

MATERIAL SAFETY DATA SHEET

Date Printed:
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 Version:
 Regulation: EC No 1272/2008

SECTION 1: SUBSTANCE IDENTIFICATION

Name of Substance: Butyl acrylate
 Synonyms: 2-Propenoic acid butyl ester, 2-Propenoic acid, butyl ester, Butyl 2-propenoate, n-Butyl acrylate, Acrylic acid butyl ester
 CAS #: 141-32-2
 EC #: 205-480-7
 Registration #: 01-2119453155-43-0001

PRIMARY / COMMON USES

Identified Uses	Process Category (PROC)	Product Category (PC)	Environmental release category (ERC):	Sector of Use (SU)
Manufacture and distribution of the substance	<p>PROC 1: Use in closed process, no likelihood of exposure</p> <p>PROC 2: Use in closed, continuous process with occasional controlled exposure</p> <p>PROC 3: Use in closed batch process (synthesis or formulation)</p> <p>PROC 8a: Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non-dedicated facilities</p> <p>PROC 8b: Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities</p> <p>PROC 9: Transfer of substance or preparation into small containers (dedicated filling line, including weighing)</p>	PC 19: Intermediate	ERC 1: Manufacture of substances	<p>SU 8: Manufacture of bulk, large scale chemicals (including petroleum products)</p> <p>SU 9: Manufacture of fine chemicals</p>
Polymerization at production sites	<p>PROC 1: Use in closed process, no likelihood of exposure</p> <p>PROC 2: Use in closed, continuous process with occasional controlled exposure</p> <p>PROC 3: Use in closed batch process (synthesis or formulation)</p>	<p>PC 19: Intermediate</p> <p>PC 32: Polymer preparations and compounds</p>	ERC 6d: Industrial use of process regulators for polymerisation processes	SU 8: Manufacture of bulk, large scale chemicals (including petroleum products)

Identified Uses	Process Category (PROC)	Product Category (PC)	Environmental release category (ERC):	Sector of Use (SU)
	<p>PROC 4: Use in batch and other process (synthesis) where opportunity for exposure arises</p> <p>PROC 5: Mixing or blending in batch processes for formulation of preparations and articles (multistage and/or significant contact)</p> <p>PROC 8a: Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non-dedicated facilities</p> <p>PROC 8b: Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities</p> <p>PROC 9: Transfer of substance or preparation into small containers (dedicated filling line, including weighing)</p>	nds	<p>production of resins, rubbers, polymers</p> <p>ERC 6c: Industrial use of monomers for manufacture of thermoplastics</p>	<p>products)</p> <p>SU 9: Manufacture of fine chemicals</p> <p>SU 12: Manufacture of plastics products, including compounding and conversion</p>
Polymerization at downstream user sites	<p>PROC 1: Use in closed process, no likelihood of exposure</p> <p>PROC 2: Use in closed, continuous process with occasional controlled exposure</p> <p>PROC 3: Use in closed batch process (synthesis or formulation)</p> <p>PROC 4: Use in batch and other process (synthesis) where opportunity for exposure arises</p> <p>PROC 5: Mixing or blending in batch processes for formulation of preparations and articles (multistage and/or significant contact)</p> <p>PROC 8a: Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non-dedicated facilities</p> <p>PROC 8b: Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities</p> <p>PROC 9: Transfer of substance or preparation into small containers (dedicated filling line, including weighing)</p>	<p>PC 19: Intermediate</p> <p>PC 32: Polymer preparations and compounds</p>	<p>ERC 6d: Industrial use of process regulators for polymerization processes in production of resins, rubbers, polymers</p> <p>ERC 6c: Industrial use of monomers for manufacture of thermoplastics</p>	<p>SU 8: Manufacture of bulk, large scale chemicals (including petroleum products)</p> <p>SU 9: Manufacture of fine chemicals</p> <p>SU 12: Manufacture of plastics products, including compounding and conversion</p>
Manufacture of intermediates at	PROC 1: Use in closed process, no likelihood of	PC 19: Intermed	ERC 6a: Industrial use	SU 8: Manufactu

Identified Uses	Process Category (PROC)	Product Category (PC)	Environmental release category (ERC):	Sector of Use (SU)
downstream user sites	<p>exposure</p> <p>PROC 2: Use in closed, continuous process with occasional controlled exposure</p> <p>PROC 3: Use in closed batch process (synthesis or formulation)</p> <p>PROC 4: Use in batch and other process (synthesis) where opportunity for exposure arises</p> <p>PROC 5: Mixing or blending in batch processes for formulation of preparations and articles (multistage and/or significant contact)</p> <p>PROC 8a: Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non-dedicated facilities</p> <p>PROC 8b: Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities</p> <p>PROC 9: Transfer of substance or preparation into small containers (dedicated filling line, including weighing)</p>	<p>intermediate</p> <p>PC 32: Polymer preparations and compounds</p>	<p>resulting in manufacture of another substance (use of intermediates)</p>	<p>Manufacture of bulk, large scale chemicals (including petroleum products)</p> <p>SU 9: Manufacture of fine chemicals</p>
Use as a laboratory agent	<p>PROC 15: Use as laboratory reagent</p>	<p>PC 19: Intermediate</p> <p>PC 21: Laboratory chemicals</p>	<p>ERC 1: Manufacture of substances</p>	<p>SU 8: Manufacture of bulk, large scale chemicals (including petroleum products)</p> <p>SU 9: Manufacture of fine chemicals</p> <p>SU 24: Scientific research and development</p>

COMPANY INFORMATION

Company name: LG chem.
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Emergency Telephone:

SECTION 2: HAZARDS IDENTIFICATION

Classification:

Physical / Chemical Hazards:

Annex I of Directive 67/548/EEC:
R10

Self classification:

Flam. Liquid 3

Health Hazards:

Annex I of Directive 67/548/EEC:
Xi; R36/37/38
R43

Self classification:

Acute Tox. 4(inhalation)
Skin Irrit. 2
Eye Irrit. 2A
Skin Sens. 1
STOT Single Exp. 3

Environmental Hazards :

Annex I of Directive 67/548/EEC:
N/A

Self classification:

N/A



Labelling

Signal word : Warning

Hazard statement:

H226: Flammable liquid and vapour.
H332: Harmful if inhaled.

H315: Causes skin irritation.
H319: Causes serious eye irritation.
H317: May cause an allergic skin reaction.
H335: May cause respiratory irritation.

Additional precautionary statements:

P210 Keep away from heat/sparks/open flames/hot surfaces. No smoking
P233 Keep container tightly closed.
P240 Ground/bond container and receiving equipment.
P241 Use explosion-proof electrical/ventilating/lighting/equipment.
P242 Use only non-sparking tools.
P243 Take precautionary measures against static discharge.
P280 Wear protective gloves/protective clothing/eye protection/face protection.
P261 Avoid breathing dust/fume/gas/mist/vapours/spray.
P271 Use only outdoors or in a well-ventilated area.
P264 Wash thoroughly after handling.
P272 Contaminated work clothing should not be allowed out of the workplace.
P303+P361+P353 IF ON SKIN (or hair): Remove/Take off immediately all contaminated clothing.
Rinse skin with water/shower.
P370+P378 In case of fire: Use for extinction.
P304+P340 IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing.
P312 Call a POISON CENTER or doctor/physician if you feel unwell.
P302+P352 IF ON SKIN: Wash with plenty of soap and water.
P321 Specific treatment.
P332+P313 If skin irritation occurs, get medical advice/attention.
P362 Take off contaminated clothing and wash before reuse.
P305+P351+P338 IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P337+P313 If eye irritation persists, get medical advice/attention.
P333+P313 If skin irritation or a rash occurs, get medical advice/attention.
P363 Wash contaminated clothing before reuse.
P403+P235 Store in a well-ventilated place. Keep cool.
P403+P233 Store in a well-ventilated place. Keep container tightly closed.
P405 Store locked up.
P501 Dispose of contents/container to.

SECTION 3: COMPOSITION / INFORMATION ON INGREDIENTS

Component	Conc ⁿ / %	CAS / EC #	Classification
Butyl acrylate	>= 99.5	141-32-2/205-480-7	See section.2

SECTION 4: FIRST AID MEASURES

After skin contact: ·Wash off immediately with plenty of water and soap for at least 15 minutes.
·Wash and dry carefully contaminated clothing and shoes before reuse.
·In case of contact with chemicals, get immediate medical advice/attention.
After eye contact: ·In case of contact with chemicals, immediately flush eyes with running water for more than 15 minutes.
·Remove contact lenses if present and easy to do.
·Get immediate medical advice/attention if irritating, pain, swelling, tear, dazzling eyes occur.

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- After inhalation:
- Move victims immediately to place with fresh air and not contaminated area.
 - Give artificial respiration if victim is not breathing.
 - If not breathing, give artificial respiration and have a trained individual administer oxygen.
 - Get medical attention immediately if inhaled.
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SECTION 5: FIREFIGHTING MEASURES

Suitable (and unsuitable) extinguishing media

- o suitable extinguishing media:
 - Small fire: Dry chemical, CO₂, water spray, alcohol-resistant foam
 - Large fire: fog or alcohol-resistant foam, water spray
- o unsuitable extinguishing media: Do not use straight streams
- o In case of major fire and large quantities:
 - Move containers from fire area if you can do it without risk.
 - Use water spray or alcohol-resistant foam.
- o tank/trailer/train truck fire:
 - Fight fire from maximum distance or use unmanned hose holders or monitor nozzles.
 - For massive fire, use unmanned hose holders or monitor nozzles; if this is impossible, withdraw from area and let fire burn.
 - Cool containers with flooding quantities of water until well after fire is out.
 - Withdraw immediately in case of rising sound from venting safety devices or discoloration of tank.
 - ALWAYS stay away from tanks engulfed in fire.

Specific hazards arising from the chemical

- o Thermal decomposition products : Carbon oxides (CO, CO₂)
- o Fires and an explosion
 - HIGHLY FLAMMABLE: Will be easily ignited by heat, sparks or flames.
 - Vapours may explode when mixed with air.
 - Will be explosively polymerized by heat or fires.
 - Vapours explosion hazard indoors, outdoors or in sewers.
 - Containers may explode when heated.
 - Most vapours are heavier than air. They will spread along ground and collect in low or confined area. (sewers, basements, tanks)
 - If tank, rail car or tank truck is involved in a fire, ISOLATE for 800 meters (1/2 mile) in all directions; also, consider initial evacuation for 800 meters (1/2 mile) in all directions.
 - Do not inhale the substance itself or the burning artifact.
 - Water may be ineffective.
 - Call emergency response telephone number on shipping paper first. If shipping paper not available or no answer, refer to appropriate telephone number listed on the inside back cover.
 - Runoff from fire control or dilution water may be corrosive and/or toxic and cause pollution.
 - Vapour or gas may travel from a distance in an instance after ignition.

Special protective equipment and precautions for fire-fighters

- Protective: safety helmet, AIR CYLINDER MASK (air respirator), fireproof-cloth (heatproof clothes), chemical-resistant gloves
 - Stay up wind and keep out of low areas.
 - Structural firefighters' protective clothing will only provide limited protection.
 - Fight fire from maximum distance or use unmanned hose holders or monitor nozzles: cool containers with flooding quantities of water until well after fire is out.
 - Keep unauthorized personnel away: Let the fire burn.
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SECTION 6: ACCIDENTAL RELEASE MEASURES

Personal precautions, protective equipment and emergency procedures

- Eye protection: Wear facepiece with goggles to protect from scattering dust or toxic liquid.
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- Body protection: Wear appropriate protective chemical-resistant clothing.
 - Hand protection: Wear appropriate chemical-resistant gloves that protect chemicals directly.
 - Protection materials: rubber, neoprene
 - Ventilation: Provide local exhaust ventilation system. Check legal suitability of exposure level
 - Respiratory protection: Safety measure for respiration is needed for hard exposure. Respiration safety categorized from minimum concentration to maximum concentration. Consider characteristic of warning. Air-purifying respirator with an appropriate, government approved (where applicable), air purifying filter, cartridge or canister. Emergency or planned entry into unknown concentrations or IDLH conditions-Air-line mask(combination air-line respirator), Any air-purifying(full-facepiece respirator)
 - As an immediate precautionary measure, isolate spill or leak area in all directions for at least 50 meters (150 feet) in all directions.

Environmental precautions and protective procedures

- Provide local exhaust ventilation system.
- Absorb or cover with dry earth, sand or other non-combustible material and transfer to containers.
- Prevent entry into waterways, sewers, basements or confined areas. Keep release below the limit of quantification (LOQ) of 10µg/L in the sewage treatment plant (STP) effluent.

The methods of purification and removal

- o Small spill
 - Eliminate all ignition sources (no smoking, flares, sparks or flames in immediate area).
 - All equipment used when handling the product must be grounded.
 - Do not touch or walk through spilled material.
 - Stop leak if you can do it without risk.
 - Prevent entry into waterways, sewers, basements or confined areas.
 - Vapours suppressing foam may be used to reduce vapours.
 - Absorb or cover with sand or other non-combustible material and remove.
 - Use clean non-sparking tools to collect absorbed material.
- o Large spill
 - Dike far ahead of liquid spill for later material.
 - Water spray may reduce vapour; but may not prevent ignition in closed spaces.
 - When spilled over limited quantities, inform central government and local self-government.
 - Keep unauthorized personnel away.
 - Stay upwind and keep out of low area.

SECTION 7: HANDLING AND STORAGE

Handling:

- Do not physical impact(pressurization, cutting, grinding, heating) or mechanical processes (welding, soldering, grinding, connecting, boring).
- Provide spark or explosion prevention system.
- Do handle according to safety precautions because of residue in empty containers.
- Do attentively guard static occurrence of container.
- Ventilate entire areas or by local ventilation system.
- Wash and dry carefully contaminated clothing and shoes before reuse.
- Do not breathe gas/fumes/vapours/spray.
- Wash thoroughly after handling.
- Wear suitable protective clothes and face shield.
- Avoid contact with skin, eyes and cloths.

Storage:

- Store locked up.
 - Keep away from oxidizing materials.
 - Keep in a cool, dry place and in well-ventilated place.
 - Keep away ignition sources.
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SECTION 8: EXPOSURE CONTROL / PERSONAL PROTECTION

Exposure limits / standards:

- Regulation in Korea: TWA : 2ppm(11mg/m³) STEL: 10ppm(55mg/m³)
- US (NIOSH/OSHA AGGIH):
 - NIOSH- TWA: 10ppm(55mg/m³)
 - ACGIH- TWA: 2ppm
- Australia : 10ppm, sensitizer
- Federal Republic of Germany: 10 ppm, sensitizer, short-term level 20 ppm, 5 min
- Sweden: 10 ppm, short-term value 15 ppm, sensitizer
- United Kingdom: 10 ppm
- Biological Exposure Index: Not available

Occupational exposure controls:

- **DNEL and PNEC**
 - **DNEL : 11 mg/m³, PNEC : 0.00272 mg/L (freshwater)**

Engineering Controls:

- Provide local exhaust ventilation system or other engineering controls to keep the airborne concentrations of vapours below their respective threshold limit value.
- Check legal suitability of exposure level.

Personal Protection:

Respiratory protection

- Safety measure for respiration is needed for hard exposure.
- Respiration safety categorized from minimum concentration to maximum concentration.
- Consider characteristic of warning.
- Respirator type: Air-purifying respirator with an appropriate, government approved(where applicable), air-purifying filter,cartridge or canister.
- Emergency or planned entry into unknown concentrations or IDLH: conditions-Air-line mask(combination air-line respirator), Any air-purifying(full-facepiece respirator)

Eye protection

- Wear facepiece with goggles to protect from scattering toxic liquid.
- An eye wash unit and safety shower station should be available nearby work place.

Hand protection

- Wear appropriate chemical-resistant gloves that protect chemicals directly.

Body protection

- Wear appropriate protective chemical-resistant clothing.

Environmental exposure controls:

Not required

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

Appearance:	Liquid
Odour:	Not available
Odour threshold	Not available
pH:	Not available
Molecular weight	128.169
Freezing point:	Not available
Melting point:	- 64.6 °C
Boiling point / range:	147 °C at 1013.25 hPa
Autoignition temperature	565 K at 1013 hPa
Flash point	37 °C
Flammability:	Flammable upon ignition. The substance has no pyrophoric properties and does not liberate flammable gases on contact with water.
Explosive properties:	non explosive
Oxidising properties:	no oxidising properties
Vapour pressure:	5 hPa at 22.2 °C.
Relative density:	0.9 at 20°C
Solubility:	Not available
Water solubility:	1.7 g/l at 20 °C
Log partition coefficient (n-octanol/water):	2.38 at 20 °C
Viscosity:	0.88 mPa · s (dynamic) at 20° C
Vapour density:	Not applicable
Evaporation rate (n-butyl acetate = 1):	Not available
Other information:	None
Surface tension:	not surface active
Granulometry:	not applicable
Stability in organic solvents and identity of relevant degradation products:	not applicable
Dissociation constant	not applicable

SECTION 10: STABILITY AND REACTIVITY

Chemical stability

-Stable under normal temperatures and pressures

Possibility of hazardous reactions

-Forms explosive mixtures with air.

-Hazardous polymerization may occur if heated.

Conditions to avoid

-Containers may explode when heated.

-Avoid heat, sparks, open flames, or other sources of ignition.

Incompatible materials

-Halogens, peroxides, cyanides, acid, base, amines, metals, oxidants

Hazardous decomposition product

-Thermal decomposition product : Carbon oxides

SECTION 11: TOXICOLOGICAL INFORMATION

	Conclusion / Remarks
(a) acute toxicity;	
By oral route	LD50= ca. 3150 mg/kg bw (rat) (OECD Guideline 401)
By inhalation	LC50 = 10.3 mg/L (4h, rat) (OECD TG 403)
By dermal route	LD50= 2000~3024 mg/kg bw (rabbit, occlusive)
(b) skin corrosion/irritation;	n-Butyl acrylate was applied to the skin of rabbits with an occlusive covering for one minute, 5 minutes, 15 minutes and 20 hours. After 24 hours, moderate to strong erythema and edema were observed in all exposure groups. Mean erythema scores (24-48-72 hours) for the 15-min and 20-hour exposure were 3.9 and 3.9, respectively. Mean edema scores (24-48-72 hours) for the 15-min and 20-hour exposure were 2.9 and 3.0, respectively. The effects were not fully reversible within 8 days. Six and eight days after the applications, slight scaling was observed for the 1-, 5- and 15 -minute applications. The 20-hour application caused parchment like necrosis of the upper skin layer and scaling. Thus, n-butyl acrylate was assessed to be irritating to the skin .
(c) serious eye damage/irritation;	0.5 mL undiluted n-butyl acrylate was instilled into the eyes of 5 rabbits (one eye per animal). Observed effects ranged from no injury in one rabbit to moderate effects in 2 rabbits and severe effects (iritis) in 2 rabbits. In another eye irritation study in White Vienna rabbits conducted according to an internal study protocol, 50 µL of the undiluted substance were instilled into the eyes of 2 rabbits. The adjacent untreated eyes of the same animals served as control. The eyes were not washed out as recommended by the OECD TG 405. Eye reactions were read after 1 and 24 hours. The effects were completely reversible within 24 hours .
(d) respiratory or skin sensitization;	The skin sensitizing potential of n-Butyl acrylate was investigated in a Local Lymph node Assay conducted according to OECD guideline 429 and GLP regulations (BAMM 2006, Testing lab.: Syngenta Central Toxicology Laboratory). The application of the test substance at concentrations of 1, 2.5, 5, 10, or 25 % w/v in acetone: olive oil (4:1) resulted in an increase in isotope incorporation which was greater than 3-fold at the 25 % w/v concentration. Consequently, the test substance was shown to be a potential skin sensitizer. The concentration giving rise to a 3 fold increase in lymphocyte proliferation (EC3) was calculated to be 11.2 % w/v (2800 µg/cm ²), indicative of a sensitizer of weak potency. Butyl acrylate was tested in guinea pigs and mice using a variety of methods and gave a positive response in most of the tests. n-Butyl acrylate (purity > 99%) was positive in the Guinea Pig Maximization test. Positive results were noted in 7 out of 10 animals at challenge and re-challenge (Van der Walle, 1982).

(e) germ cell mutagenicity;	In vitro, n-Butyl acrylate was negative in the Ames Assay both with and without metabolic activation. An in vitro micronucleus assay and an in vitro UDS assay in Syrian hamster embryo fibroblasts were both negative without an exogenous metabolic activation system which was not required since intrinsic metabolic capacity had been shown in SHE cells previously. In vivo, n-Butyl acrylate showed no genotoxic effects after vapour inhalation exposure in rats and hamsters.
(f) carcinogenicity;	n-Butyl acrylate was not carcinogenic in an adequately performed 2-year inhalation study in Sprague-Dawley rats up to the highest tested dose (135 ppm = 0.773 mg/L) and in a lifetime skin painting study in C3H/HeJ mice at approx. 8 mg/kg bw.
(g) reproductive toxicity;	The results of a subchronic animal study gave no indication of a fertility impairing effect caused by butyl acrylate. In addition, there are data from the structural analogue methyl acrylate. In a two-generation study in which groups of rats were whole-body exposed to methyl acrylate vapours, no effects on reproductive function (i.e. fertility) were observed. The NOAEC for reproductive function was 75 ppm (= ca. 0.269 mg/L). A developmental toxicity study in rabbits conducted with the structural analogue methyl acrylate did not give any indication for a developmental toxic or teratogenic effect.
(h) STOT-single exposure;	An acute inhalation study was conducted according to ASTM E961-84, to evaluate the potential for Butyl Acrylate vapour to produce depression of respiratory rate resulting from airway irritation when administered to mice by head-only inhalation exposure. Respiratory depression may result from upper airway sensory irritation and/or pulmonary irritation. In addition, there is evidence from acute and subchronic inhalation studies that butyl acrylate vapours were irritating to the respiratory tract of rats.
(i) STOT-repeated exposure;	In a 13 week-study, F344-rats (15 animals per sex and dose) received n-butyl acrylate via drinking water in concentrations of 0, 0.015, 0.09 and 0.15 % (0, 12, 73, 84 mg/kg body weight per day for males and 0, 15, 91, 111 mg/kg body weight per day for females). A satellite group (5 male and 5 female rats) was given 150 mg/kg bw n-butyl acrylate (in corn oil) via gavage 5 days a week for 13 weeks (Dow Chemical 1980). The only effects reported were a slight reduction in water consumption, which occurred in all dose groups, and a decrease in weight gain for male rats in the highest dose group. No abnormal haematology, clinical chemistry, urinalysis, or histopathology findings were reported. In the gavage satellite group, the only effect observed was a slight increase in relative liver weight. The highest level administered in drinking water approaches the maximum solubility limit of butyl acrylate in water and thus was the highest concentration that could be reasonably given. The NOAEL for the drinking water study is 84 (male) and 111 (female) mg/kg body weight per day and the LOAEL for the gavage study is 150 mg/kg bw per day (male and female).
(j) aspiration hazard.	Not relevant.

SECTION 12: ECOLOGICAL INFORMATION

	Conclusion / Remarks
12.1 Toxicity	
Acute toxicity	Fish: 96hr-LC50 = 5.2 mg/l (measured) (<i>Salmo gairdneri</i>) (OECD TG 203)
	Invertebrates: 48hr-EC = 8.2 mg/l (measured) (<i>Daphnia magna</i>) (OECD TG 202)
	Algae: 96hr-EC50 = 2.65 mg/l (measured) (<i>Selenastrum capricornutum</i>)
Chronic toxicity	Invertebrates: 21d-NOEC (reproduction) = 0.136 mg/L (<i>Daphnia magna</i>) (OECD TG 211, semi-static)
12.2 Persistence and degradability	Readily biodegradable Based on a log Kow 2.38 butyl acrylate is not expected to persistence. This result is supported by an other biodegradation assay conducted according to OECD Guideline 301 C, the modified MITI Test (I), in which n-butyl acrylate was readily biodegradable: 100 mg test substance/L; sludge concentration: 30 mg/L; 61% biodegradation after 14 days expressed as BOD/ThOD (Chemicals Inspection & Testing Institute Japan, 1992). Finally, in a Closed Bottle Test (OECD-Guideline 301D) with secondary effluent of a domestic waste water treatment plant a biodegradation of 57.8 % within 28 days was achieved (BAMM, 1996, Testing lab.: Roy F. Weston Inc.).
12.3 Bioaccumulative potential	Based on an experimental log Kow 2.38 and subsequently calculated BCF 17.27, a potential for bioaccumulation has not to be expected.
12.4 Mobility in soil	Based on a Koc 88.4 butyl acrylate is placed into a low to very low mobility.
12.5 Results of PBT and vPvB assessment	Regarding all available data on biotic and abiotic degradation, bioaccumulation and toxicity it can be stated that the substance does not fulfill the PBT criteria (not PBT) and not the vPvB criteria (not vPvB).
12.6 Other adverse effects	None identified

SECTION 13: DISPOSAL CONSIDERATIONS

Disposal method

- Dilute with a suitable solvent and Incinerate in a furnace where permitted under appropriate national and local regulations.
- Incinerate residues after treatment by methods of evaporation and condensation.
- Incinerate residues after purification by methods of separation, distillation, extraction and filtration.
- Treat with reactions such as neutralization, oxidation, reduction, polymerization and condensation.
- Incinerate residues after treatment by the methods of cohesion, precipitation, filter and dehydration.

Disposal precaution

- Consider the require attentions in accordance with waste treatment management regulation.
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SECTION 14: TRANSPORT INFORMATION

UN #: 2348

Class:	class 3
Proper shipping name:	BUTYL ACRYLATES, STABILIZED
Packing group:	III
Marine pollutant	Not applicable
EmS number:	F-E, S-D

SECTION 15: REGULATORY INFORMATION

Chemical Safety Assessment has been performed for Butyl acrylate.

Dangerous as defined by the EU CLP 2008:

- for physical-chemical properties
Flam. Liquid 3, Acute Tox. 4(inhalation), Skin Irrit. 2, Eye Irrit. 2A, Skin Sens. 1, STOT Single Exp. 3



Labelling

Signal word : Warning

Hazard statement:

H226: Flammable liquid and vapour.
H332: Harmful if inhaled.
H315: Causes skin irritation.
H319: Causes serious eye irritation.
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Additional precautionary statements:

P210 Keep away from heat/sparks/open flames/hot surfaces. No smoking
P233 Keep container tightly closed.
P240 Ground/bond container and receiving equipment.
P241 Use explosion-proof electrical/ventilating/lighting/equipment.
P242 Use only non-sparking tools.
P243 Take precautionary measures against static discharge.
P280 Wear protective gloves/protective clothing/eye protection/face protection.
P261 Avoid breathing dust/fume/gas/mist/vapours/spray.
P271 Use only outdoors or in a well-ventilated area.
P264 Wash thoroughly after handling.
P272 Contaminated work clothing should not be allowed out of the workplace.
P303+P361+P353 IF ON SKIN (or hair): Remove/Take off immediately all contaminated clothing.
Rinse skin with water/shower.
P370+P378 In case of fire: Use for extinction.
P304+P340 IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing.
P312 Call a POISON CENTER or doctor/physician if you feel unwell.
P302+P352 IF ON SKIN: Wash with plenty of soap and water.

P321 Specific treatment.
P332+P313 If skin irritation occurs, get medical advice/attention.
P362 Take off contaminated clothing and wash before reuse.
P305+P351+P338 IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P337+P313 If eye irritation persists, get medical advice/attention.
P333+P313 If skin irritation or a rash occurs, get medical advice/attention.
P363 Wash contaminated clothing before reuse.
P403+P235 Store in a well-ventilated place. Keep cool.
P403+P233 Store in a well-ventilated place. Keep container tightly closed.
P405 Store locked up.
P501 Dispose of contents/container to.

SECTION 16: OTHER INFORMATION

Product safety data sheet for Butyl acrylate prepared in accordance with Annex II of the REACH Regulation EG 1907/2006, Regulation (EG) 1272/2008.

Version: 1.0/EN
Revision date: 22 November 2010

This safety data sheet (SDS) is based on the legal provisions of the REACH Regulation (EC 1907/2006; article 31 and Annex II), as amended. Its contents are intended as a guide to the appropriate precautionary handling of the material. It is the responsibility of recipients of this SDS to ensure that the information contained therein is properly read and understood by all people who may use, handle, dispose or in any way come in contact with the product. Information and instructions provided in this SDS are based on the current state of scientific and technical knowledge at the date of issue indicated. It should not be construed as any guarantee of technical performance, suitability for particular applications, and does not establish a legally valid contractual relationship. This version of the SDS supersedes all previous versions.

ANNEX TO THE SDS

EXPOSURE ASSESSMENT

n-Butyl acrylate is manufactured as a chemical intermediate in a closed system. Its major use is in the production of homo- and co-polymers with other monomers (i.e. acrylic acid and its salts, esters, amides, etc.) to produce emulsion polymers. The three major uses of polymers of acrylate esters are: surface coatings, adhesives/sealants and textiles.

General remarks

Description of ECETOC TRA details can be found in the Technical Report 93 (2004) or at <https://www.ecetoc-tra.org/>. (version used: ECETOC TRA v2.0)

The assessment of environmental exposure was carried out by means of EUSES v2.1. Documentation concerning EUSES 2.1 can be found at <http://ecb.jrc.ec.europa.eu/euses/>.

Human health – Worker

- Long-term exposure:

Butyl acrylate is a chemical intermediate, manufactured and processed within closed systems. The primary routes of industrial exposure to butyl acrylate are skin contact and inhalation. In an industrial setting, ingestion is not an anticipated route of exposure.

Long-term exposure systemic DNELs were not calculated due to the lack of long-term systemic effects. Dose-level selection for long-term studies was limited by severity of local effects on the upper respiratory tract.

- Short-term exposure:

In addition, an induction-specific DNEL was derived for skin sensitization.

Human health – Worker and Consumer

The exposure assessment covers the life cycle of the substance (monomer) until the transesterification or polymerization reaction. The unreacted residual monomer in a polymer is to be regarded as impurity (< 1000 ppm) that need not to be critically addressed in the exposure assessment.

All use descriptors relevant for the pure substance are addressed in this chapter of the CSR. All other relevant use descriptors are considered valid only for preparations containing the residual monomer at < 1000 ppm.

Environment

Releases of n-butyl acrylate into the environment are to be expected during production and processing (polymerization, transesterification) mainly via wastewater and lesser amounts via exhaust gases.

The exposure assessment covers the life cycle of the substance (monomer) up to the polymerization reaction. The residual monomer in a polymer is to be regarded as impurity (< 1000 ppm) therefore, development of exposure scenarios covering downstream uses (i.e., professional use, consumer use, etc) are not required and have not been conducted for this assessment.

Analytical monitoring of the plant site effluent to and from the STP at all 5 production sites of nBA in Europe were performed, revealing no concentrations above the limit of quantification of 1 µg/L in the effluent from the STP.

Based on those analytical measurements an overestimating value of 0.01 mg.L-1 [10 µg.L-1] was input into EUSES as the STP effluent concentration for the production sites and the internal and external DU process sites. Thus the assumption of 10 µg.L-1 would be considered

Water emission samples were analyzed in February, 2010, and April, 2010, for a total of at least six samples per site taken on different work days. Values in the following table represent averages of the influent to and effluent from the wastewater treatment plant at each site. The five sites represent major producers and downstream users in Europe.

N-BUTYL ACRYLATE										
µg/l	Site 1		Site 2		Site 3		Site 4		Site 5	
Industrial Use	Influent	Effluent	Influent	Effluent	Influent	Effluent	Influent	Effluent	Influent	Effluent
Manufacture and Distribution of Substance	17.46	<1	1184	<1	202	<1	33.6	<1	<1	<1
Polymerization at Production Site			1184	<1			33.6	<1		
Polymerization at Downstream User Sites										
Manufacture of Intermediates at Production and Downstream User Sites							33.6	<1		
Use as Laboratory Reagent			1184	<1	202	<1				

Use of Preparations Containing Up to 21% Monomer										
Other Uses of Substance as Intermediate										

Sampling in this manner encompasses production (see Exposure Scenario 1) and [internal] downstream uses including wet polymerization (see Exposure Scenario 2).

Calculations have been made on the basis of general accessible market information on the overall production volume of n-butyl acrylate, i.E. TECNON Report (Tecnon OrbiChem, November 2009).

Table 1.1: Production and Life Cycle Steps

Production	Fraction	mt/a	IndCat	UseCat
Site 1	0.55	2.80E05	[3] Chemical Industry: chemicals used in synthesis	[33] Intermediates
Site 2	0.2	1.0E05	[3] Chemical Industry: chemicals used in synthesis	[33] Intermediates
Site 3	0.1	5.1E04	[3] Chemical Industry: chemicals used in synthesis	[33] Intermediates
Site 4	0.1	5.1E04	[3] Chemical Industry: chemicals used in synthesis	[33] Intermediates
Site 5	0.05	2.55E04	[3] Chemical Industry:	[33]

			chemicals used in synthesis	Intermediates
Other Life Cycle Steps (DU)	Fraction	mt/a	IndCat	UseCat
Wet Polymerization [Internal]	0.42	2.58E05	[11] Polymers Industry	[33] Intermediates / [43] Process regulator
Wet Polymerization [External]	0.53	3.26E05	[11] Polymers Industry	[33] Intermediates / [43] Process regulator
Intermediate Manufacture [External]	0.05	3.08E04	[3] Chemical Industry: chemicals used in synthesis	[33] Intermediates

mt/a = metric tons per year

Short description of all exposure scenarios

Table 1.2: Short description of all exposure scenarios with their use descriptors and life cycle stage

Number (ES)	Short description of exposure scenario	Product Category (PC)	Life cycle stage covered by ES						Sector of use (SU)	Process category (PROC)	Article Category (AC)	Environmental release category (ERC)
			Manufacture	Formulation	End use			Service Life				
					Industrial	Professional	Consumer					
1	Manufacture and distribution of the substance	19	X	-	X	-	-	-	8, 9	1, 2, 3, 8a, 8b, 9	-	1
2	Polymerization at production sites	19, 32	-	-	X	-	-	-	8, 9, 12	1, 2, 3, 4,	-	6c + 6d

Number (ES)	Short description of exposure scenario	Product Category (PC)	Life cycle stage covered by ES						Sector of use (SU)	Process category (PROC)	Article Category (AC)	Environmental release category (ERC)
			Manufacture	Formulation	End use			Service Life				
					Industrial	Professional	Consumer					
									5, 8a, 8b, 9			
3	Polymerization at downstream user sites	19, 32	-	-	X	-	-	-	8, 9, 12	1, 2, 3, 4, 5, 8a, 8b, 9	-	6c + 6d
4	Manufacture of intermediates at downstream user sites	19, 32	-	-	X	-	-	-	8, 9	1, 2, 3, 4, 5, 8a, 8b, 9	-	6a
5	Use as a laboratory agent	19, 21	-	-	X	-	-	-	8, 9, 24	15	-	1*

*The substance is used and handled as a laboratory agent in small-scale analytical laboratories associated with the production sites. Any residues are treated together with residues from manufacture at the production sites. Thus, this use (PROC 15) is linked with ERC 1 for manufacture.

Based on the physico-chemical properties of the substance and the overall release into the environment described in the five exposure scenarios, regional PECs for the various environmental compartments were calculated by means of EUSES v2.1.

Regional PECs:

Table 1.3 PECs Regional

Compartment	PEC	Unit
Surface water	1.19E-03	mg L-1
Seawater	9.58E-05	mg L-1
Air	2.3E-04	mg m-3
Agricultural soil	6.07E-04	mg kgwwt-1
Pore water of agricultural soil	3.62E-04	mg L-1
Natural soil	3.53E-05	mg kgwwt-1
Industrial soil	6.22E-03	mg kgwwt-1
Sediment	3.01E-03	mg kgwwt-1
Seawater sediment	2.34E-04	mg kgwwt-1

Total daily intake (regional) for humans was estimated to be 1.42E-04 mg/kg bw/d.

Taking into account the divergent process conditions (technical and otherwise) at the different producer and downstream user facilities, all PROCs with the exception of PROC 1 and 15 were calculated using three different scenarios, hereafter named Scenario A, B, and C. In these scenarios operational measures, the use of personal protection equipment and strict time limits for exposure respectively were applied to make sure that use of the substance in the intended processes is safe.

1.1. Manufacture and distribution of the substance

1.1.1. Exposure Scenario

Table 1.4 Description of the ES

1.1.1.1. Title	
Reference number	1
Free short title	Manufacture and distribution of the substance
Systematic title based on use descriptor	SU 8 and 9; PROC 1, 2, 3, 8a, 8b, and 9; ERC 1
Processes, tasks, activities covered	<p>PROC1: Use in closed process, no likelihood of exposure; Industrial setting.</p> <p>PROC2: Use in closed, continuous process with occasional controlled exposure (e.g. sampling); Industrial setting.</p> <p>PROC3: Use in closed batch process (synthesis or formulation); Industrial setting.</p> <p>PROC8a: Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non dedicated facilities; Industrial setting.</p> <p>PROC8b: Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities; Industrial setting.</p> <p>PROC9: Transfer of substance or preparation into small containers (dedicated filling line, including weighing); Industrial setting.</p>
Environment characteristic covered	ERC1: Production of chemicals.
1.1.1.2. Operational conditions and risk management measures	
Production in closed systems. Manufacture of the substance is limited to 5 production sites in Europe.	
1.1.1.2.1 Control of workers exposure for PROC 1	
Title information related to contributing scenario	
Workers related free short title	Use in closed process, no likelihood of exposure.
Use descriptor covered	PROC 1
Processes, tasks, activities covered	Use of the substance in high integrity contained system where little potential exists for exposures, e.g. any sampling via closed loop systems.
Assessment Method	ECETOC TRA Worker v2.0 with modifications
Product characteristic	
Physical state	liquid
Concentration of substance	100%
Amounts used	
This information is not needed for assessment of worker's exposure.	
Frequency and duration of use/exposure	
Duration of exposure	> 4 hours/day

Frequency of exposure	≤ 240 days/year		
Human factors not influenced by risk management			
Exposed skin surface	Palm of one hand (240 cm ²)		
Other given operational conditions affecting workers exposure			
Location	Inside		
Domain	Industrial		
Technical conditions and measures at process level (source) to prevent release			
Not applicable – closed system			
Technical conditions and measures to control dispersion from source towards the worker			
Not applicable – closed system			
Organisational measures to prevent /limit releases, dispersion and exposure			
Not applicable – closed system			
Conditions and measures related to personal protection, hygiene and health evaluation			
Not applicable – closed system			
1.1.1.2.2 Control of workers exposure for PROC 2			
Title information related to contributing scenario			
Workers related free short title	Use in closed, continuous process with occasional controlled exposure (e.g. sampling).		
Use descriptor covered	PROC 2		
Processes, tasks, activities covered	Continuous process but where the design philosophy is not specifically aimed at minimizing emissions. It is not high integrity and occasional exposure will arise e.g. through maintenance, sampling and equipment brakings.		
Assessment Method	ECETOC TRA Worker v2.0 with modifications		
Scenario	A	B	C
Product characteristic			
Physical state	liquid	liquid	liquid
Concentration of substance	100%	100%	100%
Amounts used			
This information is not needed for assessment of worker's exposure.			
Frequency and duration of use/exposure			
Duration of exposure	> 4 hours/day	> 4 hours/day	15 min - 1 hour/day
Frequency of exposure	≤ 240 days/year	≤ 240 days/year	≤ 240 days/year
Human factors not influenced by risk management			
Exposed skin surface	Palm of both hands (480 cm ²)	Palm of both hands (480 cm ²)	Palm of both hands (480 cm ²)
Other given operational conditions affecting workers exposure			
Location	Inside	Inside	Inside

Domain	Industrial	Industrial	Industrial
Technical conditions and measures at process level (source) to prevent release			
Not applicable – closed system			
Technical conditions and measures to control dispersion from source towards the worker			
Local exhaust ventilation ³	yes Effectiveness: 90%	no	no
Organisational measures to prevent /limit releases, dispersion and exposure			
Not applicable – closed system			
Conditions and measures related to personal protection, hygiene and health evaluation			
Suitable respiratory protection	no	90%	no
Gloves ⁴	yes	yes	yes
Chemical goggles	yes	yes	yes
1.1.1.2.3 Control of workers exposure for PROC 3			
Title information related to contributing scenario			
Workers related free short title	Use in closed batch process (synthesis or formulation); Industrial setting.		
Use descriptor covered	PROC 3		
Processes, tasks, activities covered	Batch manufacture of a chemical or formulation where the predominant handling is in a contained manner, but where some opportunity for contact with chemicals occurs (e.g. through sampling).		
Assessment Method	ECETOC TRA Worker v2.0 with modifications		
Scenario	A	B	C
Product characteristic			
Physical state	liquid	liquid	liquid
Concentration of substance	100%	100%	100%
Amounts used			
This information is not needed for assessment of worker's exposure.			
Frequency and duration of use/exposure			
Duration of exposure	1 - 4 hours/day	> 4 hours/day	< 15 min/day
Frequency of exposure	≤ 240 days/year	≤ 240 days/year	≤ 240 days/year
Human factors not influenced by risk management			
Exposed skin surface	Palm of one hand (240 cm ²)	Palm of one hand (240 cm ²)	Palm of one hand (240 cm ²)
Other given operational conditions affecting workers exposure			
Location	Inside	Inside	Inside
Domain	Industrial	Industrial	Industrial
Technical conditions and measures at process level (source) to prevent release			

Not relevant			
Technical conditions and measures to control dispersion from source towards the worker			
Local exhaust ventilation ³	yes Effectiveness: 90%	no	no
Organisational measures to prevent /limit releases, dispersion and exposure			
Not relevant			
Conditions and measures related to personal protection, hygiene and health evaluation			
Suitable respiratory protection	no	95%	60% ¹
Gloves ⁴	yes	yes	yes
Chemical goggles	yes	yes	yes
1.1.1.2.4 Control of workers exposure for PROC 8a			
Title information related to contributing scenario			
Workers related free short title	PROC 8a: Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non-dedicated facilities; Industrial or non-industrial setting.		
Use descriptor covered	PROC 8a		
Processes, tasks, activities covered	PROC 8a: Sampling, loading, filling, transfer, dumping, bagging in non dedicated facilities. Exposure related to dust, vapour, aerosols or spillage, and cleaning of equipment to be expected.		
Assessment Method	ECETOC TRA Worker v2.0 with modifications		
Scenario	A	B	C
Product characteristic			
Physical state	liquid	liquid	liquid
Concentration of substance	100%	100%	100%
Amounts used			
Not relevant			
Operational conditions affecting workers exposure			
Location	Inside	Inside	Inside
Domain	Industrial	Industrial	Industrial
Frequency and duration of use/exposure			
Duration of exposure	15 min - 1 hour/day	15 min - 1 hour/day	< 15 min/day
Frequency of exposure	≤ 240 days/year	≤ 240 days/year	≤ 240 days/year
Human factors not influenced by risk management			
Exposed skin surface	Both hands (960 cm ²)	Both hands (960 cm ²)	Both hands (960 cm ²)
Technical conditions and measures at process level (source) to prevent release			
Not relevant.			

Technical conditions and measures to control dispersion from source towards the worker			
Local exhaust ventilation ³	yes Effectiveness: 90%	no	no
Organisational measures to prevent /limit releases, dispersion and exposure			
Not relevant.			
Conditions and measures related to personal protection, hygiene and health evaluation			
Suitable respiratory protection	no	90%	60% ¹
Gloves ⁴	yes	yes	yes
Chemical goggles	yes	yes	yes
1.1.1.2.5 Control of workers exposure for PROC 8b			
Title information related to contributing scenario			
Workers related free short title	Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities; Industrial or non-industrial setting.		
Use descriptor covered	PROC 8b		
Processes, tasks, activities covered	Sampling, loading, filling, transfer, dumping, bagging in dedicated facilities. Exposure related to dust, vapour, aerosols or spillage, and cleaning of equipment to be expected.		
Assessment Method	ECETOC TRA Worker v2.0 with modifications		
Scenario	A	B	C
Product characteristic			
Physical state	liquid	liquid	liquid
Concentration of substance	100%	100%	100%
Amounts used			
Not relevant			
Operational conditions affecting workers exposure			
Location	Inside	Inside	Inside
Domain	Industrial	Industrial	Industrial
Frequency and duration of use/exposure			
Duration of exposure	> 4 hours/day	1 – 4 hours/day	< 15 min/day
Frequency of exposure	≤ 240 days/year	≤ 240 days/year	≤ 240 days/year
Human factors not influenced by risk management			
Exposed skin surface	Palm of both hands (480 cm ²)	Palm of both hands (480 cm ²)	Palm of both hands (480 cm ²)
Technical conditions and measures at process level (source) to prevent release			
Not relevant.			
Technical conditions and measures to control dispersion from source towards the worker			

Local exhaust ventilation ³	yes Effectiveness: 97%	no	no
Organisational measures to prevent /limit releases, dispersion and exposure			
Not relevant.			
Conditions and measures related to personal protection, hygiene and health evaluation			
Suitable respiratory protection	no	95%	60% ¹
Gloves ⁴	yes	yes	yes
Chemical goggles	yes	yes	yes
1.1.1.2.6 Control of workers exposure for PROC 9			
Title information related to contributing scenario			
Workers related free short title	PROC 9: Transfer of substance or preparation into small containers (dedicated filling line, including weighing); Industrial setting.		
Use descriptor covered	PROC 9		
Processes, tasks, activities covered	PROC 9: Filling lines specifically designed for both, capturing vapour and aerosol emissions and minimise spillage.		
Assessment Method	ECETOC TRA Worker v2.0 with modifications		
Scenario	A	B	C
Product characteristic			
Physical state	liquid	liquid	liquid
Concentration of substance	100%	100%	100%
Amounts used			
Not relevant			
Operational conditions affecting workers exposure			
Location	Inside	Inside	Inside
Domain	Industrial	Industrial	Industrial
Frequency and duration of use/exposure			
Duration of exposure	15 min – 1 hour/day	1 – 4 hours/day	< 15 min/day
Frequency of exposure	≤ 240 days/year	≤ 240 days/year	≤ 240 days/year
Human factors not influenced by risk management			
Exposed skin surface	Palm of both hands (480 cm ²)	Palm of both hands (480 cm ²)	Palm of both hands (480 cm ²)
Technical conditions and measures at process level (source) to prevent release			
Not relevant.			
Technical conditions and measures to control dispersion from source towards the worker			
Local exhaust ventilation ³	yes Effectiveness:	no	no

	90%		
Organisational measures to prevent /limit releases, dispersion and exposure			
Not relevant.			
Conditions and measures related to personal protection, hygiene and health evaluation			
Suitable respiratory protection	no	95%	60% ¹
Gloves ⁴	yes	yes	yes
Chemical goggles	yes	yes	yes
1.1.1.2.7 Control of environmental exposure for ERC 1			
Free short title	Production of chemical.		
Use descriptor covered	ERC 1		
Description	Production of organic and inorganic substances in chemical, petrochemical, primary metals and minerals industry including intermediates, monomers using continuous processes or batch processes applying dedicated or multi-purpose equipment, either technically controlled or operated by manual interventions.		
Assessment Method	EUSES v2.1		
Product characteristics			
Physical state	liquid		
Concentration of substance	100%		
Amounts used			
Maximum daily use at a site	≤ 933 tons/day		
Maximum annual use at a site	≤ 280000 tons/year		
Fraction of the main local source	1		
Frequency and duration of use	300 days (no. of emission days/year)		
Pattern of release to the environment	Continuous		
Environment factors not influenced by risk management			
Receiving surface water flow rate	≥ 1.8E+04 m ³ /d (default)		
Other given operational conditions affecting environmental exposure			
Industry category	3: Chemical industry: chemicals used in synthesis		
Use category	33: Intermediates		
Main category production	Ib: Intermed. stored on-site/continuous prod.		
Main category industrial use	Ib: Continuous production process		
Extra details on use category	Wet process		
Emission tables	Production: A1.2, B1.6; Industrial use: A3.3, B3.2		
Indoor use.			
		Production	Industrial use
Release fraction to air from process		1E-04 (default)	1E-05 (default)

Release fraction to wastewater from process	3E-03 (default)	5E-04 (default)
Release fraction to soil from process	1E-05 (default)	1E-04 (default)
Technical conditions and measures at process level (source) to prevent release		
Fraction connected to sewer system	100%	
Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil		
Dry sludge application on agricultural soil	no	
Organizational measures to prevent/limit release from site		
Fraction of EU tonnage for region (private use)	0%	
Conditions and measures related to municipal sewage treatment plant		
Municipal Sewage Treatment Plant (STP)	Yes (freshwater and marine assessment)	
Discharge rate of the Municipal STP	≥ 2000 m ³ /d (default)	
Incineration of the sludge of the Municipal STP	No (default)	
Concentration of chemical in untreated wastewater²	1.64E+06 µg/L (EUSES output)	
Concentration of chemical (total) in the STP effluent²	10 µg/L	
Conditions and measures related to external treatment of waste for disposal		
Not relevant.		
Conditions and measures related to external recovery of waste		
Not relevant.		

¹ Respiratory protection: another effectiveness value was applied

² Analytical monitoring of the plant site effluent to and from the STP at all 5 production sites of nBA in Europe were performed, revealing no concentrations above the limit of quantification of 1 µg.L⁻¹ in the effluent from the STP.

Based on those analytical measurements an overestimating value of 0.01 mg.L⁻¹ [10 µg.L⁻¹] was input into EUSES as the STP effluent concentration for the production sites and the internal and external DU process sites. Thus the assumption of 10 µg.L⁻¹ would be considered conservative since measured values were below the LOD of 1 µg.L⁻¹.

³ The LEV exposure modifying factors for dermal exposure implemented in the ECETOC TRA v2.0 are not considered.

⁴ Gloves were implemented as an additional RMM. The following effectiveness values are assumed: Use of suitable gloves: 80%; Use of suitable gloves in combination with basic employee training: 90%; Use of suitable gloves in combination with specific activity training: 95%; Use of suitable gloves in combination with intensive management supervision controls: 98%

1.1.2. Exposure Estimation

Table 1.5 Estimated exposure for workers / PROC 1

Route of exposure	Concentrations			
Scenario	A	B	C	
	Value			Unit
Long-term exposure, local, dermal	100.0	NA	NA	µg/cm ²
Long-term exposure, local, inhalative	0.0534	NA	NA	mg/m ³
Short-term exposure, local, dermal ¹	100.0	NA	NA	µg/cm ²

NA = Not applicable

¹ As dermal exposure generally is considered to accumulate during the period of exposure the full shift dermal exposure estimates will also be used for short-term dermal exposure.

Table 1.6 Estimated exposure for workers / PROC 2

Route of exposure	Concentrations			
Scenario	A	B	C	
	Value			Unit
Long-term exposure, local, dermal	40.0	40.0	40.0	µg/cm ²
Long-term exposure, local, inhalative	0.0534	0.0534	10.683	mg/m ³
Short-term exposure, local, dermal ¹	40.0	40.0	40.0	µg/cm ²

¹ As dermal exposure generally is considered to accumulate during the period of exposure the full shift dermal exposure estimates will also be used for short-term dermal exposure.

Table 1.7 Estimated exposure for workers / PROC 3

Route of exposure	Concentrations			
Scenario	A	B	C	
	Value			Unit
Long-term exposure, local, dermal	20.0	20.0	20.0	µg/cm ²
Long-term exposure, local, inhalative	8.0125	6.677	5.342	mg/m ³
Short-term exposure, local, dermal ¹	20.0	20.0	20.0	µg/cm ²

¹ As dermal exposure generally is considered to accumulate during the period of exposure the full shift dermal exposure estimates will also be used for short-term dermal exposure.

Table 1.8 Estimated exposure for workers / PROC 8a

Route of exposure	Concentrations			
Scenario	A	B	C	
	Value			Unit
Long-term exposure, local, dermal	200.0	200.0	200.0	µg/cm ²
Long-term exposure, local, inhalative	5.342	5.342	10.683	mg/m ³
Short-term exposure, local, dermal ¹	200.0	200.0	200.0	µg/cm ²

¹ As dermal exposure generally is considered to accumulate during the period of exposure the full shift dermal exposure estimates will also be used for short-term dermal exposure.

Table 1.9 Estimated exposure for workers / PROC 8b

Route of exposure	Concentrations			
Scenario	A	B	C	
	Value			Unit
Long-term exposure, local, dermal	200.0	200.0	200.0	µg/cm ²
Long-term exposure, local, inhalative	8.0125	8.0125	10.683	mg/m ³
Short-term exposure, local, dermal ¹	200.0	200.0	200.0	µg/cm ²

¹ As dermal exposure generally is considered to accumulate during the period of exposure the full shift dermal exposure estimates will also be used for short-term dermal exposure.

Table 1.10 Estimated exposure for workers / PROC 9

Route of exposure	Concentrations			
Scenario	A	B	C	
	Value			Unit
Long-term exposure, local, dermal	200.0	200.0	200.0	µg/cm ²
Long-term exposure, local, inhalative	5.342	8.0125	10.683	mg/m ³
Short-term exposure, local, dermal ¹	200.0	200.0	200.0	µg/cm ²

¹ As dermal exposure generally is considered to accumulate during the period of exposure the full shift dermal exposure estimates will also be used for short-term dermal exposure.

Table 1.11 Estimated exposure for the environment / Production (ERC 1)

Compartment	PEC / TDI	Unit	Remark
STP	1E-02	mg L-1	Production site 1 is bigger than the other four production sites. Only results from the largest producer are reported.
Freshwater	2.19E-03	mg L-1	
Freshwater sediment	5.93E-03	mg kgwwt-1	
Soil (agricultural)	7.9E-03	mg kgwwt-1	
Marine water	1.96E-04	mg L-1	
Marine water sediment	5.3E-04	mg kgwwt-1	
Total daily intake man via the environment	0.0129	mg.kgbw-1.d-1	

Compartment	PEC	Unit	Remark
Air (annual average)	0.0432	mgc.m-3	Production site 1 is bigger than the other four production sites. Only results from the largest producer are reported.

1.2. Polymerization at production sites

1.2.1. Exposure Scenario

Table 1.12 Description of the ES

1.2.1.1. Title	
Reference number	2
Free short title	Polymerization at production sites.
Systematic title based on use descriptor	SU 8, 9 and 12; PROC 1, 2, 3, 4, 5, 8a, 8b, and 9; ERC 6c + 6d
Processes, tasks, activities covered	<p>PROC1: Use in closed process, no likelihood of exposure; Industrial setting.</p> <p>PROC2: Use in closed, continuous process with occasional controlled exposure (e.g. sampling); Industrial setting.</p> <p>PROC3: Use in closed batch process (synthesis or formulation); Industrial setting.</p> <p>PROC4: Use in batch and other processes (synthesis) where opportunity for exposure arises; Industrial setting.</p> <p>PROC5: Mixing and blending in batch processes for formulation of preparations and articles (multistage and/or significant contact); Industrial setting.</p> <p>PROC8a: Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non dedicated facilities; Industrial setting.</p> <p>PROC8b: Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities; Industrial setting.</p> <p>PROC9: Transfer of substance or preparation into small containers (dedicated filling line, including weighing); Industrial setting.</p>
Environment characteristic covered	<p>ERC 6c: Industrial use of monomers for manufacture of thermoplastics.</p> <p>ERC 6d: Production of resins/rubbers.</p>
1.2.1.2. Operational conditions and risk management measures	
Polymerization, processes limited to the 5 production sites.	
1.2.1.2.1 Control of workers exposure for PROC 1	
Title information related to contributing scenario	
Workers related free short title	Use in closed process, no likelihood of exposure.
Use descriptor covered	PROC 1
Processes, tasks, activities covered	Use of the substance in high integrity contained system where little potential exists for exposures, e.g. any sampling via closed loop systems.
Assessment Method	ECETOC TRA Worker v2.0 with modifications
For further information see Table 1.4	
1.2.1.2.2 Control of workers exposure for PROC 2	
Title information related to contributing scenario	

Workers related free short title	Use in closed, continuous process with occasional controlled exposure (e.g. sampling).		
Use descriptor covered	PROC 2		
Processes, tasks, activities covered	Continuous process but where the design philosophy is not specifically aimed at minimizing emissions. It is not high integrity and occasional exposure will arise e.g. through maintenance, sampling and equipment brakings.		
Assessment Method	ECETOC TRA Worker v2.0 with modifications		
For further information see Table 1.4			
1.2.1.2.3 Control of workers exposure for PROC 3			
Title information related to contributing scenario			
Workers related free short title	Use in closed batch process (synthesis or formulation); Industrial setting.		
Use descriptor covered	PROC 3		
Processes, tasks, activities covered	Batch manufacture of a chemical or formulation where the predominant handling is in a contained manner, but where some opportunity for contact with chemicals occurs (e.g. through sampling).		
Assessment Method	ECETOC TRA Worker v2.0 with modifications		
For further information see Table 1.4			
1.2.1.2.4 Control of workers exposure for PROC 4			
Title information related to contributing scenario			
Workers related free short title	Use in batch and other process (synthesis) where opportunity for exposure arises; Industrial setting.		
Use descriptor covered	PROC 4		
Processes, tasks, activities covered	Use in batch manufacture of a chemical where significant opportunity for exposure arises, e.g. during the charging, the sampling or discharge of material, and when the nature of the design is likely to result in exposure.		
Assessment Method	ECETOC TRA Worker v2.0 with modifications		
Scenario	A	B	C
Product characteristic			
Physical state	liquid	liquid	liquid
Concentration of substance	100%	100%	100%
Amounts used			
Not relevant			
Operational conditions affecting workers exposure			
Location	Inside	Inside	Inside
Domain	Industrial	Industrial	Industrial
Frequency and duration of use/exposure			
Duration of exposure	> 4 hours/day	> 4 hours/day	< 15 min/day
Frequency of exposure	≤ 240 days/year	≤ 240 days/year	≤ 240 days/year

Human factors not influenced by risk management			
Exposed skin surface	Palm of both hands (480 cm ²)	Palm of both hands (480 cm ²)	Palm of both hands (480 cm ²)
Technical conditions and measures at process level (source) to prevent release			
Not relevant.			
Technical conditions and measures to control dispersion from source towards the worker			
Local exhaust ventilation ³	yes Effectiveness: 90%	no	no
Organisational measures to prevent /limit releases, dispersion and exposure			
Not relevant.			
Conditions and measures related to personal protection, hygiene and health evaluation			
Suitable respiratory protection	no	90%	no
Gloves ⁴	yes	yes	yes
Chemical goggles	yes	yes	yes
1.2.1.2.5 Control of workers exposure for PROC 5			
Title information related to contributing scenario			
Workers related free short title	Mixing and blending in batch processes for formulation of preparations and articles (multistage and/or significant contact); Industrial setting.		
Use descriptor covered	PROC 5		
Processes, tasks, activities covered	Manufacture or formulation of chemical products or articles using technologies related to mixing and blending of solid or liquid materials, and where the process is in stages and provides the opportunity for significant contact at any stage.		
Assessment Method	ECETOC TRA Worker v2.0 with modifications		
Scenario	A	B	C
Product characteristic			
Physical state	liquid	liquid	liquid
Concentration of substance	100%	100%	100%
Amounts used			
Not relevant			
Operational conditions affecting workers exposure			
Location	Inside	Inside	Inside
Domain	Industrial	Industrial	Industrial
Frequency and duration of use/exposure			
Duration of exposure	15 min – 1 hour/day	15 min – 1 hour/day	< 15 min/day
Frequency of exposure	≤ 240 days/year	≤ 240 days/year	≤ 240 days/year
Human factors not influenced by risk management			
Exposed skin surface	Palm of both	Palm of both	Palm of both

	hands (480 cm ²)	hands (480 cm ²)	hands (480 cm ²)
Technical conditions and measures at process level (source) to prevent release			
Not relevant.			
Technical conditions and measures to control dispersion from source towards the worker			
Local exhaust ventilation	yes Effectiveness: 90%	no	no
Organisational measures to prevent /limit releases, dispersion and exposure			
Not relevant.			
Conditions and measures related to personal protection, hygiene and health evaluation			
Suitable respiratory protection	no	90%	60% ¹
Gloves ⁴	yes + basic training	yes + basic training	yes + basic training
Chemical goggles	yes	yes	yes
1.2.1.2.6 Control of workers exposure for PROC 8a			
Title information related to contributing scenario			
Workers related free short title	Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non-dedicated facilities; Industrial or non-industrial setting.		
Use descriptor covered	PROC 8a		
Processes, tasks, activities covered	Sampling, loading, filling, transfer, dumping, bagging in non dedicated facilities. Exposure related to dust, vapour, aerosols or spillage, and cleaning of equipment to be expected.		
Assessment Method	ECETOC TRA Worker v2.0 with modifications		
For further information see Table 1.4			
1.2.1.2.7 Control of workers exposure for PROC 8b			
Title information related to contributing scenario			
Workers related free short title	Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities; Industrial or non-industrial setting.		
Use descriptor covered	PROC 8b		
Processes, tasks, activities covered	Sampling, loading, filling, transfer, dumping, bagging in dedicated facilities. Exposure related to dust, vapour, aerosols or spillage, and cleaning of equipment to be expected.		
Assessment Method	ECETOC TRA Worker v2.0 with modifications		
For further information see Table 1.4			
1.2.1.2.8 Control of workers exposure for PROC 9			
Title information related to contributing scenario			
Workers related free short title	Transfer of substance or preparation into small containers (dedicated filling line, including weighing); Industrial setting.		
Use descriptor covered	PROC 9		
Processes, tasks, activities covered	Filling lines specifically designed to for both, capturing vapour and aerosol emissions and minimise spillage.		

Assessment Method	ECETOC TRA Worker v2.0 with modifications	
For further information see Table 1.4		
1.2.1.2.9 Control of environmental exposure for ERC 6c + 6d		
Free short title	Industrial use of monomers for manufacture of thermoplastics and Production of resins/rubbers.	
Use descriptor covered	ERC 6c + 6d	
Description	Industrial use of monomers in the production of polymers, plastics (thermoplastics), polymerization processes. Industrial use of chemicals (cross-linking agents, curing agents) in the production of thermosets and rubbers, polymerization processes.	
Assessment Method	EUSES v2.1	
Product characteristics		
Physical state	liquid	
Concentration of substance	100%	
Amounts used		
Maximum daily use at a site	≤ 43 tons/day	
Maximum annual use at a site	≤ 12900 tons/year	
Fraction of the main local source	0.2	
Frequency and duration of use	300 days (no. of emission days/year)	
Pattern of release to the environment	Continuous	
Environment factors not influenced by risk management		
Receiving surface water flow rate	≥ 18000 m ³ /d (default)	
Other given operational conditions affecting environmental exposure		
Industry category	11: Polymers industry	
Use category	33: Intermediates + 43: Process regulators	
Main category industrial use	III: Non-dispersive use	
Extra details on use category	Wet: monomers	
Emission tables	Industrial use: A3.10, B3.9	
Indoor use.		
Release fraction to air from process	1E-02 (default)	
Release fraction to wastewater from process	1E-02 (default)	
Release fraction to soil from process	0 (default)	
Technical conditions and measures at process level (source) to prevent release		
Fraction connected to sewer system	100 %	
Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil		
Dry sludge application on agricultural soil	no	
Organizational measures to prevent/limit release from site		

Fraction of EU tonnage for region (private use)		0 %
Conditions and measures related to municipal sewage treatment plant		
Municipal Sewage Treatment Plant (STP)	Yes (freshwater and marine assessment)	
Discharge rate of the Municipal STP	≥ 2000 m ³ /d (default)	
Incineration of the sludge of the Municipal STP	No (default)	
Concentration of chemical in untreated wastewater²	8.61E+05 µg/L (EUSES output)	
Concentration of chemical (total) in the STP effluent²	10 µg/L	
Conditions and measures related to external treatment of waste for disposal		
Not relevant		
Conditions and measures related to external recovery of waste		
Not relevant		

¹ Respiratory protection: another effectiveness value was applied

² Analytical monitoring of the plant site effluent to and from the STP at all 5 production sites of nBA in Europe were performed, revealing no concentrations above the limit of quantification of 1 µg.L⁻¹ in the effluent from the STP.

Based on those analytical measurements an overestimating value of 0.01 mg.L⁻¹ [10 µg.L⁻¹] was input into EUSES as the STP effluent concentration for the production sites and the internal and external DU process sites. Thus the assumption of 10 µg.L⁻¹ would be considered conservative since measured values were below the LOD of 1 µg.L⁻¹.

³ The LEV exposure modifying factors for dermal exposure implemented in the ECETOC TRA v2.0 are not considered.

⁴ Gloves were implemented as an additional RMM. The following effectiveness values are assumed: Use of suitable gloves: 80%; Use of suitable gloves in combination with basic employee training: 90%; Use of suitable gloves in combination with specific activity training: 95%; Use of suitable gloves in combination with intensive management supervision controls: 98%

1.2.2. Exposure Estimation

For the estimated exposure for workers / PROC 1 see Table 1.5

For the estimated exposure for workers / PROC 2 see Table 1.6

For the estimated exposure for workers / PROC 3 see Table 1.7

For the estimated exposure for workers / PROC 8a see Table 1.8

For the estimated exposure for workers / PROC 8b see Table 1.9

For the estimated exposure for workers / PROC 9 see Table 1.10

Table 1.13 Estimated exposure for workers / PROC 4

Route of exposure	Concentrations			
Scenario	A	B	C	
	Value			Unit
Long-term exposure, local, dermal	200.0	200.0	200.0	µg/cm ²
Long-term exposure, local, inhalative	10.683	10.683	10.683	mg/m ³
Short-term exposure, local, dermal ¹	200.0	200.0	200.0	µg/cm ²

¹ As dermal exposure generally is considered to accumulate during the period of exposure the full shift dermal exposure estimates will also be used for short-term dermal exposure.

Table 1.14 Estimated exposure for workers / PROC 5

Route of exposure	Concentrations			
Scenario	A	B	C	
	Value			Unit
Long-term exposure, local, dermal	200.0	200.0	200.0	µg/cm ²
Long-term exposure, local, inhalative	5.342	5.342	10.683	mg/m ³
Short-term exposure, local, dermal ¹	200.0	200.0	200.0	µg/cm ²

¹ As dermal exposure generally is considered to accumulate during the period of exposure the full shift dermal exposure estimates will also be used for short-term dermal exposure.

Table 1.15 Estimated exposure for the environment / Polymerization at production sites (ERC 6c + 6d)

Compartment	PEC / TDI	Unit	Remark
STP	1E-02	mg L-1	NA
Freshwater	2.19E-03	mg L-1	
Freshwater sediment	5.93E-03	mg kgwwt-1	
Soil (agricultural)	0.0493	mg kgwwt-1	
Marine water	1.96E-04	mg L-1	
Marine water sediment	5.3E-04	mg kgwwt-1	
Total daily intake man via the environment	0.0293	mg.kgbw-1.d-1	

Compartment	PEC	Unit	Remark
Air (annual average)	0.0986	mgc.m-3	NA

NA = Not applicable

1.3. Polymerization at downstream user sites

1.3.1. Exposure Scenario

Table 1.16 Description of the ES

1.3.1.1. Title	
Reference number	3
Free short title	Polymerization at downstream user sites.
Systematic title based on use descriptor	SU 8, 9 and 12; PROC 1, 2, 3, 4, 5, 8a, 8b, and 9; ERC 6c + 6d
Processes, tasks, activities covered	<p>PROC1: Use in closed process, no likelihood of exposure; Industrial setting.</p> <p>PROC2: Use in closed, continuous process with occasional controlled exposure (e.g. sampling); Industrial setting.</p> <p>PROC3: Use in closed batch process (synthesis or formulation); Industrial setting.</p> <p>PROC4: Use in batch and other processes (synthesis) where opportunity for exposure arises; Industrial setting.</p> <p>PROC5: Mixing and blending in batch processes for formulation of preparations and articles (multistage and/or significant contact); Industrial setting.</p> <p>PROC8a: Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non dedicated facilities; Industrial setting.</p> <p>PROC8b: Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at</p>

	dedicated facilities; Industrial setting. PROC9: Transfer of substance or preparation into small containers (dedicated filling line, including weighing); Industrial setting.
Environment characteristic covered	ERC 6c: Industrial use of monomers for manufacture of thermoplastics. ERC 6d: Production of resins/rubbers.
1.3.1.2. Operational conditions and risk management measures	
Polymerization processes at various downstream user sites.	
1.3.1.2.1 Control of workers exposure for PROC 1	
Title information related to contributing scenario	
Workers related free short title	Use in closed process, no likelihood of exposure.
Use descriptor covered	PROC 1
Processes, tasks, activities covered	Use of the substance in high integrity contained system where little potential exists for exposures, e.g. any sampling via closed loop systems.
Assessment Method	ECETOC TRA Worker v2.0 with modifications
For further information see Table 1.4	
1.3.1.2.2 Control of workers exposure for PROC 2	
Title information related to contributing scenario	
Workers related free short title	Use in closed, continuous process with occasional controlled exposure (e.g. sampling).
Use descriptor covered	PROC 2
Processes, tasks, activities covered	Continuous process but where the design philosophy is not specifically aimed at minimizing emissions. It is not high integrity and occasional exposure will arise e.g. through maintenance, sampling and equipment brakings.
Assessment Method	ECETOC TRA Worker v2.0 with modifications
For further information see Table 1.4	
1.3.1.2.3 Control of workers exposure for PROC 3	
Title information related to contributing scenario	
Workers related free short title	Use in closed batch process (synthesis or formulation); Industrial setting.
Use descriptor covered	PROC 3
Processes, tasks, activities covered	Batch manufacture of a chemical or formulation where the predominant handling is in a contained manner, but where some opportunity for contact with chemicals occurs (e.g. through sampling).
Assessment Method	ECETOC TRA Worker v2.0 with modifications
For further information see Table 1.4	
1.3.1.2.4 Control of workers exposure for PROC 4	

Title information related to contributing scenario	
Workers related free short title	Use in batch and other process (synthesis) where opportunity for exposure arises; Industrial setting.
Use descriptor covered	PROC 4
Processes, tasks, activities covered	Use in batch manufacture of a chemical where significant opportunity for exposure arises, e.g. during the charging, the sampling or discharge of material, and when the nature of the design is likely to result in exposure.
Assessment Method	ECETOC TRA Worker v2.0 with modifications
For further information see Table 1.12	
1.3.1.2.5 Control of workers exposure for PROC 5	
Title information related to contributing scenario	
Workers related free short title	Mixing and blending in batch processes for formulation of preparations and articles (multistage and/or significant contact); Industrial setting.
Use descriptor covered	PROC 5
Processes, tasks, activities covered	Manufacture or formulation of chemical products or articles using technologies related to mixing and blending of solid or liquid materials, and where the process is in stages and provides the opportunity for significant contact at any stage.
Assessment Method	ECETOC TRA Worker v2.0 with modifications
For further information see Table 1.12	
1.3.1.2.6 Control of workers exposure for PROC 8a	
Title information related to contributing scenario	
Workers related free short title	PROC 8a: Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non-dedicated facilities; Industrial or non-industrial setting.
Use descriptor covered	PROC 8a
Processes, tasks, activities covered	PROC 8a: Sampling, loading, filling, transfer, dumping, bagging in non dedicated facilities. Exposure related to dust, vapour, aerosols or spillage, and cleaning of equipment to be expected.
Assessment Method	ECETOC TRA Worker v2.0 with modifications
For further information see Table 1.4	
1.3.1.2.7 Control of workers exposure for PROC 8b	
Title information related to contributing scenario	
Workers related free short title	Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities; Industrial or non-industrial setting.
Use descriptor covered	PROC 8b
Processes, tasks, activities covered	Sampling, loading, filling, transfer, dumping, bagging in dedicated facilities. Exposure related to dust, vapour,

	aerosols or spillage, and cleaning of equipment to be expected.
Assessment Method	ECETOC TRA Worker v2.0 with modifications
For further information see Table 1.4	
1.3.1.2.8 Control of workers exposure for PROC 9	
Title information related to contributing scenario	
Workers related free short title	PROC 9: Transfer of substance or preparation into small containers (dedicated filling line, including weighing); Industrial setting
Use descriptor covered	PROC 9
Processes, tasks, activities covered	PROC 9: Filling lines specifically designed for both, capturing vapour and aerosol emissions and minimise spillage.
Assessment Method	ECETOC TRA Worker v2.0 with modifications
For further information see Table 1.4	
1.3.1.2.9 Control of environmental exposure for ERC 6c + 6d	
Free short title	Industrial use of monomers for manufacture of thermoplastics and Production of resins/rubbers.
Use descriptor covered	ERC 6c + 6d
Description	Industrial use of monomers in the production of polymers, plastics (thermoplastics), polymerization processes. Industrial use of chemicals (cross-linking agents, curing agents) in the production of thermosets and rubbers, polymerization processes.
Assessment Method	EUSES v2.1
Product characteristics	
Physical state	liquid
Concentration of substance	100%
Amounts used	
Maximum daily use at a site	≤ 54 tons/day
Maximum annual use at a site	≤ 16300 tons/year
Fraction of the main local source	0.05 (default)
Frequency and duration of use	300 days (no. of emission days/year)
Pattern of release to the environment	Continuous
Environment factors not influenced by risk management	
Receiving surface water flow rate	≥ 18000 m ³ /d (default)
Other given operational conditions affecting environmental exposure	
Industry category	11: Polymers industry
Use category	33: Intermediates + 43: Process regulators

Main category industrial use	III: Non-dispersive use (default)	
Extra details on use category	Polymerization processes	
Extra details on use category	Wet: monomers	
Emission tables	Industrial use: A3.10, B3.9	
Indoor use.		
Release fraction to air from process	1E-02 (default)	
Release fraction to wastewater from process	1E-02 (default)	
Release fraction to soil from process	0.0 (default)	
Technical conditions and measures at process level (source) to prevent release		
Fraction connected to sewer system	100 %	
Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil		
Dry sludge application on agricultural soil	no	
Organizational measures to prevent/limit release from site		
Fraction of EU tonnage for region (private use)	0 %	
Conditions and measures related to municipal sewage treatment plant		
Municipal Sewage Treatment Plant (STP)	Yes (freshwater and marine assessment)	
Discharge rate of the Municipal STP	≥ 2000 m ³ /d (default)	
Incineration of the sludge of the Municipal STP	No (default)	
Concentration of chemical in untreated wastewater²	2.72E+05 µg/L (default)	
Concentration of chemical (total) in the STP effluent²	10 µg/L	
Conditions and measures related to external treatment of waste for disposal		
Not relevant		
Conditions and measures related to external recovery of waste		
Not relevant		

¹ Respiratory protection: another effectiveness value was applied

² Analytical monitoring of the plant site effluent to and from the STP at all 5 production sites of nBA in Europe were performed, revealing no concentrations above the limit of quantification of 1 µg.L-1 in the effluent from the STP.

Based on those analytical measurements an overestimating value of 0.01 mg.L-1 [10 µg.L-1] was input into EUSES as the STP effluent concentration for the production sites and the internal and external DU process sites. Thus the assumption of 10 µg.L-1 would be considered conservative since measured values were below the LOD of 1 µg.L-1.

³ The LEV exposure modifying factors for dermal exposure implemented in the ECETOC TRA v2.0 are not considered.

⁴ Gloves were implemented as an additional RMM. The following effectiveness values are assumed: Use of suitable gloves: 80%; Use of suitable gloves in combination with basic employee training: 90%; Use of suitable gloves in combination with specific activity training: 95%; Use of suitable gloves in combination with intensive management supervision controls: 98%

1.3.2. Exposure Estimation

For the estimated exposure for workers / PROC 1 see Table 1.5

For the estimated exposure for workers / PROC 2 see Table 1.6

For the estimated exposure for workers / PROC 3 see Table 1.7

For the estimated exposure for workers / PROC 4 see Table 1.13

For the estimated exposure for workers / PROC 5 see Table 1.14

For the estimated exposure for workers / PROC 8a see Table 1.8

For the estimated exposure for workers / PROC 8b see Table 1.9

For the estimated exposure for workers / PROC 9 see Table 1.10

Table 1.17 Estimated exposure for the environment / Polymerization at DU sites (ERC 6c + 6d)

Compartment	PEC / TDI	Unit	Remark
STP	1E-02	mg L-1	NA
Freshwater	2.19E-03	mg L-1	
Freshwater sediment	5.93E-03	mg kgwt-1	
Soil (agricultural)	0.0156	mg kgwt-1	
Marine water	1.96E-04	mg L-1	
Marine water sediment	5.3E-04	mg kgwt-1	
Total daily intake man via the environment	0.0369	mg.kgbw-1.d-1	

Compartment	PEC	Unit	Remark
Air (annual average)	0.124	mgc.m-3	NA

NA = Not applicable

1.4. Manufacture of intermediates at downstream user sites

1.4.1. Exposure Scenario

Table 1.18 Description of the ES

1.4.1.1. Title	
Reference number	4
Free short title	Manufacture of intermediates at downstream user sites.
Systematic title based on use descriptor	SU 8 and 9; PROC 1, 2, 3, 4, 5, 8a, 8b, and 9; ERC 6a
Processes, tasks, activities covered	<p>PROC1: Use in closed process, no likelihood of exposure; Industrial setting.</p> <p>PROC2: Use in closed, continuous process with occasional controlled exposure (e.g. sampling); Industrial setting.</p> <p>PROC3: Use in closed batch process (synthesis or formulation); Industrial setting.</p> <p>PROC4: Use in batch and other processes (synthesis) where opportunity for exposure arises; Industrial setting.</p> <p>PROC5: Mixing and blending in batch processes for formulation of preparations and articles (multistage and/or significant contact); Industrial setting.</p> <p>PROC8a: Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non dedicated facilities; Industrial setting.</p> <p>PROC8b: Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities; Industrial setting.</p> <p>PROC9: Transfer of substance or preparation into small containers (dedicated filling line, including weighing); Industrial setting.</p>
Environment characteristic covered	ERC 6a: Industrial use of intermediates.
1.4.1.2. Operational conditions and risk management measures	
Manufacture of intermediates at various downstream user sites.	
1.4.1.2.1 Control of workers exposure for PROC 1	
Title information related to contributing scenario	
Workers related free short title	Use in closed process, no likelihood of exposure.
Use descriptor covered	PROC 1
Processes, tasks, activities covered	Use of the substance in high integrity contained system where little potential exists for exposures, e.g. any sampling via closed loop systems.
Assessment Method	ECETOC TRA Worker v2.0 with modifications
For further information see Table 1.4	
1.4.1.2.2 Control of workers exposure for PROC 2	
Title information related to contributing scenario	

Workers related free short title	Use in closed, continuous process with occasional controlled exposure (e.g. sampling).
Use descriptor covered	PROC 2
Processes, tasks, activities covered	Continuous process but where the design philosophy is not specifically aimed at minimizing emissions. It is not high integrity and occasional exposure will arise e.g. through maintenance, sampling and equipment brakings.
Assessment Method	ECETOC TRA Worker v2.0 with modifications
For further information see Table 1.4	
1.4.1.2.3 Control of workers exposure for PROC 3	
Title information related to contributing scenario	
Workers related free short title	Use in closed batch process (synthesis or formulation); Industrial setting.
Use descriptor covered	PROC 3
Processes, tasks, activities covered	Batch manufacture of a chemical or formulation where the predominant handling is in a contained manner, but where some opportunity for contact with chemicals occurs (e.g. through sampling).
Assessment Method	ECETOC TRA Worker v2.0 with modifications
For further information see Table 1.4	
1.4.1.2.4 Control of workers exposure for PROC 4	
Title information related to contributing scenario	
Workers related free short title	Use in batch and other process (synthesis) where opportunity for exposure arises; Industrial setting.
Use descriptor covered	PROC 4
Processes, tasks, activities covered	Use in batch manufacture of a chemical where significant opportunity for exposure arises, e.g. during the charging, the sampling or discharge of material, and when the nature of the design is likely to result in exposure.
Assessment Method	ECETOC TRA Worker v2.0 with modifications
For further information see Table 1.12	
1.4.1.2.5 Control of workers exposure for PROC 5	
Title information related to contributing scenario	
Workers related free short title	Mixing and blending in batch processes for formulation of preparations and articles (multistage and/or significant contact); Industrial setting.
Use descriptor covered	PROC 5
Processes, tasks, activities covered	Manufacture or formulation of chemical products or articles using technologies related to mixing and blending of solid or liquid materials, and where the process is in stages and provides the opportunity for significant contact at any stage.
Assessment Method	ECETOC TRA Worker v2.0 with modifications

For further information see Table 1.12	
1.4.1.2.6 Control of workers exposure for PROC 8a	
Title information related to contributing scenario	
Workers related free short title	Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non-dedicated facilities; Industrial or non-industrial setting.
Use descriptor covered	PROC 8a
Processes, tasks, activities covered	Sampling, loading, filling, transfer, dumping, bagging in non dedicated facilities. Exposure related to dust, vapour, aerosols or spillage, and cleaning of equipment to be expected.
Assessment Method	ECETOC TRA Worker v2.0 with modifications
For further information see Table 1.4	
1.4.1.2.7 Control of workers exposure for PROC 8b	
Title information related to contributing scenario	
Workers related free short title	Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities; Industrial or non-industrial setting.
Use descriptor covered	PROC 8b
Processes, tasks, activities covered	Sampling, loading, filling, transfer, dumping, bagging in dedicated facilities. Exposure related to dust, vapour, aerosols or spillage, and cleaning of equipment to be expected.
Assessment Method	ECETOC TRA Worker v2.0 with modifications
For further information see Table 1.4	
1.4.1.2.8 Control of workers exposure for PROC 9	
Title information related to contributing scenario	
Workers related free short title	Transfer of substance or preparation into small containers (dedicated filling line, including weighing); Industrial setting.
Use descriptor covered	PROC 9
Processes, tasks, activities covered	Filling lines specifically designed to for both, capturing vapour and aerosol emissions and minimise spillage.
Assessment Method	ECETOC TRA Worker v2.0 with modifications
For further information see Table 1.4	
1.4.1.2.9 Control of environmental exposure for ERC 6a	
Free short title	Industrial use of intermediates.
Use descriptor covered	ERC 6a
Description	Use of intermediates in primarily the chemical industry using continuous processes or batch processes applying dedicated or multi-purpose equipment, either technically controlled or operated by manual interventions, for the synthesis (manufacture) of other substances.
Assessment Method	EUSES v2.1

Product characteristics	
Physical state	liquid
Concentration of substance	100%
Amounts used	
Maximum daily use at a site	≤ 20.5 tons/day
Maximum annual use at a site	≤ 6160 tons/year
Fraction of the main local source	0.2 (default)
Frequency and duration of use	300 days (no. of emission days/year)
Pattern of release to the environment	Continuous
Environment factors not influenced by risk management	
Receiving surface water flow rate	≥ 18000 m ³ /d (default)
Other given operational conditions affecting environmental exposure	
Industry category	3: Chemical industry: chemicals used in synthesis
Use category	33: Intermediates
Main category industrial use	III: Multi-purpose equipment
Extra details on use category	Wet process
Emission tables	Industrial use: A3.3, B3.2
Indoor use.	
Release fraction to air from process	1E-02 (default)
Release fraction to wastewater from process	7E-03 (default)
Release fraction to soil from process	1E-04 (default)
Technical conditions and measures at process level (source) to prevent release	
Fraction connected to sewer system	100 %
Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil	
Dry sludge application on agricultural soil	no
Organizational measures to prevent/limit release from site	
Fraction of EU tonnage for region (private use)	0 %
Conditions and measures related to municipal sewage treatment plant	
Municipal Sewage Treatment Plant (STP)	Yes (freshwater and marine assessment)
Discharge rate of the Municipal STP	≥ 2000 m ³ /d (default)
Incineration of the sludge of the Municipal STP	No (default)
Concentration of chemical in	7.18E+04 µg/L (EUSES output)

untreated wastewater²	
Concentration of chemical (total) in the STP effluent²	10 µg/L
Conditions and measures related to external treatment of waste for disposal	
Not relevant	
Conditions and measures related to external recovery of waste	
Not relevant	

¹ Respiratory protection: another effectiveness value was applied

² Analytical monitoring of the plant site effluent to and from the STP at all 5 production sites of nBA in Europe were performed, revealing no concentrations above the limit of quantification of 1 µg.L-1 in the effluent from the STP.

Based on those analytical measurements an overestimating value of 0.01 mg.L-1 [10 µg.L-1] was input into EUSES as the STP effluent concentration for the production sites and the internal and external DU process sites. Thus the assumption of 10 µg.L-1 would be considered conservative since measured values were below the LOD of 1 µg.L-1.

³ The LEV exposure modifying factors for dermal exposure implemented in the ECETOC TRA v2.0 are not considered.

⁴ Gloves were implemented as an additional RMM. The following effectiveness values are assumed: Use of suitable gloves: 80%; Use of suitable gloves in combination with basic employee training: 90%; Use of suitable gloves in combination with specific activity training: 95%; Use of suitable gloves in combination with intensive management supervision controls: 98%

1.4.2. Exposure Estimation

For the estimated exposure for workers / PROC 1 see Table 1.5

For the estimated exposure for workers / PROC 2 see Table 1.6

For the estimated exposure for workers / PROC 3 see Table 1.7

For the estimated exposure for workers / PROC 4 see Table 1.13

For the estimated exposure for workers / PROC 5 see Table 1.14

For the estimated exposure for workers / PROC 8a see Table 1.8

For the estimated exposure for workers / PROC 8b see Table 1.9

For the estimated exposure for workers / PROC 9 see Table 1.10

Table 1.19 Estimated exposure for the environment / Manufacture of intermediates at DU sites (ERC 6a)

Compartment	PEC / TDI	Unit	Remark
STP	1E-02	mg L-1	NA
Freshwater	2.19E-03	mg L-1	

Freshwater sediment	5.93E-03	mg kgwt-1	
Soil (agricultural)	5.8E-03	mg kgwt-1	
Marine water	1.96E-04	mg L-1	
Marine water sediment	5.3E-04	mg kgwt-1	
Total daily intake man via the environment	0.014	mg.kgbw-1.d-1	

Compartment	PEC	Unit	Remark
Air (annual average)	0.0471	mgc.m-3	NA

NA = Not applicable

1.5. Use as laboratory reagent

1.5.1. Exposure Scenario

Table 1.20 Description of the ES

1.5.1.1. Title	
Reference number	5
Free short title	Use as laboratory reagent
Systematic title based on use descriptor	SU 8, 9 and 24; PROC 15; ERC 1
Processes, tasks, activities covered	PROC15: Use a laboratory reagent; Non-industrial setting.
Environment characteristic covered	ERC1: Production of chemicals.
1.5.1.2. Operational conditions and risk management measures	
Use as laboratory agent at the 5 production sites in Europe.	
1.5.1.2.1 Control of workers exposure for PROC 15	
Title information related to contributing scenario	
Workers related free short title	Use a laboratory reagent; Non-industrial setting.
Use descriptor covered	PROC 15
Processes, tasks, activities covered	Use of substances at small scale laboratory (< 1 L or 1 kg). Larger laboratories and R+D installations should be treated as industrial processes.
Assessment Method	ECETOC TRA Worker v2.0 with modifications
Product characteristic	Industrial
Physical state	liquid
Concentration of substance	100%
Amounts used	
This information is not needed for assessment of worker's exposure.	
Operational conditions affecting workers exposure	
Location	Inside
Domain	Industrial
Frequency and duration of use/exposure	
Duration of exposure	> 4 hours/day
Frequency of exposure	≤ 240 days/year
Human factors not influenced by risk management	
Exposed skin surface	Palm of one hand (240 cm ²)
Technical conditions and measures at process level (source) to prevent release	
Not relevant.	
Technical conditions and measures to control dispersion from source towards the worker	

Local exhaust ventilation	yes Effectiveness: 90%
Organisational measures to prevent /limit releases, dispersion and exposure	
Not relevant.	
Conditions and measures related to personal protection, hygiene and health evaluation	
Suitable respiratory protection	no
Gloves ⁴	yes
Chemical goggles	yes yes yes
1.5.1.2.2 Control of environmental exposure for ERC 1	
Free short title	Production of chemical.
Use descriptor covered	ERC 1
Description	Production of organic and inorganic substances in chemical, petrochemical, primary metals and minerals industry including intermediates, monomers using continuous processes or batch processes applying dedicated or multi-purpose equipment, either technically controlled or operated by manual interventions.
Assessment Method	EUSES v2.1
For further information see Table 1.4	

¹ Respiratory protection: another effectiveness value was applied

² Analytical monitoring of the plant site effluent to and from the STP at all 5 production sites of nBA in Europe were performed, revealing no concentrations above the limit of quantification of 1 µg.L-1 in the effluent from the STP.

Based on those analytical measurements an overestimating value of 0.01 mg.L-1 [10 µg.L-1] was input into EUSES as the STP effluent concentration for the production sites and the internal and external DU process sites. Thus the assumption of 10 µg.L-1 would be considered conservative since measured values were below the LOD of 1 µg.L-1.

³ The LEV exposure modifying factors for dermal exposure implemented in the ECETOC TRA v2.0 are not considered.

⁴ Gloves were implemented as an additional RMM. The following effectiveness values are assumed: Use of suitable gloves: 80%; Use of suitable gloves in combination with basic employee training: 90%; Use of suitable gloves in combination with specific activity training: 95%; Use of suitable gloves in combination with intensive management supervision controls: 98%

1.5.2. Exposure Estimation

Table 1.21 Estimated exposure for workers / PROC 15

Route of exposure	Concentrations			
Scenario	A	B	C	
	Value			Unit

Long-term exposure, local, dermal	20.0	NA	NA	µg/cm ²
Long-term exposure, local, inhalative	5.342	NA	NA	mg/m ³
Short-term exposure, local, dermal ¹	20.0	NA	NA	µg/cm ²

NA = Not applicable

¹ As dermal exposure generally is considered to accumulate during the period of exposure the full shift dermal exposure estimates will also be used for short-term dermal exposure.

For the estimated exposure for the environment / ERC 1 see Table