalis.

10.2. Chemical stability

Stable at ambient temperature and under normal conditions of use.

10.3. Possibility of hazardous reactions

No additional information available

10.4. Conditions to avoid

Heat, ignition sources, flames or sparks.

10.5. Incompatible materials

Strong acids, strong bases and strong oxidants.

10.6. Hazardous decomposition products

Under normal conditions of storage and use, hazardous decomposition products should not be produced.
Thermal decomposition may produce: Carbon oxides (CO and CO₂). Nitrogen oxides. Other toxic gases.

SECTION 11: Toxicological information

11.1. Information on toxicological effects

Acute toxicity (oral)	: Oral: Harmful if swallowed.
Acute toxicity (dermal)	: Not classified (Based on available data, the classification criteria are not met)
Acute toxicity (inhalation)	: Not classified (Based on available data, the classification criteria are not met)

Gamma butyrolactone (96-48-0)	
LD50 oral rat	1582 mg/kg bodyweight
LD50 dermal	5000 mg/kg
LC50 inhalation rat (mg/l)	> 5.1 mg/l/4h

Skin corrosion/irritation	: Not classified (Based on available data, the classification criteria are not met)
Serious eye damage/irritation	: Causes serious eye damage. pH: 4 - 5 (100 g/l, 20°C)
Respiratory or skin sensitisation	: Not classified (Based on available data, the classification criteria are not met)
Germ cell mutagenicity	: Not classified (Based on available data, the classification criteria are not met)
Carcinogenicity	: Not classified (Based on available data, the classification criteria are not met)
Reproductive toxicity	: Not classified (Based on available data, the classification criteria are not met)
STOT-single exposure	: May cause drowsiness or dizziness.
STOT-repeated exposure	: Not classified (Based on available data, the classification criteria are not met)
Aspiration hazard	: Not classified (Based on available data, the classification criteria are not met)

SECTION 12: Ecological information

12.1. Toxicity

Ecology - general	: Not classified (Based on available data, the classification criteria are not met)
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Gamma butyrolactone (96-48-0)	
LC50 fish 1	56 mg/l (Lepomis macrochirus)
EC50 Daphnia 1	> 500 mg/l
EC50 72h algae (1)	> 1000 mg/l (Scenedesmus subspicatus)
ErC50 (other aquatic plants)	4518 mg/l

12.2. Persistence and degradability

Gamma butyrolactone (96-48-0)

Persistence and degradability	Readily biodegradable, according to appropriate OECD test.
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12.3. Bioaccumulative potential

Gamma butyrolactone (96-48-0)

Log Kow	-0.566
Bioaccumulative potential	Bioaccumulation unlikely.

12.4. Mobility in soil

Gamma butyrolactone (96-48-0)

Ecology - soil	Not established.
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12.5. Results of PBT and vPvB assessment

Gamma butyrolactone (96-48-0)

This substance/mixture does not meet the PBT criteria of REACH regulation, annex XIII

This substance/mixture does not meet the vPvB criteria of REACH regulation, annex XIII

12.6. Other adverse effects

Other adverse effects : Not known.

SECTION 13: Disposal considerations

13.1. Waste treatment methods

Regional legislation (waste)	: Dispose as hazardous waste. Disposal must be done according to official regulations.
Waste treatment methods	: Collect all waste in suitable and labelled containers and dispose according to local legislation.
Sewage disposal recommendations	: Do not allow into drains or water courses.
Product/Packaging disposal recommendations	: Dispose of contents/container in accordance with licensed collector's sorting instructions. Disposal through controlled incineration or authorised waste dump.
Ecology - waste materials	: Avoid release to the environment.

SECTION 14: Transport information

In accordance with ADR / RID / IMDG / IATA / ADN

ADR	IMDG	IATA	ADN	RID
14.1. UN number				
Not applicable	Not applicable	Not applicable	Not applicable	Not applicable
14.2. UN proper shipping name				
Not applicable	Not applicable	Not applicable	Not applicable	Not applicable
14.3. Transport hazard class(es)				
Not applicable	Not applicable	Not applicable	Not applicable	Not applicable
14.4. Packing group				
Not applicable	Not applicable	Not applicable	Not applicable	Not applicable
14.5. Environmental hazards				
Not applicable	Not applicable	Not applicable	Not applicable	Not applicable
No supplementary information available				

14.6. Special precautions for user

- Overland transport

Not applicable

- Transport by sea

Not applicable

- Air transport

Not applicable

- Inland waterway transport

Not applicable

- Rail transport

Not applicable

14.7. Transport in bulk according to Annex II of Marpol and the IBC Code

Not applicable

SECTION 15: Regulatory information

15.1. Safety, health and environmental regulations/legislation specific for the substance or mixture

15.1.1. EU-Regulations

REGULATION (EC) No 1907/2006 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 18 December 2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH)

No REACH Annex XVII restrictions

Gamma butyrolactone is not on the REACH Candidate List

Gamma butyrolactone is not on the REACH Annex XIV List

REGULATION (EC) No 1272/2008 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 16 December 2008 on classification, labelling and packaging of substances and mixtures (CLP)

15.1.2. National regulations

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15.2. Chemical safety assessment

A chemical safety assessment has been carried out

SECTION 16: Other information

Abbreviations and acronyms:

ADR	European Agreement concerning the International Carriage of Dangerous Goods by Road
ADN	European Agreement concerning the International Carriage of Dangerous Goods by Inland Waterways
IATA	International Air Transport Association
IMDG	International Maritime Dangerous Goods
RID	Regulations concerning the International Carriage of Dangerous Goods by Rail
REACH	Registration, Evaluation, Authorisation and Restriction of Chemicals Regulation (EC) No 1907/2006
CLP	Classification Labelling Packaging Regulation; Regulation (EC) No 1272/2008
SDS	Safety Data Sheet
STP	Sewage treatment plant
DNEL	Derived-No Effect Level
PNEC	Predicted No-Effect Concentration
LD50	Median lethal dose
LC50	Median lethal concentration
EC50	Median effective concentration
NOEC	No-Observed Effect Concentration
PBT	Persistent Bioaccumulative Toxic
vPvB	Very Persistent and Very Bioaccumulative

Data sources : REGULATION (EC) No 1272/2008 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 16 December 2008 on classification, labelling and packaging of substances and mixtures (CLP).

Dissemination portal ECHA <https://echa.europa.eu/cs/search-for-chemicals>.

SDS Gamma butyrolactone, Date 22.11.2016., Version 16.

Training advice : Provide SDS to employees. Follow general rules on handling chemical substances and/or mixtures.

Other information : SDS was treated by EcoMole LTD. www.ecomole.com.

Full text of H- and EUH-statements:

Acute Tox. 4 (Oral)	Acute toxicity (oral), Category 4
Eye Dam. 1	Serious eye damage/eye irritation, Category 1
STOT SE 3	Specific target organ toxicity — Single exposure, Category 3, Narcosis
H302	Harmful if swallowed.
H318	Causes serious eye damage.
H336	May cause drowsiness or dizziness.

Full text of use descriptors

ERC4	Use of non-reactive processing aid at industrial site (no inclusion into or onto article)
PROC1	Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions
PROC10	Roller application or brushing

1. Exposure scenario 4
Industrial Use of γ -Butyrolactone in Laboratory

ES Ref.: 4	Date of issue: 04/12/2017
ES Type: Worker	
Version: 1.0	

Use descriptors	SU3, SU10 PROC10, PROC15 ERC4
Processes, tasks, activities covered	Use of the substance within laboratory settings, including material transfers and equipment cleaning Industrial use
Assessment method	Used ECETOC TRA model

2. Operational conditions and risk management measures
2.1. Contributing scenario controlling worker exposure (PROC10, PROC15)

PROC10	Roller application or brushing
PROC15	Use as laboratory reagent

Product characteristics

Physical form of product	Liquid
Concentration of substance in product	<= 100 % Covers percentage substance in the product up to 100 % (unless stated differently)
Vapour pressure	0.344 hPa at 20 °C

Operational conditions

Amounts used	Not applicable
Frequency and duration of use	Covers daily exposures up to 8 hours (unless stated differently)
Human factors not influenced by risk management	Not applicable
Other given operational conditions affecting workers exposure	Assumes a good basic standard of occupational hygiene is implemented

Risk Management Measures

Other risk management measures:

Laboratory activities, Normal good standard fume cupboard (97%)	Handle in a fume cupboard or under extract ventilation. Put lids on containers immediately after use. Carefully pour from containers. Ensure the ventilation system is regularly maintained and tested. Wear suitable gloves tested to EN374
Laboratory activities, Bench-mounted local extract ventilation; selected disposable gloves	Ensure material transfers are under containment or extract ventilation. Put lids on containers immediately after use. Carefully pour from containers. Ensure the ventilation system is regularly maintained and tested. Wear suitable gloves tested to EN374
Laboratory activities, Controlled general ventilation (10 ACH); selected disposable gloves	No specific measures identified. Put lids on containers immediately after use. Carefully pour from containers. Wear suitable gloves tested to EN374
Laboratory activities, Normal good standard fume cupboard (97%), Duration 0.6	Handle in a fume cupboard or under extract ventilation. Put lids on containers immediately after use. Carefully pour from containers. Ensure the ventilation system is regularly maintained and tested. Wear suitable gloves tested to EN374
Laboratory activities, Bench-mounted local extract ventilation; selected disposable gloves, Duration 0.6	Ensure material transfers are under containment or extract ventilation. Ensure the ventilation system is regularly maintained and tested. Carefully pour from containers. Put lids on containers immediately after use. Wear suitable gloves tested to EN374
Laboratory activities, Controlled general ventilation (10 ACH); selected disposable gloves, Duration 0.6	No specific measures identified. Ensure material transfers are under containment or extract ventilation. Put lids on containers immediately after use. Carefully pour from containers. Ensure the ventilation system is regularly maintained and tested. Wear suitable gloves tested to EN374
Laboratory activities, Normal good standard fume cupboard, Duration, 0,2	Handle in a fume cupboard or under extract ventilation. Put lids on containers immediately after use. Carefully pour from containers. Ensure the

1. Exposure scenario 1
Industrial Use of Coatings Containing γ -Butyrolactone

ES Ref.: 1	Date of issue: 04/12/2017
ES Type: Worker	
Version: 1.0	

Use descriptors	SU3, SU10 PROC1, PROC2, PROC4, PROC5, PROC7, PROC8b, PROC9, PROC10, PROC13, PROC14, PROC15 ERC4
Processes, tasks, activities covered	Covers the use in coatings (paints, inks, adhesives, etc) within closed or contained systems including incidental exposures during use (including materials receipt, storage, preparation and transfer from bulk and semi-bulk, application activities and film formation) and equipment cleaning, maintenance and associated laboratory activities Industrial use
Assessment method	Used ECETOC TRA model

2. Operational conditions and risk management measures
2.1.1 Contributing scenario controlling worker exposure (PROC1, PROC2, PROC4, PROC5, PROC7, PROC8b, PROC9, PROC10, PROC13, PROC14, PROC15)

PROC1	Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions
PROC2	Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions
PROC4	Chemical production where opportunity for exposure arises
PROC5	Mixing or blending in batch processes
PROC7	Industrial spraying
PROC8b	Transfer of substance or mixture (charging and discharging) at dedicated facilities
PROC9	Transfer of substance or mixture into small containers (dedicated filling line, including weighing)
PROC10	Roller application or brushing
PROC13	Treatment of articles by dipping and pouring
PROC14	Tabletting, compression, extrusion, pelletisation, granulation
PROC15	Use as laboratory reagent

Product characteristics

Physical form of product	Liquid
Concentration of substance in product	<= 100 % Covers percentage substance in the product up to 100 % (unless stated differently)
Vapour pressure	0.344 hPa at 20 °C

Operational conditions

Amounts used	Not applicable
Frequency and duration of use	Covers daily exposures up to 8 hours (unless stated differently)
Human factors not influenced by risk management	Not applicable
Other given operational conditions affecting workers exposure	Assumes a good basic standard of occupational hygiene is implemented

Risk Management Measures

Other risk management measures:

General exposures (closed systems), with sample collection, >4 hours, ambient temp, <62°C	Handle substance within a closed system. Wear suitable gloves tested to EN374
Film formation - force drying (50 - 100°C). Stoving (>100°C). UV/EB radiation curing, >4 hours, ambient temp, <62°C	Handle substance within a closed system. Ensure material transfers are under containment or extract ventilation. Ensure the ventilation system is regularly maintained and tested. Wear suitable gloves tested to EN374
Film formation - air drying, daily, ambient temp, <62°C	No specific measures identified. Provide extract ventilation to points where emissions occur. Avoid manual contact with wet work pieces. Ensure the ventilation system is regularly maintained and tested. Wear suitable gloves tested to EN374

Preparation of material for application, Mixing operations (open systems), >4 hours, ambient temp, <62°C	No specific measures identified. Provide extract ventilation to points where emissions occur. Avoid manual contact with wet work pieces. Ensure the ventilation system is regularly maintained and tested. Wear suitable gloves tested to EN374	
Spraying (automatic/robotic), daily, ambient temp, <62°C	Carry out in a vented booth provided with laminar airflow. Minimise exposure by partial enclosure of the operation or equipment and provide extract ventilation at openings. Ensure the ventilation system is regularly maintained and tested. Wear suitable gloves tested to EN374	
Spraying/fogging by manual application, >4 hours, daily, ambient temp, <62°C	Provide a good standard of general ventilation. Natural ventilation is from doors, windows etc. Controlled ventilation means air is supplied or removed by a powered fan. Provide a good standard of controlled ventilation (5 to 10 air changes per hour). Wear chemically resistant gloves (tested to EN374) in combination with specific activity training	
Material transfers, daily, ambient temp, <62°C	Clear transfer lines prior to de-coupling. Provide extract ventilation to points where emissions occur. Ensure the ventilation system is regularly maintained and tested. Wear suitable gloves tested to EN374	
Additivation and stabilisation, >4 hours, daily, ambient temp, <62°C	No specific measures identified. Provide extract ventilation to points where emissions occur. Minimise exposure by partial enclosure of the operation or equipment and provide extract ventilation at openings. Ensure the ventilation system is regularly maintained and tested. Wear suitable gloves tested to EN374	
Dipping, immersion and pouring, daily, ambient temp, <62°C	No specific measures identified. Provide extract ventilation to points where emissions occur. Avoid manual contact with wet work pieces. Clear spills immediately. Ensure the ventilation system is regularly maintained and tested. Wear suitable gloves tested to EN374	
Laboratory activities, >4 hours, ambient temp, <62°C	Avoid manual contact with wet work pieces. Provide extract ventilation to points where emissions occur. Ensure the ventilation system is regularly maintained and tested. Wear suitable gloves tested to EN374	
Material transfers, Drum/batch transfers, Transfer from/pouring from containers, >4 hours, ambient temp, <62°C	No specific measures identified. Provide extract ventilation to points where emissions occur. Ensure material transfers are under containment or extract ventilation. Ensure the ventilation system is regularly maintained and tested. Wear suitable gloves tested to EN374	
Production or preparations or articles by tableting, compression, extrusion or pelletisation, >4 hours, ambient temp, <62°C	No specific measures identified. Provide extract ventilation to points where emissions occur. Ensure the ventilation system is regularly maintained and tested. Wear suitable gloves tested to EN374	
Storage, >4 hours, ambient temp, <62°C	Store substance within a closed system. Clear transfer lines prior to de-coupling. Ensure material transfers are under containment or extract ventilation. Ensure the ventilation system is regularly maintained and tested	

3. Exposure estimation and reference to its source

3.1. Health

Information for contributing exposure scenario	
3.1.1	When the recommended risk management measures (RMMs) and operational conditions (OCs) are observed, exposures are not expected to exceed the predicted DNELs and the resulting risk characterisation ratios are expected to be less than 1.

Long-term - systemic effects						
DNEL	Inhalation: 37 mg/m ³ Dermal: 19 mg/kg bodyweight/day					
Contributing Scenario	inhalation exposure mg/m ³	RCR	dermal exposure mg/kg bodyweight/day	RCR	Sum RCR	Assessment method
General exposures (closed systems), with sample collection, >4 hours, ambient temp, <62°C	1	0.027	0.03	0.002	0.029	Inhalation: Used ECETOC TRA model Dermal: Used ECETOC TRA model

Film formation - force drying (50 - 100°C). Stoving (>100°C). UV/EB radiation curing, >4 hours, ambient temp, <62°C	1	0.027	0.14	0.007	0.034	Inhalation: Used ECETOC TRA model Dermal: Used ECETOC TRA model
Film formation - air drying, daily, ambient temp, <62°C	5	0.135	0.69	0.036	0.171	Inhalation: Used ECETOC TRA model Dermal: Used ECETOC TRA model
Preparation of material for application, Mixing operations (open systems), >4 hours, ambient temp, <62°C	5	0.135	0.07	0.004	0.139	Inhalation: Used ECETOC TRA model Dermal: Used ECETOC TRA model
Spraying (automatic/robotic), daily, ambient temp, <62°C	5	0.135	2.14	0.113	0.248	Inhalation: Used ECETOC TRA model Dermal: Used ECETOC TRA model
Spraying/fogging by manual application, >4 hours, daily, ambient temp, <62°C	30	0.811	2.14	0.113	0.924	Inhalation: Used ECETOC TRA model Dermal: Used ECETOC TRA model
Material transfers, daily, ambient temp, <62°C	5	0.135	0.69	0.036	0.171	Inhalation: Used ECETOC TRA model Dermal: Used ECETOC TRA model
Additivation and stabilisation, >4 hours, daily, ambient temp, <62°C	10	0.27	1.37	0.072	0.342	Inhalation: Used ECETOC TRA model Dermal: Used ECETOC TRA model
Dipping, immersion and pouring, daily, ambient temp, <62°C	10	0.27	0.69	0.036	0.306	Inhalation: Used ECETOC TRA model Dermal: Used ECETOC TRA model
Laboratory activities, >4 hours, ambient temp, <62°C	5	0.135	0.03	0.002	0.137	Inhalation: Used ECETOC TRA model Dermal: Used ECETOC TRA model
Material transfers, Drum/batch transfers, Transfer from/pouring from containers, >4 hours, ambient temp, <62°C	5	0.135	6.86	0.361	0.496	Inhalation: Used ECETOC TRA model Dermal: Used ECETOC TRA model
Production or preparations or articles by tableting, compression, extrusion or pelletisation, >4 hours, ambient temp, <62°C	5	0.135	3.43	0.181	0.316	Inhalation: Used ECETOC TRA model Dermal: Used ECETOC TRA model
Storage, >4 hours, ambient temp, <62°C	1	0.027	0.14	0.007	0.034	Inhalation: Used ECETOC TRA model Dermal: Used ECETOC TRA model

3.2. Environment

As a result of the hazard assessment carried out in accordance to article 14.3, the registrant concludes that the substance does not meet the criteria for classification as dangerous for the environment; therefore risk characterisations for environmental endpoints were not developed

4. Guidance to Downstream User to evaluate whether he works inside the boundaries set by the ES

4.1. Health

Guidance - Health	Confirm that RMMs and OCs are as described.
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4.2. Environment

Guidance - Environment	As a result of the hazard assessment carried out in accordance to article 14.3, the registrant concludes that the substance does not meet the criteria for classification as dangerous for the environment; therefore risk characterisations for environmental endpoints were not developed
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1. Exposure scenario 2
Industrial Use of Cleaning Agents Containing γ -Butyrolactone

 ES Ref.: 2
 ES Type: Worker
 Version: 1.0

Date of issue: 04/12/2017

Use descriptors	SU3, SU10 PROC1, PROC2, PROC4, PROC7, PROC8b, PROC10, PROC13 ERC4
Processes, tasks, activities covered	Covers the use as a component of cleaning products including transfer from storage, pouring/unloading from drums or containers. Exposures during mixing/diluting in the preparatory phase and cleaning activities (including spraying, brushing, dipping, wiping, automated and by hand), related equipment cleaning and maintenance Industrial use
Assessment method	Used ECETOC TRA model

2. Operational conditions and risk management measures
2.1.1 Contributing scenario controlling worker exposure (PROC1, PROC2, PROC4, PROC7, PROC8b, PROC10, PROC13)

PROC1	Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions
PROC2	Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions
PROC4	Chemical production where opportunity for exposure arises
PROC7	Industrial spraying
PROC8b	Transfer of substance or mixture (charging and discharging) at dedicated facilities
PROC10	Roller application or brushing
PROC13	Treatment of articles by dipping and pouring

Product characteristics

Physical form of product	Liquid
Concentration of substance in product	<= 100 % Covers percentage substance in the product up to 100 % (unless stated differently)
Vapour pressure	0.344 hPa at 20 °C

Operational conditions

Amounts used	Not applicable
Frequency and duration of use	Covers daily exposures up to 8 hours (unless stated differently)
Human factors not influenced by risk management	Not applicable
Other given operational conditions affecting workers exposure	Assumes a good basic standard of occupational hygiene is implemented

Risk Management Measures

Other risk management measures:

Bulk transfers, >4 hours, ambient temp.	Clear transfer lines prior to de-coupling. Clear up spills immediately and dispose of waste safely. Wear suitable gloves (tested to EN374) and eye protection. Wear suitable coveralls to prevent exposure to the skin
Use in contained systems, Automated process with (semi) closed systems, >4 hours, ambient temp.	No specific measures identified. Clear transfer lines prior to de-coupling. Clear up spills immediately and dispose of waste safely. Wear suitable gloves tested to EN374
Filling / preparation of equipment from drums or containers, daily, ambient temp.	Wear suitable gloves (tested to EN374), coverall and eye protection
Use in contained batch processes, Automated process with (semi) closed systems, >4 hours, temperature above boiling point	Clear transfer lines prior to de-coupling. Provide extract ventilation to points where emissions occur. Ensure the ventilation system is regularly maintained and tested. Wear suitable gloves (tested to EN374), coverall and eye protection. Clear up spills immediately and dispose of waste safely
Dipping, immersion and pouring, >4 hours, ambient temp.	Wear suitable gloves (tested to EN374), coverall and eye protection. Avoid manual contact with wet work pieces

Cleaning with low-pressure washers, >4 hours, ambient temp.	Wear suitable gloves (tested to EN374) and eye protection. Avoid manual contact with wet work pieces. Clear up spills immediately and dispose of waste safely. Wear chemically resistant gloves (tested to EN374) in combination with 'basic' employee training	
Cleaning with high pressure washers, >4 hours, ambient temp.	Wear suitable respiratory protection (conforming to EN140 with Type A filter or better) and gloves (type EN374) if regular skin contact likely. Use suitable eye protection	
Manual, Surfaces, Cleaning, no spraying, >4 hours, ambient temp.	Minimise exposure by partial enclosure of the operation or equipment and provide extract ventilation at openings. Ensure the ventilation system is regularly maintained and tested. Wear suitable gloves (tested to EN374) and eye protection	
Storage, >4 hours, ambient temp.	Avoid dip sampling. Store substance within a closed system. Use suitable eye protection and gloves	

3. Exposure estimation and reference to its source

3.1. Health

Information for contributing exposure scenario	
3.1.1	When the recommended risk management measures (RMMs) and operational conditions (OCs) are observed, exposures are not expected to exceed the predicted DNELs and the resulting risk characterisation ratios are expected to be less than 1.

Long-term - systemic effects						
DNEL	Inhalation: 37 mg/m ³ Dermal: 19 mg/kg bodyweight/day					
Contributing Scenario	inhalation exposure mg/m ³	RCR	dermal exposure mg/kg bodyweight/day	RCR	Sum RCR	Assessment method
Bulk transfers, >4 hours, ambient temp.	5	0.135	0.03	0.002	0.137	Inhalation: Used ECETOC TRA model Dermal: Used ECETOC TRA model
Use in contained systems, Automated process with (semi) closed systems, >4 hours, ambient temp.	1	0.027	1.37	0.072	0.099	Inhalation: Used ECETOC TRA model Dermal: Used ECETOC TRA model
Filling / preparation of equipment from drums or containers, daily, ambient temp.	5	0.135	0.69	0.036	0.171	Inhalation: Used ECETOC TRA model Dermal: Used ECETOC TRA model
Use in contained batch processes, Automated process with (semi) closed systems, >4 hours, temperature above boiling point	10	0.27	0.69	0.036	0.306	Inhalation: Used ECETOC TRA model Dermal: Used ECETOC TRA model
Dipping, immersion and pouring, >4 hours, ambient temp.	10	0.27	0.69	0.036	0.306	Inhalation: Used ECETOC TRA model Dermal: Used ECETOC TRA model
Cleaning with low-pressure washers, >4 hours, ambient temp.	10	0.27	5.49	0.289	0.559	Inhalation: Used ECETOC TRA model Dermal: Used ECETOC TRA model
Cleaning with high pressure washers, >4 hours, ambient temp.	10	0.27	8.57	0.451	0.721	Inhalation: Used ECETOC TRA model Dermal: Used ECETOC TRA model
Manual, Surfaces, Cleaning, no spraying, >4 hours, ambient temp.	10	0.27	2.74	0.144	0.414	Inhalation: Used ECETOC TRA model Dermal: Used ECETOC TRA model
Storage, >4 hours, ambient temp.	1	0.027	0.14	0.007	0.034	Inhalation: Used ECETOC TRA model Dermal: Used ECETOC TRA model

3.2. Environment

As a result of the hazard assessment carried out in accordance to article 14.3, the registrant concludes that the substance does not meet the criteria for classification as dangerous for the environment; therefore risk characterisations for environmental endpoints were not developed

4. Guidance to Downstream User to evaluate whether he works inside the boundaries set by the ES

4.1. Health

Guidance - Health	Confirm that RMMs and OCs are as described.
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4.2. Environment

Guidance - Environment	As a result of the hazard assessment carried out in accordance to article 14.3, the registrant concludes that the substance does not meet the criteria for classification as dangerous for the environment; therefore risk characterisations for environmental endpoints were not developed
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1. Exposure scenario 3

Industrial Use of Binders and Release Agents Containing γ -Butyrolactone

ES Ref.: 3	Date of issue: 04/12/2017
ES Type: Worker	
Version: 1.0	

Use descriptors	SU3 PROC1, PROC2, PROC3, PROC4, PROC6, PROC7, PROC8b, PROC10, PROC14 ERC4
Processes, tasks, activities covered	Covers the use as binders and release agents including material transfers, mixing, application (including spraying and brushing), mould forming and casting, and handling of waste Industrial use
Assessment method	Used ECETOC TRA model

2. Operational conditions and risk management measures

2.1.1 Contributing scenario controlling worker exposure (PROC1, PROC2, PROC3, PROC4, PROC6, PROC7, PROC8b, PROC10, PROC14)

PROC1	Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions
PROC2	Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions
PROC3	Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition
PROC4	Chemical production where opportunity for exposure arises
PROC6	Calendering operations
PROC7	Industrial spraying
PROC8b	Transfer of substance or mixture (charging and discharging) at dedicated facilities
PROC10	Roller application or brushing
PROC14	Tabletting, compression, extrusion, pelletisation, granulation

Product characteristics

Physical form of product	Liquid
Concentration of substance in product	<= 100 % Covers percentage substance in the product up to 100 % (unless stated differently)
Vapour pressure	0.344 hPa at 20 °C

Operational conditions

Amounts used	Not applicable
Frequency and duration of use	Covers daily exposures up to 8 hours (unless stated differently)
Human factors not influenced by risk management	Not applicable
Other given operational conditions affecting workers exposure	Assumes a good basic standard of occupational hygiene is implemented

Risk Management Measures

Other risk management measures:

Material transfers, 1-4 hours, ambient temp, <62°C	Transfer via enclosed lines. Clear transfer lines prior to de-coupling. Remotely vent displaced vapours
Drum/batch transfers, daily, ambient temp, <62°C	Use drum pumps. Avoid spillage when withdrawing pump. Wear suitable gloves (tested to EN374),

	coverall and eye protection	
Mixing operations (closed systems), >4 hours,daily,ambient temp,<62°C	No special precautions required	
Mixing operations (open systems), >4 hours,daily,ambient temp,<62°C	No special precautions required. Wear suitable gloves (tested to EN374) and eye protection	
Mold forming, >4 hours,daily,ambient temp,<62°C	No other specific measures identified. Wear suitable gloves (tested to EN374) and eye protection	
Casting operations, >4 hours,daily,ambient temp,<62°C	Provide a good standard of controlled ventilation (5 to 15 air changes per hour) . Provide extract ventilation to points where emissions occur. Ensure the ventilation system is regularly maintained and tested. Wear suitable gloves (tested to EN374) and eye protection	
Casting operations, >4 hours,daily,ambient temp,<62°C,Aerosols	Provide a good standard of controlled ventilation (5 to 15 air changes per hour) . Provide extract ventilation to points where emissions occur. Ensure the ventilation system is regularly maintained and tested. Wear suitable gloves (tested to EN374) and eye protection	
Spraying,Machine, >4 hours,daily,ambient temp,<62°C	Minimise exposure by partial enclosure of the operation or equipment and provide extract ventilation at openings. Ensure the ventilation system is regularly maintained and tested. Segregate the activity away from other operations. Automate activity where possible. Wear suitable gloves tested to EN374	
Spraying,Machine, >4 hours,daily,ambient temp,<62°C,Aerosols	Minimise exposure by partial enclosure of the operation or equipment and provide extract ventilation at openings. Ensure the ventilation system is regularly maintained and tested. Segregate the activity away from other operations. Automate activity where possible. Wear suitable gloves tested to EN374	
Manual,Roller application or brushing, >4 hours,daily,ambient temp,<62°C	Wear suitable gloves tested to EN374. Provide a good standard of general ventilation. Natural ventilation is from doors, windows etc. Controlled ventilation means air is supplied or removed by a powered fan	
Spraying,Manual, >4 hours,daily,ambient temp,<62°C	Wear suitable gloves (tested to EN374), coverall and eye protection. Wear a respirator conforming to EN140 with Type A filter or better. Segregate the activity away from other operations	
Spraying,Manual, >4 hours,daily,ambient temp,<62°C,Aerosols	Wear suitable gloves (tested to EN374), coverall and eye protection. Wear a respirator conforming to EN140 with Type A filter or better. Segregate the activity away from other operations	
Storage,daily,ambient temp,<62°C	Store substance within a closed system. Ensure material transfers are under containment or extract ventilation. Ensure the ventilation system is regularly maintained and tested	

3. Exposure estimation and reference to its source

3.1. Health

Information for contributing exposure scenario	
3.1.1	When the recommended risk management measures (RMMs) and operational conditions (OCs) are observed, exposures are not expected to exceed the predicted DNELs and the resulting risk characterisation ratios are expected to be less than 1.

Long-term - systemic effects						
DNEL	Inhalation: 37 mg/m ³ Dermal: 19 mg/kg bodyweight/day					
Contributing Scenario	inhalation exposure mg/m ³	RCR	dermal exposure mg/kg bodyweight/day	RCR	Sum RCR	Assessment method
Material transfers,1-4 hours,ambient temp,<62°C	3	0.081	1.37	0.072	0.153	Inhalation: Used ECETOC TRA model Dermal: Used ECETOC TRA model
Drum/batch transfers,daily,ambient temp,<62°C	5	0.135	6.86	0.361	0.496	Inhalation: Used ECETOC TRA model Dermal: Used ECETOC TRA model
Mixing operations	3	0.081	1.37	0.072	0.153	Inhalation: Used ECETOC TRA

(closed systems), >4 hours,daily,ambient temp,<62°C						model Dermal: Used ECETOC TRA model
Mixing operations (open systems), >4 hours,daily,ambient temp,<62°C	5	0.135	13.71	0.722	0.857	Inhalation: Used ECETOC TRA model Dermal: Used ECETOC TRA model
Mold forming, >4 hours,daily,ambient temp,<62°C	5	0.135	3.43	0.181	0.316	Inhalation: Used ECETOC TRA model Dermal: Used ECETOC TRA model
Casting operations, >4 hours,daily,ambient temp,<62°C	5	0.135	1.37	0.072	0.207	Inhalation: Used ECETOC TRA model Dermal: Used ECETOC TRA model
Casting operations, >4 hours,daily,ambient temp,<62°C,Aerosols	5	0.135	1.37	0.072	0.207	Inhalation: Used ECETOC TRA model Dermal: Used ECETOC TRA model
Spraying,Machine, >4 hours,daily,ambient temp,<62°C	5	0.135	2.14	0.113	0.248	Inhalation: Used ECETOC TRA model Dermal: Used ECETOC TRA model
Spraying,Machine, >4 hours,daily,ambient temp,<62°C,Aerosols	5	0.135	2.14	0.113	0.248	Inhalation: Used ECETOC TRA model Dermal: Used ECETOC TRA model
Manual,Roller application or brushing, >4 hours,daily,ambient temp,<62°C	10	0.27	5.49	0.289	0.559	Inhalation: Used ECETOC TRA model Dermal: Used ECETOC TRA model
Spraying,Manual, >4 hours,daily,ambient temp,<62°C	10	0.27	8.57	0.451	0.721	Inhalation: Used ECETOC TRA model Dermal: Used ECETOC TRA model
Spraying,Manual, >4 hours,daily,ambient temp,<62°C,Aerosols	10	0.27	8.57	0.451	0.721	Inhalation: Used ECETOC TRA model Dermal: Used ECETOC TRA model
Storage, daily,ambient temp,<62°C	1	0.027	0.14	0.007	0.034	Inhalation: Used ECETOC TRA model Dermal: Used ECETOC TRA model

3.2. Environment

As a result of the hazard assessment carried out in accordance to article 14.3, the registrant concludes that the substance does not meet the criteria for classification as dangerous for the environment; therefore risk characterisations for environmental endpoints were not developed

4. Guidance to Downstream User to evaluate whether he works inside the boundaries set by the ES

4.1. Health

Guidance - Health	Confirm that RMMs and OCs are as described.
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4.2. Environment

Guidance - Environment	As a result of the hazard assessment carried out in accordance to article 14.3, the registrant concludes that the substance does not meet the criteria for classification as dangerous for the environment; therefore risk characterisations for environmental endpoints were not developed
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1. Exposure scenario 4
Industrial Use of γ -Butyrolactone in Laboratory

ES Ref.: 4	Date of issue: 04/12/2017
ES Type: Worker	
Version: 1.0	

Use descriptors	SU3, SU10 PROC10, PROC15 ERC4
Processes, tasks, activities covered	Use of the substance within laboratory settings, including material transfers and equipment cleaning Industrial use
Assessment method	Used ECETOC TRA model

2. Operational conditions and risk management measures
2.1. Contributing scenario controlling worker exposure (PROC10, PROC15)

PROC10	Roller application or brushing
PROC15	Use as laboratory reagent

Product characteristics

Physical form of product	Liquid
Concentration of substance in product	<= 100 % Covers percentage substance in the product up to 100 % (unless stated differently)
Vapour pressure	0.344 hPa at 20 °C

Operational conditions

Amounts used	Not applicable
Frequency and duration of use	Covers daily exposures up to 8 hours (unless stated differently)
Human factors not influenced by risk management	Not applicable
Other given operational conditions affecting workers exposure	Assumes a good basic standard of occupational hygiene is implemented

Risk Management Measures

Other risk management measures:

Laboratory activities, Normal good standard fume cupboard (97%)	Handle in a fume cupboard or under extract ventilation. Put lids on containers immediately after use. Carefully pour from containers. Ensure the ventilation system is regularly maintained and tested. Wear suitable gloves tested to EN374
Laboratory activities, Bench-mounted local extract ventilation; selected disposable gloves	Ensure material transfers are under containment or extract ventilation. Put lids on containers immediately after use. Carefully pour from containers. Ensure the ventilation system is regularly maintained and tested. Wear suitable gloves tested to EN374
Laboratory activities, Controlled general ventilation (10 ACH); selected disposable gloves	No specific measures identified. Put lids on containers immediately after use. Carefully pour from containers. Wear suitable gloves tested to EN374
Laboratory activities, Normal good standard fume cupboard (97%), Duration 0.6	Handle in a fume cupboard or under extract ventilation. Put lids on containers immediately after use. Carefully pour from containers. Ensure the ventilation system is regularly maintained and tested. Wear suitable gloves tested to EN374
Laboratory activities, Bench-mounted local extract ventilation; selected disposable gloves, Duration 0.6	Ensure material transfers are under containment or extract ventilation. Ensure the ventilation system is regularly maintained and tested. Carefully pour from containers. Put lids on containers immediately after use. Wear suitable gloves tested to EN374
Laboratory activities, Controlled general ventilation (10 ACH); selected disposable gloves, Duration 0.6	No specific measures identified. Ensure material transfers are under containment or extract ventilation. Put lids on containers immediately after use. Carefully pour from containers. Ensure the ventilation system is regularly maintained and tested. Wear suitable gloves tested to EN374
Laboratory activities, Normal good standard fume cupboard, Duration, 0,2	Handle in a fume cupboard or under extract ventilation. Put lids on containers immediately after use. Carefully pour from containers. Ensure the

	ventilation system is regularly maintained and tested. Wear suitable gloves tested to EN374	
Laboratory activities, Bench-mounted local extract ventilation; selected disposable gloves, Duration, 0, 2	Ensure material transfers are under containment or extract ventilation. Ensure the ventilation system is regularly maintained and tested. Carefully pour from containers. Put lids on containers immediately after use. Wear suitable gloves tested to EN374	
Laboratory activities, Controlled general ventilation (10 ACH); selected disposable gloves, Duration, 0, 2	No specific measures identified. Provide enhanced general ventilation by mechanical means. Put lids on containers immediately after use. Carefully pour from containers. Ensure the ventilation system is regularly maintained and tested. Wear suitable gloves tested to EN374	
Laboratory activities, Normal good standard fume cupboard, Duration, 0, 1	Handle in a fume cupboard or under extract ventilation. Put lids on containers immediately after use. Carefully pour from containers. Ensure the ventilation system is regularly maintained and tested. Wear suitable gloves tested to EN374	
Laboratory activities, Bench-mounted local extract ventilation; selected disposable gloves, Duration, 0, 1	Ensure material transfers are under containment or extract ventilation. Ensure the ventilation system is regularly maintained and tested. Put lids on containers immediately after use. Carefully pour from containers. Wear suitable gloves tested to EN374	
Laboratory activities, Controlled general ventilation (10 ACH); selected disposable gloves, Duration, 0, 1	No specific measures identified. Provide enhanced general ventilation by mechanical means. Put lids on containers immediately after use. Carefully pour from containers. Ensure the ventilation system is regularly maintained and tested. Wear suitable gloves tested to EN374	
Laboratory activities, Normal good standard fume cupboard (97%), Duration, 0, 2	Handle in a fume cupboard or under extract ventilation. Put lids on containers immediately after use. Carefully pour from containers. Ensure the ventilation system is regularly maintained and tested. Wear suitable gloves tested to EN374	
Laboratory activities, Bench-mounted local extract ventilation; selected disposable gloves, Duration, 0, 2	Ensure material transfers are under containment or extract ventilation. Ensure the ventilation system is regularly maintained and tested. Put lids on containers immediately after use. Carefully pour from containers. Wear suitable gloves tested to EN374	
Laboratory activities, Controlled general ventilation (10 ACH); selected disposable gloves, Duration, 0, 2	Wear suitable gloves tested to EN374. Provide enhanced general ventilation by mechanical means. Put lids on containers immediately after use. Carefully pour from containers. Ensure the ventilation system is regularly maintained and tested	
Laboratory activities, Normal good standard fume cupboard (97%), Duration, 0, 1	Handle in a fume cupboard or under extract ventilation. Put lids on containers immediately after use. Carefully pour from containers. Ensure the ventilation system is regularly maintained and tested. Wear suitable gloves tested to EN374	
Laboratory activities, Bench-mounted local extract ventilation; selected disposable gloves, Duration, 0, 1	Ensure material transfers are under containment or extract ventilation. Ensure the ventilation system is regularly maintained and tested. Put lids on containers immediately after use. Carefully pour from containers. Wear suitable gloves tested to EN374	
Laboratory activities, Controlled general ventilation (10 ACH); selected disposable gloves, Duration, 0, 1	Wear suitable gloves tested to EN374. Provide enhanced general ventilation by mechanical means. Put lids on containers immediately after use. Carefully pour from containers. Ensure the ventilation system is regularly maintained and tested	

3. Exposure estimation and reference to its source

3.1. Health

Information for contributing exposure scenario	
3.1.1	When the recommended risk management measures (RMMs) and operational conditions (OCs) are observed, exposures are not expected to exceed the predicted DNELs and the resulting risk characterisation ratios are expected to be less than 1.

Long-term - systemic effects						
DNEL	Inhalation: 37 mg/m ³ Dermal: 19 mg/kg bodyweight/day					
Contributing Scenario	inhalation exposure mg/m ³	RCR	dermal exposure mg/kg bodyweight/day	RCR	Sum RCR	Assessment method

Laboratory activities, Normal good standard fume cupboard (97%)	0.15	0.004	0.03	0.002	0.006	Inhalation: Used ECETOC TRA model Dermal: Used ECETOC TRA model
Laboratory activities, Bench-mounted local extract ventilation; selected disposable gloves	1	0.027	0.03	0.002	0.029	Inhalation: Used ECETOC TRA model Dermal: Used ECETOC TRA model
Laboratory activities, Controlled general ventilation (10 ACH); selected disposable gloves	5	0.135	0.34	0.018	0.153	Inhalation: Used ECETOC TRA model Dermal: Used ECETOC TRA model
Laboratory activities, Normal good standard fume cupboard (97%), Duration 0.6	0.09	0.002	0.03	0.002	0.004	Inhalation: Used ECETOC TRA model Dermal: Used ECETOC TRA model
Laboratory activities, Bench-mounted local extract ventilation; selected disposable gloves, Duration 0.6	0.6	0.016	0.03	0.002	0.018	Inhalation: Used ECETOC TRA model Dermal: Used ECETOC TRA model
Laboratory activities, Controlled general ventilation (10 ACH); selected disposable gloves, Duration 0.6	3	0.081	0.34	0.018	0.099	Inhalation: Used ECETOC TRA model Dermal: Used ECETOC TRA model
Laboratory activities, Normal good standard fume cupboard, Duration, 0,2	0.03	0.001	0.03	0.002	0.003	Inhalation: Used ECETOC TRA model Dermal: Used ECETOC TRA model
Laboratory activities, Bench-mounted local extract ventilation; selected disposable gloves, Duration, 0,2	0.1	0.003	0.03	0.002	0.005	Inhalation: Used ECETOC TRA model Dermal: Used ECETOC TRA model
Laboratory activities, Controlled general ventilation (10 ACH); selected disposable gloves, Duration, 0,2	1	0.027	0.34	0.018	0.045	Inhalation: Used ECETOC TRA model Dermal: Used ECETOC TRA model
Laboratory activities, Normal good standard fume cupboard, Duration, 0,1	0.02	0.001	0.03	0.002	0.003	Inhalation: Used ECETOC TRA model Dermal: Used ECETOC TRA model
Laboratory activities, Bench-mounted local extract ventilation; selected disposable gloves, Duration, 0,1	0.1	0.003	0.03	0.002	0.005	Inhalation: Used ECETOC TRA model Dermal: Used ECETOC TRA model
Laboratory activities, Controlled general ventilation (10 ACH); selected disposable gloves, Duration, 0,1	0.5	0.014	0.34	0.018	0.032	Inhalation: Used ECETOC TRA model Dermal: Used ECETOC TRA model
Laboratory activities, Normal good standard fume cupboard (97%), Duration, 0,2	0.06	0.002	1.37	0.072	0.074	Inhalation: Used ECETOC TRA model Dermal: Used ECETOC TRA model
Laboratory activities, Bench-mounted local extract ventilation; selected disposable	0.4	0.011	1.37	0.072	0.083	Inhalation: Used ECETOC TRA model Dermal: Used ECETOC TRA model

gloves,Duration,0,2						
Laboratory activities,Controlled general ventilation (10 ACH); selected disposable gloves,Duration,0,2	2	0.054	5.49	0.289	0.343	Inhalation: Used ECETOC TRA model Dermal: Used ECETOC TRA model
Laboratory activities,Normal good standard fume cupboard (97%),Duration,0,1	0.03	0.001	1.37	0.072	0.073	Inhalation: Used ECETOC TRA model Dermal: Used ECETOC TRA model
Laboratory activities,Bench-mounted local extract ventilation; selected disposable gloves,Duration,0,1	0.2	0.005	1.37	0.072	0.077	Inhalation: Used ECETOC TRA model Dermal: Used ECETOC TRA model
Laboratory activities,Controlled general ventilation (10 ACH); selected disposable gloves,Duration,0,1	1	0.027	5.49	0.289	0.316	Inhalation: Used ECETOC TRA model Dermal: Used ECETOC TRA model

3.2. Environment

As a result of the hazard assessment carried out in accordance to article 14.3, the registrant concludes that the substance does not meet the criteria for classification as dangerous for the environment; therefore risk characterisations for environmental endpoints were not developed

4. Guidance to Downstream User to evaluate whether he works inside the boundaries set by the ES

4.1. Health

Guidance - Health	Confirm that RMMs and OCs are as described.
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4.2. Environment

Guidance - Environment	As a result of the hazard assessment carried out in accordance to article 14.3, the registrant concludes that the substance does not meet the criteria for classification as dangerous for the environment; therefore risk characterisations for environmental endpoints were not developed
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