

SAFETY DATA SHEET according to Regulation (EC) No. 1907/2006

BORIC ACID

Version 6.0

Print Date 2017/01/31

Revision date / valid from 2017/01/31

MSDS code: MBAC100

SECTION 1: Identification of the substance/mixture and of the company/undertaking**1.1. Product identifier**

Trade name : BORIC ACID
Substance name : boric acid
Index-No. : 005-007-00-2
C&L-No. : 02-2119752829-22-0000
CAS-No. : 10043-35-3
EC-No. : 233-139-2
EU REACH-Reg. No. : 01-2119486683-25-xxxx

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

Use of the Substance/Mixture : Identified use: See table in front of appendix for a complete overview of identified uses.
Uses advised against : At this moment we have not identified any uses advised against

1.3. Details of the supplier of the safety data sheet

Company : Brenntag UK Limited
Alpha House, Lawnswood Business Park
GB LS16 6QY Leeds
Telephone : +44 (0) 113 3879 200
Telefax : +44 (0) 113 3879 280
E-mail address : msds@brenntag.co.uk

1.4. Emergency telephone number

Emergency telephone number : Emergency only telephone number (open 24 hours):
+44 (0) 1865 407333 (N.C.E.C. Culham)

SECTION 2: Hazards identification**2.1. Classification of the substance or mixture**

Classification according to Regulation (EC) No 1272/2008

REGULATION (EC) No 1272/2008			
Hazard class	Hazard category	Target Organs	Hazard statements
Reproductive toxicity	Category 1B	---	H360FD


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For the full text of the H-Statements mentioned in this Section, see Section 16.

Most important adverse effects

Human Health	:	May damage fertility. May damage the unborn child.
Physical and chemical hazards	:	Stable under normal conditions.
Potential environmental effects	:	According to available data, this product is not harmful to the environment.

2.2. Label elements**Labelling according to Regulation (EC) No 1272/2008**

Hazard symbols	:		
Signal word	:	Danger	
Hazard statements	:	H360FD	May damage fertility. May damage the unborn child.
Precautionary statements			
Prevention	:	P201 P202	Obtain special instructions before use. Do not handle until all safety precautions have been read and understood.
Response	:	P308 + P313	IF exposed or concerned: Get medical advice/ attention.
Disposal	:	P501	Dispose of contents/ container to an approved waste disposal plant.

Additional Labelling:

Restricted to professional users.

Hazardous components which must be listed on the label:

- boric acid

2.3. Other hazards

For Results of PBT and vPvB assessment see section 12.5.

BORIC ACID**SECTION 3: Composition/information on ingredients****3.1. Substances**

		Classification (REGULATION (EC) No 1272/2008)	
Hazardous components	Amount [%]	Hazard class / Hazard category	Hazard statements
boric acid			
Index-No. : 005-007-00-2	<= 100	Repr.1B	H360FD
CAS-No. : 10043-35-3			
EC-No. : 233-139-2			
EU REACH- : 01-2119486683-25-xxxx			
Reg. No.			

Remarks : This product contains a substance included on the candidate list according to article 59 (1, 10) of regulation EC No. 1907/2006 ('REACH') in a concentration $\geq 0.1\%$ w/w.

For the full text of the H-Statements mentioned in this Section, see Section 16.

SECTION 4: First aid measures**4.1. Description of first aid measures**

General advice	: Take off all contaminated clothing immediately. Wash contaminated clothing before re-use.
If inhaled	: Move to fresh air. If symptoms persist, call a physician.
In case of skin contact	: Wash off immediately with plenty of water. If skin irritation persists, call a physician.
In case of eye contact	: Rinse immediately with plenty of water, also under the eyelids, for at least 10 minutes. If eye irritation persists, consult a specialist.
If swallowed	: Rinse mouth with water. Never give anything by mouth to an unconscious person. Do NOT induce vomiting. Call a physician immediately.

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

Symptoms	: See Section 11 for more detailed information on health effects and symptoms.
Effects	: See Section 11 for more detailed information on health effects and symptoms.

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

Treatment	: Treat symptomatically.
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No further information available.

SECTION 5: Firefighting measures**5.1. Extinguishing media**

- Suitable extinguishing media : The product itself does not burn. Use extinguishing measures that are appropriate to local circumstances and the surrounding environment.
- Unsuitable extinguishing media : No information available.

5.2. Special hazards arising from the substance or mixture

- Specific hazards during firefighting : Hazardous decomposition products formed under fire conditions.

5.3. Advice for firefighters

- Special protective equipment for firefighters : In the event of fire, wear self-contained breathing apparatus. Use personal protective equipment.
- Further advice : Collect contaminated fire extinguishing water separately. This must not be discharged into drains. Fire residues and contaminated fire extinguishing water must be disposed of in accordance with local regulations.

SECTION 6: Accidental release measures**6.1. Personal precautions, protective equipment and emergency procedures**

- Personal precautions : Use personal protective equipment. Avoid contact with skin, eyes and clothing. Do not breathe dust. For personal protection see section 8.

6.2. Environmental precautions

- Environmental precautions : Should not be released into the environment. If the product contaminates rivers and lakes or drains inform respective authorities. If material reaches soil inform authorities responsible for such cases.

6.3. Methods and materials for containment and cleaning up

- Methods and materials for containment and cleaning up : Use mechanical handling equipment. Keep in suitable, closed containers for disposal.
- Further information : Treat recovered material as described in the section "Disposal considerations".

6.4. Reference to other sections

See Section 1 for emergency contact information.

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See Section 8 for information on personal protective equipment.
See Section 13 for waste treatment information.

SECTION 7: Handling and storage**7.1. Precautions for safe handling**

- Advice on safe handling : Keep container tightly closed. Use personal protective equipment. Provide sufficient air exchange and/or exhaust in work rooms. Avoid contact with skin, eyes and clothing. Do not breathe dust. Emergency eye wash fountains and emergency showers should be available in the immediate vicinity.
- Hygiene measures : Keep away from food, drink and animal feedingstuffs. Smoking, eating and drinking should be prohibited in the application area. Wash hands before breaks and at the end of workday. Take off all contaminated clothing immediately. Keep working clothes separately. Avoid contact with skin, eyes and clothing. Do not breathe dust.

7.2. Conditions for safe storage, including any incompatibilities

- Requirements for storage areas and containers : Store in a place accessible by authorized persons only. Store in original container.
- Advice on protection against fire and explosion : Normal measures for preventive fire protection. The product is not flammable.
- Fire-fighting class : non-combustible
- Further information on storage conditions : Keep tightly closed in a dry and cool place.
- Advice on common storage : Keep away from food, drink and animal feedingstuffs. Materials to avoid: Oxidizing and spontaneously flammable products

7.3. Specific end use(s)

- Specific use(s) : Identified use: See table in front of appendix for a complete overview of identified uses.

SECTION 8: Exposure controls/personal protection**8.1. Control parameters**

Component:	boric acid	CAS-No. 10043-35-3
Derived No Effect Level (DNEL)/Derived Minimal Effect Level (DMEL)		

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DNEL		
Workers, Long-term - systemic effects, Inhalation	:	8.3 mg/m ³
DNEL		
Workers, Long-term - systemic effects, Skin contact	:	392 mg/kg bw/day
DNEL		
Consumers, Long-term - systemic effects, Inhalation	:	4.15 mg/m ³
DNEL		
Consumers, Long-term - systemic effects, Skin contact	:	196 mg/kg bw/day
DNEL		
Consumers, Acute - systemic effects, Ingestion	:	0.98 mg/kg bw/day
DNEL		
Consumers, Long-term - systemic effects, Ingestion	:	0.98 mg/kg bw/day

Predicted No Effect Concentration (PNEC)

Fresh water	:	1.35 mg/l
Marine water	:	1.35 mg/l
Intermittent releases	:	9.1 mg/l
Sewage treatment plant (STP)	:	1.75 mg/l
Fresh water sediment	:	1.8 mg/kg d.w.
Marine sediment	:	1.8 mg/kg d.w.
Soil	:	5.4 mg/kg d.w.

Component:**Other Occupational Exposure Limit Values**

UK. EH40 Workplace Exposure Limits (WELs), Time Weighted Average (TWA):, Inhalable dust., Inhalable dust.
10 mg/m³, 8 h

UK. EH40 Workplace Exposure Limits (WELs), Time Weighted Average (TWA):, Respirable dust., Respirable dust
4 mg/m³, 8 h

8.2. Exposure controls**Appropriate engineering controls**

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Refer to protective measures listed in sections 7 and 8.

Provide for appropriate exhaust ventilation and dust collection at machinery.

Personal protective equipment*Respiratory protection*

Advice : Use the indicated respiratory protection if the occupational exposure limit is exceeded and/or in case of product release (dust).
Recommended Filter type:
Particle filter:P2
Particle filter:P3

Hand protection

Advice : The glove material has to be impermeable and resistant to the product / the substance / the preparation.
Take note of the information given by the producer concerning permeability and break through times, and of special workplace conditions (mechanical strain, duration of contact).
Protective gloves should be replaced at first signs of wear.
The following information applies to aqueous, saturated solutions.

Material : Natural Rubber
Break through time : ≥ 8 h
Glove thickness : 0.5 mm

Material : polychloroprene
Break through time : ≥ 8 h
Glove thickness : 0.5 mm

Material : Nitrile rubber
Break through time : ≥ 8 h
Glove thickness : 0.35 mm

Material : butyl-rubber
Break through time : ≥ 8 h
Glove thickness : 0.5 mm

Material : Fluorinated rubber
Break through time : ≥ 8 h
Glove thickness : 0.4 mm

Material : Polyvinylchloride
Break through time : ≥ 8 h
Glove thickness : 0.5 mm

Eye protection

Advice : Tightly fitting safety goggles

BORIC ACID*Skin and body protection*

Advice : Choose body protection in relation to its type, to the concentration and amount of dangerous substances, and to the specific work-place.
Wear appropriate chemical resistant clothing and boots.

Environmental exposure controls

General advice : Should not be released into the environment.
If the product contaminates rivers and lakes or drains inform respective authorities.
If material reaches soil inform authorities responsible for such cases.

SECTION 9: Physical and chemical properties**9.1. Information on basic physical and chemical properties**

Form	: crystalline powder or granular
Colour	: white
Odour	: none
Odour Threshold	: no data available
pH	: acidic
Melting point/range	: ca. 170 °C
Boiling point/boiling range	: 300 °C
Flash point	: Not applicable
Evaporation rate	: no data available
Flammability (solid, gas)	: no data available
Upper explosion limit	: no data available
Lower explosion limit	: no data available
Vapour pressure	: no data available
Relative vapour density	: no data available
Density	: 1.4 g/cm ³ (20 °C)
Water solubility	: 49 g/l (20 °C)

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Partition coefficient: n-octanol/water	:	no data available
Auto-ignition temperature	:	no data available
Thermal decomposition	:	no data available
Viscosity, dynamic	:	no data available
Explosivity	:	Product is not explosive.
Oxidizing properties	:	no data available

9.2. Other information

Molecular weight	:	61.83 g/mol
Bulk density	:	1100 kg/m3

SECTION 10: Stability and reactivity**10.1. Reactivity**

Advice	:	Stable under recommended storage conditions.
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10.2. Chemical stability

Advice	:	Stable under normal conditions.
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10.3. Possibility of hazardous reactions

Hazardous reactions	:	May release hydrogen by reaction with strong reducing agents. Organic materials
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10.4. Conditions to avoid

Conditions to avoid	:	At heating water will be lost.
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10.5. Incompatible materials

Materials to avoid	:	Strong oxidizing agents, Acids, metal salts, Alkali metals, Reducing agents
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10.6. Hazardous decomposition products

Hazardous decomposition products	:	In case of fire hazardous decomposition products may be produced such as: boric oxide
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SECTION 11: Toxicological information**11.1. Information on toxicological effects**

Component:	boric acid	CAS-No. 10043-35-3
Acute toxicity		

BORIC ACID**Oral**

LD50 Oral : > 2600 mg/kg (Rat, male) (OECD Test Guideline 401)

Dermal

LD50 : > 2000 mg/kg (Rabbit, male and female) (US-EPA method)

Irritation**Skin**

Result : No skin irritation (Rabbit) (US-EPA method)

Eyes

Result : No eye irritation (Rabbit; 24 h) (OECD Test Guideline 405)

Sensitisation

Result : not sensitizing (Buehler Test; Dermal; Guinea pig) (OECD Test Guideline 406)

CMR effects**CMR Properties**

Carcinogenicity : Animal testing did not show any carcinogenic effects.

Mutagenicity : In vitro tests did not show mutagenic effects
In vivo tests did not show mutagenic effects

Teratogenicity : Did not show teratogenic effects in animal experiments.

Reproductive toxicity : May damage fertility. May damage the unborn child.

Specific Target Organ Toxicity**Single exposure**

Remark : The substance or mixture is not classified as specific target organ toxicant, single exposure.

Repeated exposure

Remark : The substance or mixture is not classified as specific target organ toxicant, repeated exposure.

Other toxic properties

BORIC ACID**Aspiration hazard**

Not applicable,

Component:**CAS-No. 10043-35-3****Acute toxicity****Oral**

LD50 Oral : > 2600 mg/kg (Rat, male) (OECD Test Guideline 401)

Inhalation

No valid data available.

Dermal

LD50 : > 2000 mg/kg (Rabbit, male and female) (US-EPA method)

Irritation**Skin**

Result : No skin irritation (Rabbit) (US-EPA method)

Eyes

Result : No eye irritation (Rabbit; 24 h) (OECD Test Guideline 405)

Sensitisation

Result : not sensitizing (Buehler Test; Dermal; Guinea pig) (OECD Test Guideline 406)

CMR effects**CMR Properties**

Carcinogenicity : Animal testing did not show any carcinogenic effects.

Mutagenicity : In vitro tests did not show mutagenic effects
In vivo tests did not show mutagenic effects

Teratogenicity : Did not show teratogenic effects in animal experiments.

Reproductive toxicity : May damage fertility. May damage the unborn child.

Carcinogenicity

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NOEL : > 5,000 ppm
(negative, Mouse, B6C3F1, male and female)
(Oral; 103 weeks)
(OECD Test Guideline 451)

Genotoxicity in vitro

Result : negative (In vitro gene mutation study in mammalian cells; mouse lymphoma cells; with and without metabolic activation) (OECD Test Guideline 476)

negative (Bacterial Reverse Mutation Test; Salmonella typhimurium; with and without metabolic activation) (OECD Test Guideline 471)

negative (sister chromatid exchange assay; CHO (Chinese Hamster Ovary) cells; with and without metabolic activation) (No guideline followed)

Genotoxicity in vivo

Result : negative (Micronucleus test; Mouse, male and female)
(Oral;) (OECD Test Guideline 474)

Reproductive toxicity

NOAEL : 17.5 mg/kg bw/day
Parent
NOAEL : 17.5 mg/kg bw/day
F1
(Three-generation study; Rat, Sprague-Dawley, male and female)
(Oral)
(No guideline followed)
The value is given in analogy to the following substances:
Boron

Specific Target Organ Toxicity**Single exposure**

Remark : The substance or mixture is not classified as specific target organ toxicant, single exposure.

Repeated exposure

Remark : The substance or mixture is not classified as specific target organ toxicant, repeated exposure.

Other toxic properties**Repeated dose toxicity**

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NOAEL : 17.5 mg/kg bw/day

(Rat, Sprague-Dawley, male and female; Test substance: Boron)
(Oral; 24 month)
Target Organs: Testes

Aspiration hazard

Not applicable,

SECTION 12: Ecological information**12.1. Toxicity**

Component:	boric acid	CAS-No. 10043-35-3
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Acute toxicity**Fish**

LC50 : 50 - 100 mg/l (Oncorhynchus mykiss; 96 h)

Toxicity to daphnia and other aquatic invertebrates

EC50 : 133 mg/l (Daphnia magna; 48 h)

algae

no data available

Component:	CAS-No. 10043-35-3
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Acute toxicity**Fish**

LC50 : 456 mg/l (Pimephales promelas (fathead minnow); 96 h) (static test; OPPTS 850.1075)
Read-across (Analogy)

Toxicity to daphnia and other aquatic invertebrates

EC50 : 760 mg/l (Daphnia magna; 48 h)

algae

EC50 : 229 mg/l (Pseudokirchneriella subcapitata (green algae); 72 h)

12.2. Persistence and degradability

BORIC ACID**Data for the product****Persistence and degradability****Persistence**

Result : no data available

Biodegradability

Result : The methods for determining the biological degradability are not applicable to inorganic substances.

Component: **boric acid** **CAS-No. 10043-35-3**

Persistence and degradability**Persistence**

Result : no data available

Biodegradability

Result : The methods for determining the biological degradability are not applicable to inorganic substances.

12.3. Bioaccumulative potential**Data for the product****Bioaccumulation**

Result : No information available.

Component: **boric acid** **CAS-No. 10043-35-3**

Bioaccumulation

Result : log Kow -1.09 (22 °C; pH 7.5) (Directive 84/449/EEC, A.8)
Bioaccumulation is not expected.

12.4. Mobility in soil**Data for the product****Mobility**

Result : The product is mobile in water environment.

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Component:	boric acid	CAS-No. 10043-35-3
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Mobility

Water : The product is water soluble.

Soil : Not expected to adsorb on soil.

12.5. Results of PBT and vPvB assessment

Data for the product

Results of PBT and vPvB assessment

Result : no data available

Component:	boric acid	CAS-No. 10043-35-3
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Results of PBT and vPvB assessment

Result : The PBT or vPvB criteria of Annex XIII to the REACH Regulation does not apply to inorganic substances.

12.6. Other adverse effects

Data for the product

Additional ecological information
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Result : Do not flush into surface water or sanitary sewer system.

Component:	boric acid	CAS-No. 10043-35-3
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Additional ecological information
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Result : no data available

SECTION 13: Disposal considerations**13.1. Waste treatment methods**

Product : Disposal together with normal waste is not allowed. Special disposal required according to local regulations. Do not let product enter drains. Contact waste disposal services.

Contaminated packaging : Empty contaminated packagings thoroughly. They can be recycled after thorough and proper cleaning. Packagings that cannot be cleaned are to be disposed of in the same manner as the product.

European Waste : No waste code according to the European Waste Catalogue

BORIC ACID

Catalogue Number

can be assigned for this product, as the intended use dictates the assignment. The waste code is established in consultation with the regional waste disposer.

SECTION 14: Transport information

Not dangerous goods for ADR, RID, IMDG and IATA.

14.1. UN number

Not applicable.

14.2. UN proper shipping nameNot applicable.**14.3. Transport hazard class(es)**

Not applicable.

14.4. Packaging group

Not applicable.

14.5. Environmental hazards

Not applicable.

14.6. Special precautions for user

Not applicable.

14.7. Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code

IMDG : Not applicable.

SECTION 15: Regulatory information**15.1. Safety, health and environmental regulations/legislation specific for the substance or mixture****Data for the product**

EU. REACH Candidate : **boric acid**
 List of Substances of
 Very High Concern for
 Authorization (SVHC)
 Reproductive toxicity (ED/30/2010; 18/06/2010)

Component: **boric acid** **CAS-No. 10043-35-3**

EU. Regulation EU No. : ; The substance/mixture does not fall under this legislation.
 649/2012 concerning the
 export and import of
 dangerous chemicals

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EU. REACH, Annex XVII, : , 233-139-2; Reproductive toxicity; Category 1B

Appendix 6, Entry 30 -

Toxic to

reproduction(Regulation
1907/2006/EC)

EU. REACH, Annex XVII,
Marketing and Use
Restrictions (Regulation
1907/2006/EC)

Point Nos.: , 3; Listed

Point Nos.: , 30; Listed

EU. REACH Candidate : EC Number/Date of inclusion: 2,331,392, 18/06/2010;
List of Substances of Reproductive toxicity; Decision Number: ED/30/2010
Very High Concern for
Authorization (SVHC)

EU. Directive 98/8/EC, : Minimum purity: 990, g/kg; Wood preservatives; Special
Annex 1, Active provisions may apply; see text of legislation.
substances in biocidal
products

Inclusion Date: , 1 Sep 2011

Deadline for Compliance: , 31 Aug 2013

Expiry Date of Inclusion: , 31 Aug 2021

EU. Regulation No : EC Number: , 233-139-2; Listed
1451/2007 [Biocides],
Annex I, OJ (L 325)

EU. Regulation No. : Maximum concentration in ready for use preparation: 3 %;
1223/2009 on cosmetic Cosmetic products other than talcum powder and oral products
products, Annex III: List (excluding bath products and hair waving products); See the
of Restricted Substances text of the regulation for applicable exceptions or provisions.
in Cosmetic Products

Maximum concentration in ready for use preparation: 5 %; In
talcum powders; See the text of the regulation for applicable
exceptions or provisions.

Maximum concentration in ready for use preparation: 0.1 %;
Oral products; See the text of the regulation for applicable
exceptions or provisions.

EU. Directive : ; The substance/mixture does not fall under this legislation.
2012/18/EU (SEVESO
III) Annex I

UK. Releases to air and : Annual reporting level threshold: 5,000 kg
water (UK ISR)

Notification status**boric acid:**

Regulatory List	Notification	Notification number
AICS	YES	
DSL	YES	
EINECS	YES	233-139-2
ENCS (JP)	YES	(1)-63

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IECSC	YES	
ISHL (JP)	YES	(1)-63
JEX (JP)	YES	(1)-63
KECI (KR)	YES	KE-03499
NZIOC	YES	HSR002995
PICCS (PH)	YES	
TSCA	YES	

15.2. Chemical safety assessment

A Chemical Safety Assessment has been carried out for this substance.

SECTION 16: Other information**Full text of H-Statements referred to under sections 2 and 3.**

H360FD May damage fertility. May damage the unborn child.

Abbreviations and Acronyms

BCF	bioconcentration factor
BOD	biochemical oxygen demand
CAS	Chemical Abstracts Service
CLP	Classification, Labelling and Packaging
CMR	carcinogenic, mutagenic or toxic to reproduction
COD	chemical oxygen demand
DNEL	derived no-effect level
EINECS	European Inventory of Existing Commercial Chemical Substances
ELINCS	European List of Notified Chemical Substances
GHS	Globally Harmonized System of Classification and Labelling of Chemicals
LC50	median lethal concentration
LOAEC	lowest observed adverse effect concentration
LOAEL	lowest observed adverse effect level
LOEL	lowest observed effect level
NLP	no-longer polymer
NOAEC	no observed adverse effect concentration
NOAEL	no observed adverse effect level
NOEC	no observed effect concentration
NOEL	no observed effect level
OECD	Organisation for Economic Cooperation and Development
OEL	occupational exposure limit
PBT	persistent, bioaccumulative and toxic
PNEC	predicted no-effect concentration

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STOT	specific target organ toxicity
SVHC	substance of very high concern
UVCB	substance of unknown or variable composition, complex reaction products or biological materials
vPvB	very persistent and very bioaccumulative

Further information

Key literature references : Supplier information and data from the "Database of registered substances" of the European Chemicals Agency (ECHA) were used to create this safety data sheet.

Methods used for product classification : The classification for human health, physical and chemical hazards and environmental hazards were derived from a combination of calculation methods and if available test data.

Hints for trainings : The workers have to be trained regularly on the safe handling of the products based on the information provided in the Safety Data Sheet and the local conditions of the workplace. National regulations for the training of workers in the handling of hazardous materials must be adhered to.

Other information : Restricted to professional users. Attention - Avoid exposure - obtain special instructions before use.
The information provided in this Safety Data Sheet is correct to our knowledge at the date of its revision. The information given only describes the products with regard to safety arrangements and is not to be considered as a warranty or quality specification and does not constitute a legal relationship.
The information contained in this Safety Data Sheet relates only to the specific material designated and may not be valid for such material used in combination with any other material or in any process, unless specified in the text.

|| Indicates updated section.

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No.	Short title	Main User Group (SU)	Sector of Use (SU)	Product Category (PC)	Process Category (PROC)	Environmental Release Category (ERC)	Article Category (AC)	Specified
1	Manufacture of substance	3	8, 9	NA	1, 2, 3, 4, 8a, 8b, 9, 14, 15	1, 6a	NA	ES12195
2	Use as an intermediate	3	NA	NA	1, 2, 3, 4, 5, 8a, 8b, 9, 14, 15	1, 6a, 6b	NA	ES12256
3	Formulation & (re)packing of substances and mixtures	3	NA	NA	1, 2, 3, 4, 5, 8a, 8b, 9, 14, 15	2	NA	ES12203
4	Use as additive	21	NA	35	NA	8a	NA	ES12288
5	Use as additive	22	NA	NA	21	10a, 11a	NA	ES12286
6	Use in Cleaning Agents	3	NA	NA	1, 2, 3, 4, 5, 6, 7, 8a, 8b, 9, 10, 12, 13, 18, 19, 23, 24	4	NA	ES12280
7	Use in Cleaning Agents	22	NA	NA	1, 2, 3, 10, 11, 13, 19	8a, 8d	NA	ES12283
8	Use as processing aid	3	NA	NA	1, 2, 3, 4, 5, 8a, 8b, 9, 13, 14, 15, 17, 18, 19, 22, 23, 24	4	NA	ES12238
9	Use as reactive process agent or use as catalyst	3	8, 9	NA	1, 2, 3, 4, 8a, 8b	1, 6a, 6b	NA	ES12312
10	Manufacture of catalysts	3	NA	NA	3, 4, 5, 8a, 8b, 9, 14	1, 3, 6a, 6b	NA	ES12314
11	Use as a process chemical	3	NA	NA	1, 2, 3, 4, 5, 8a, 8b, 9, 14, 15, 22, 23	6b	NA	ES12265
12	Use in glass production	3	NA	NA	1, 2, 3, 8a, 8b, 15, 22, 23	2, 5, 6a	NA	ES12215
13	Use in nuclear power plants	3	NA	NA	1, 2, 3, 4, 5, 8b, 15	7	NA	ES12274
14	Use of abrasives	22	NA	NA	21	12a	NA	ES12310
15	Use in agrochemicals	22	NA	NA	2, 5, 8a, 9, 13	8a, 8c, 8d, 8f	NA	ES12293
16	Industrial formulation	3	NA	NA	1, 2, 3, 4, 5, 8a, 8b, 9, 14, 15, 22, 23, 26	3	NA	ES12224
17	Use in building and construction work	21	NA	0, 1, 9b	NA	10a, 11a	NA	ES12304

BORIC ACID**1. Short title of Exposure Scenario 1: Manufacture of substance**

Main User Groups	SU 3: Industrial uses: Uses of substances as such or in preparations at industrial sites
Sectors of end-use	SU8: Manufacture of bulk, large scale chemicals (including petroleum products) SU9: Manufacture of fine chemicals
Process categories	PROC1: Use in closed process, no likelihood of exposure PROC2: Use in closed, continuous process with occasional controlled exposure PROC3: Use in closed batch process (synthesis or formulation) PROC4: Use in batch and other process (synthesis) where opportunity for exposure arises PROC8a: Transfer of substance or preparation (charging/ discharging) from/ to vessels/ large containers at non-dedicated facilities PROC8b: Transfer of substance or preparation (charging/ discharging) from/ to vessels/ large containers at dedicated facilities PROC9: Transfer of substance or preparation into small containers (dedicated filling line, including weighing) PROC14: Production of preparations or articles by tableting, compression, extrusion, pelletisation PROC15: Use as laboratory reagent
Environmental Release Categories	ERC1: Manufacture of substances ERC6a: Industrial use resulting in manufacture of another substance (use of intermediates)

2.1 Contributing scenario controlling environmental exposure for: ERC1, ERC6a

Product characteristics	Concentration of the Substance in Mixture/Article	Covers percentage substance in the product up to 100 % (unless stated differently).
Amount used	Annual amount per site	100000 ton(s)/year (No water emissions ERC1, ERC6a)
Frequency and duration of use	Continuous exposure	220 days/year
Other given operational conditions affecting environmental exposure	Emission or Release Factor: Air	0.53 g/ton of product
	Emission or Release Factor: Water	0 g/ton of product
Technical conditions and measures at process level (source) to prevent release Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil Organizational measures to prevent/limit release from the site	Air	Substance specific waste air treatment:, Electrostatic precipitation, Cyclones, ceramic filters, Bag filters, Fabric filter
	Water	Substance specific waste water treatment, Ion exchange, Reverse osmosis (Degradation effectiveness: 40 - 90 %)
Conditions and measures related to sewage treatment plant	Wastewater emission controls are not applicable as there is no direct release to wastewater.	
Conditions and measures related to external treatment of waste for disposal	Waste treatment	Send back to the process
	Disposal methods	Vacuum up spillage and collect in suitable containers for disposal., Dispose of as hazardous waste in compliance with local and national regulations.
Conditions and measures related to external recovery of waste	Recovery Methods	There is no envisaged external recovery of waste.

2.2 Contributing scenario controlling worker exposure for: PROC1, PROC2, PROC3

Activity	Product delivery/storage - product storage - indoor	
Product characteristics	Concentration of the	Covers percentage substance in the product up to

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	Substance in Mixture/Article	100 % (unless stated differently).
	Physical Form (at time of use)	granules, Powder
Amount used	Amount per Shift	> 1000 tonnes
Frequency and duration of use	Covers daily exposures up to 8 hours (unless stated differently).	
Other operational conditions affecting workers exposure	Indoor use.	
Technical conditions and measures to control dispersion from source towards the worker	Where there are breaches in the closed system, such as pouring and removal of slag in metal production, LEV is used to control fumes.	
Organisational measures to prevent /limit releases, dispersion and exposure	Ensure operatives are trained to minimise exposures. Regular inspection and maintenance of equipment and machines.	
Conditions and measures related to personal protection, hygiene and health evaluation	Wear suitable protective clothing. Wear protective shoes. Safety glasses Safety goggles In case of dust or aerosol formation: use respiratory protection with approved filter (P2) or Particle filter:P3	

2.3 Contributing scenario controlling worker exposure for: PROC1, PROC2, PROC3, PROC4, PROC14

Activity	Processing	
Product characteristics	Concentration of the Substance in Mixture/Article	Concentration of substance in product: 5% - 25%
	Physical Form (at time of use)	granules, Powder
Amount used	Amount per Use	1500 kg
	The amount used per worker varies from activity to activity	
Frequency and duration of use	Covers daily exposures up to 8 hours (unless stated differently).	
Other operational conditions affecting workers exposure	Indoor use.	
	Operation is carried out at elevated temperature (> 20 °C above ambient temperature).	
Technical conditions and measures to control dispersion from source towards the worker	Use closed dosing, transfer, sampling and application systems including connectors. Provide local exhaust ventilation (LEV). Discharge sacks via suitable vented charge chute. Provide a good standard of general ventilation. Natural ventilation is from doors, windows etc. Controlled ventilation means air is supplied or removed by a powered fan. Clear spills immediately. Provide extract ventilation to points where emissions occur.	
Organisational measures to prevent /limit releases, dispersion and exposure	Provide basic employee training to prevent/minimize exposures Regular inspection and maintenance of equipment and machines.	
Conditions and measures related to personal protection, hygiene and health evaluation	Wear suitable protective clothing. Wear protective shoes. Safety glasses Wear protective gloves. In case of dust or aerosol formation: use respiratory protection with approved filter (P2) or Particle filter:P3	

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Activity	Relevant for Cleaning and Maintenance	
Product characteristics	Concentration of the Substance in Mixture/Article	Covers concentrations more than 25%
	Physical Form (at time of use)	granules, Powder
Amount used	The amount used per worker varies from activity to activity	
Other operational conditions affecting workers exposure	Indoor and outdoor use.	
Technical conditions and measures to control dispersion from source towards the worker	Provide local exhaust ventilation (LEV). Minimise exposure by partial enclosure of the operation or equipment and provide extract ventilation at openings.	
Organisational measures to prevent /limit releases, dispersion and exposure	Ensure operatives are trained to minimise exposures. Regular inspection and maintenance of equipment and machines.	
Conditions and measures related to personal protection, hygiene and health evaluation	Wear suitable protective clothing. Wear protective shoes. Safety glasses In case of dust or aerosol formation: use respiratory protection with approved filter (P2) or Particle filter:P3	

2.5 Contributing scenario controlling worker exposure for: PROC8a, PROC8b

Activity	Off-loading substances from ships.	
Product characteristics	Concentration of the Substance in Mixture/Article	Covers percentage substance in the product up to 100 % (unless stated differently).
	Physical Form (at time of use)	granules, Powder
Amount used	Amount per Application	10000 kg
Frequency and duration of use	Frequency of use	1 - 2 days/month
	Covers daily exposures up to 8 hours (unless stated differently).	
Other operational conditions affecting workers exposure	Outdoor use.	
Technical conditions and measures to control dispersion from source towards the worker	Transfer via enclosed lines. Closed process and closed circuits where relevant and possible Use closed dosing, transfer, sampling and application systems including connectors. Provide local exhaust ventilation (LEV). Use front end loaders with air conditioned cab	
Organisational measures to prevent /limit releases, dispersion and exposure	Ensure operatives are trained to minimise exposures. Regular inspection and maintenance of equipment and machines.	
Conditions and measures related to personal protection, hygiene and health evaluation	Wear suitable protective clothing. Wear protective gloves. In case of dust or aerosol formation: use respiratory protection with approved filter (P2) or Wear air purifying half mask APF10	
	Equipment cleaning and maintenance	Wear air purifying half mask APF10 Particle filter:P2

2.6 Contributing scenario controlling worker exposure for: PROC8a, PROC8b

Activity	Loading (including marine vessel/barge, rail/road car and IBC loading) and repacking (including drums and small packs) of substance, including its sampling,
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	storage, unloading, distribution and associated laboratory activities.	
Product characteristics	Concentration of the Substance in Mixture/Article	Concentration of substance in product: 5% - 25%
	Physical Form (at time of use)	Solid, high dustiness, granules, Powder
Amount used	Amount per Use	25000 kg
Frequency and duration of use	Application duration	30 min
	Covers daily exposures up to 8 hours (unless stated differently).	
Other operational conditions affecting workers exposure	Outdoor use.	
	Assumes activities are at ambient temperature.	
Technical conditions and measures to control dispersion from source towards the worker	Automate activity where possible.	
Organisational measures to prevent /limit releases, dispersion and exposure	Provide basic employee training to prevent/minimize exposures	
	Regular inspection and maintenance of equipment and machines.	
Conditions and measures related to personal protection, hygiene and health evaluation	Wear suitable protective clothing. Wear protective shoes. Safety glasses Wear respiratory protection. Particle filter:P2 or Particle filter:P3	

2.7 Contributing scenario controlling worker exposure for: PROC8a, PROC8b, PROC9

Activity	Packaging	
Product characteristics	Concentration of the Substance in Mixture/Article	Concentration of substance in product: 5% - 25%
	Physical Form (at time of use)	granules, Powder
Amount used	The amount used per worker varies from activity to activity	
Frequency and duration of use	Covers daily exposures up to 8 hours (unless stated differently).	
Other operational conditions affecting workers exposure	Indoor use.	
	Assumes activities are at ambient temperature.	
Technical conditions and measures to control dispersion from source towards the worker	Provide local exhaust ventilation (LEV).	
	Automate activity where possible.	
Organisational measures to prevent /limit releases, dispersion and exposure	Provide basic employee training to prevent/minimize exposures	
	Regular inspection and maintenance of equipment and machines.	
Conditions and measures related to personal protection, hygiene and health evaluation	Wear protective clothing. Safety shoes Safety glasses In the case of dust or aerosol formation use respirator with an approved filter. Particle filter:P2 or Particle filter:P3	

2.8 Contributing scenario controlling worker exposure for: PROC15

Activity	Use of small quantities within laboratory settings, including material transfers and equipment cleaning.	
Product characteristics	Concentration of the Substance in Mixture/Article	Concentration of substance in product: 5% - 25%

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	Physical Form (at time of use)	Powdered substance, granular-like
Amount used	Amount per Application	1 kg
Frequency and duration of use	Covers daily exposures up to 8 hours (unless stated differently).	
Technical conditions and measures to control dispersion from source towards the worker	Handle within a fume cupboard or implement suitable equivalent methods to minimise exposure.	
Organisational measures to prevent /limit releases, dispersion and exposure	Ensure operatives are trained to minimise exposures. Regular inspection and maintenance of equipment and machines.	
Conditions and measures related to personal protection, hygiene and health evaluation	Wear a laboratory coat Safety shoes Safety glasses	

3. Exposure estimation and reference to its source**Environment**

ERC1, ERC6a: METALS EUSES IT tool

Contributing Scenario	Specific conditions	Compartment	Value	Level of Exposure	RCR
ERC1, ERC6a	No water discharge to the environment	Soil	PEC	0.01mg/kg dry weight (d.w.)	0.002

Workers

PROC2, PROC4, PROC8a, PROC8b, PROC9, PROC15: MEASE

PROC1, PROC2, PROC3, PROC4, PROC8a, PROC8b, PROC9, PROC14, PROC15: Advanced REACH Tool (ART model) (inhalative exposure)

Contributing Scenario	Specific conditions	Exposure routes	Level of Exposure	RCR
PROC1, PROC2, PROC3	90th percentile value, 8 hours/day, without respiratory protection	Inhalation worker exposure	0.08mg/m ³	0.06
PROC2	Solid, high dustiness., during 15 mins - 1 hour	Dermal worker exposure	0.048mg/kg bw/day	< 0.001
PROC1, PROC2, PROC3, PROC4, PROC14	8 hours/day	Inhalation worker exposure	0.39 - 0.41mg/m ³	0.27 - 0.28
PROC4	Solid, high dustiness., Concentration of substance in product: 5% - 25%, during <15 mins	Dermal worker exposure	0.014mg/kg bw/day	< 0.001
PROC8a, PROC8b	90th percentile value, no respiratory protection (RPE)	Inhalation worker exposure	1.33mg/m ³	0.92
PROC8a	Solid, high dustiness., during 1 - 4 hours, with gloves	Dermal worker exposure	0.173mg/kg bw/day	< 0.001
PROC8a, PROC8b	90th percentile value, Crane drivers	Inhalation worker exposure	0.2mg/m ³	0.14
PROC8a, PROC8b	90th percentile value, Trimming ships	Inhalation worker exposure	0.68mg/m ³	0.47
PROC8a, PROC8b	90th percentile value, Driving small front end	Inhalation worker exposure	1.35mg/m ³	---

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	loaders in the ship			
PROC8a, PROC8b	90th percentile value, Work in the warehouse, Air conditioned cab front end loaders	Inhalation worker exposure	0.44mg/m ³	0.30
PROC8b	90th percentile value, Open-cab front end loaders, With respiratory protection	Inhalation worker exposure	0.72mg/m ³	0.50
PROC8a	Crane drivers, during 1 - 4 hours, Concentration of substance in product: 5% - 25%	Dermal worker exposure	0.173mg/kg bw/day	< 0.001
PROC8a, PROC8b	Trimming ships, during 15 mins - 1 hour	Dermal worker exposure	57.6mg/kg bw/day	0.012
PROC8a, PROC8b	Driving small front end loaders in the ship, during 1 - 4 hours, Air conditioned cab front end loaders	Dermal worker exposure	0.058mg/kg bw/day	< 0.001
PROC8a, PROC8b	Work in the warehouse, Air conditioned cab front end loaders, without air conditioned cab	Dermal worker exposure	0.144mg/kg bw/day	< 0.001
PROC8a, PROC8b	90th percentile value, without respiratory protection	Inhalation worker exposure	0.37mg/m ³	0.26
PROC8a, PROC8b	during 15 mins - 1 hour, with gloves, Concentration of substance in product: 5% - 25%	Dermal worker exposure	0.029mg/kg bw/day	< 0.001
PROC8a, PROC8b, PROC9	90th percentile value, With respiratory protection, Packing in big bags	Inhalation worker exposure	0.58mg/m ³	0.4
PROC8a, PROC8b, PROC9	90th percentile value, Packing in 25kg sacks	Inhalation worker exposure	1mg/m ³	0.69
PROC8a, PROC8b, PROC9	Packing in big bags, Packing in 25kg sacks, Solid, high dustiness., with gloves	Dermal worker exposure	0.144mg/kg bw/day	< 0.001
PROC15	---	Inhalable dust.	0.0005mg/m ³	---
PROC15	90th percentile value	Inhalation worker exposure	0.0001mg/m ³	---
PROC15	during 15 mins - 1 hour	Dermal worker exposure	0.014mg/kg bw/day	---

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

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

Tonnage calculations have been based on boron such that no RCR exceeds 0.97, using back calculations with the relevant PNEC's when necessary. The equivalent tonnage of product handled on site should be calculated

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from the conversion factors detailed in the product table. For those operations that handle a combination of borate compounds, the boron equivalent of the combined tonnage cannot exceed the site tonnage value. Guidance is based on assumed operating conditions which may not be applicable to all sites; thus, scaling may be necessary to define appropriate site-specific risk management measures. Where other Risk Management Measures/Operational Conditions are adopted, then users should ensure that risks are managed to at least equivalent levels. Only properly trained persons shall make use of scaling methods while checking whether the OC and RMM are within the boundaries set by the ES

Substance	Formula	Conversion factor for the equivalent dose of B (multiply by)
Boric acid	H_3BO_3	0,1748
Boric oxide	B_2O_3	0,311
Disodium tetraborate anhydrous	$\text{Na}_2\text{B}_4\text{O}_7$	0,2149
Disodium tetraborate pentahydrate	$\text{Na}_2\text{B}_4\text{O}_7 \times 5\text{H}_2\text{O}$	0,1484
Disodium tetraborate decahydrate	$\text{Na}_2\text{B}_4\text{O}_7 \times 10\text{H}_2\text{O}$	0,1134
Disodium octaborate tetrahydrate	$\text{Na}_2\text{B}_8\text{O}_{13} \times 4\text{H}_2\text{O}$	0,2096
Sodium metaborate (anhydrous)	NaBO_2	0,1643
Sodium metaborate (dihydrate)	$\text{NaBO}_2 \times 2\text{H}_2\text{O}$	0,1062
Sodium metaborate (tetrahydrate)	$\text{NaBO}_2 \times 4\text{H}_2\text{O}$	0,0784
Sodium pentaborate (anhydrous)	$\text{NaB}_5\text{O}_{10}$	0,2636
Sodium pentaborate (pentahydrate)	$\text{NaB}_5\text{O}_{10} \times 5\text{H}_2\text{O}$	0,1832

BORIC ACID**1. Short title of Exposure Scenario 2: Use as an intermediate**

Main User Groups	SU 3: Industrial uses: Uses of substances as such or in preparations at industrial sites
Process categories	PROC1: Use in closed process, no likelihood of exposure PROC2: Use in closed, continuous process with occasional controlled exposure PROC3: Use in closed batch process (synthesis or formulation) PROC4: Use in batch and other process (synthesis) where opportunity for exposure arises PROC5: Mixing or blending in batch processes for formulation of preparations and articles (multistage and/ or significant contact) PROC8a: Transfer of substance or preparation (charging/ discharging) from/ to vessels/ large containers at non-dedicated facilities PROC8b: Transfer of substance or preparation (charging/ discharging) from/ to vessels/ large containers at dedicated facilities PROC9: Transfer of substance or preparation into small containers (dedicated filling line, including weighing) PROC14: Production of preparations or articles by tableting, compression, extrusion, pelletisation PROC15: Use as laboratory reagent
Environmental Release Categories	ERC1: Manufacture of substances ERC6a: Industrial use resulting in manufacture of another substance (use of intermediates) ERC6b: Industrial use of reactive processing aids

2.1 Contributing scenario controlling environmental exposure for: ERC1, ERC6a, ERC6b

Product characteristics	Concentration of the Substance in Mixture/Article	Covers percentage substance in the product up to 100 % (unless stated differently).
Amount used	Annual amount per site	74 ton(s)/year (Default dilution ERC6a)
	Annual amount per site	190 ton(s)/year (Dilution of 10 ERC1, ERC6a, ERC6b)
	Annual amount per site	1150 ton(s)/year (Dilution of 100 ERC1, ERC6a, ERC6b)
Frequency and duration of use	Continuous exposure	365 days/year (Default dilution ERC6a)
	Continuous exposure	300 days/year (Dilution of 10, Dilution of 100 ERC1, ERC6a, ERC6b)
Environment factors not influenced by risk management	Other data. Other information	Local freshwater dilution factor:: 10
	Other data. Other information	Local marine water dilution factor:: 100
	Dilution Factor (River)	500
Other given operational conditions affecting environmental exposure	Emission or Release Factor: Air	50000 g/ton of product (Default dilution ERC1, ERC6a, ERC6b)
	Emission or Release Factor: Water	20000 g/ton of product (Default dilution ERC1, ERC6a, ERC6b)
	Emission or Release Factor: Air	36562 g/ton of product (Dilution of 10, Dilution of 100 ERC1, ERC6a, ERC6b)
	Emission or Release Factor: Water	60000 g/ton of product (Dilution of 10, Dilution of 100 ERC1, ERC6a, ERC6b)
Technical conditions and measures at process level (source) to prevent release Technical onsite conditions and measures to reduce or limit discharges, air emissions and	Air	Electrostatic precipitation, Cyclones, Treatment of air emissions by bag filters, fabric filter and wet scrubber, Ceramic & metal mash filters, PM10 particles are removed
	Water	Substance specific waste water treatment, Ion

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releases to soil Organizational measures to prevent/limit release from the site		exchange, Reverse osmosis (Degradation effectiveness: 40 - 90 %)
Conditions and measures related to sewage treatment plant	Type of Sewage Treatment Plant	Municipal sewage treatment plant
	The concentration of the substance should not exceed 1,75 mg/L in the municipal STP	
Conditions and measures related to external treatment of waste for disposal	Waste treatment	Send back to the process, Substance containing waste shall be handled as hazardous waste and removed by licensed waste removal company, incinerated or recycled
	Disposal methods	Vacuum up spillage and collect in suitable containers for disposal.

2.2 Contributing scenario controlling worker exposure for: PROC1, PROC2, PROC3

Product characteristics	Concentration of the Substance in Mixture/Article	Covers percentage substance in the product up to 100 % (unless stated differently).
	Physical Form (at time of use)	Powdered substance, granules
Amount used	Amount per Shift	1000 kg
Frequency and duration of use	Covers daily exposures up to 8 hours (unless stated differently).	
Other operational conditions affecting workers exposure	Indoor use.	
	Assumes activities are at ambient temperature.	
Technical conditions and measures to control dispersion from source towards the worker	Use closed dosing, transfer, sampling and application systems including connectors. Provide local exhaust ventilation (LEV). Where there are breaches in the closed system, such as pouring and removal of slag in metal production, LEV is used to control fumes.	
Organisational measures to prevent /limit releases, dispersion and exposure	Ensure operatives are trained to minimise exposures. Regular inspection and maintenance of equipment and machines.	
Conditions and measures related to personal protection, hygiene and health evaluation	Wear protective clothing. Safety shoes Safety glasses In case of dust or aerosol formation: use respiratory protection with approved filter (P2) or Particle filter:P3	

2.3 Contributing scenario controlling worker exposure for: PROC1, PROC2, PROC3

Activity	Potentially closed processing operations at elevated temperature.	
Product characteristics	Concentration of the Substance in Mixture/Article	Covers percentage substance in the product up to 100 % (unless stated differently).
	Physical Form (at time of use)	Powdered substance, granules
Amount used	The amount used per worker varies from activity to activity	
Frequency and duration of use	Frequency of use	24 hours/day
	Frequency of use	365 days/year
Other operational conditions affecting workers exposure	Indoor use.	
	The process temperatures are mainly very high, as these processes include glass making, ceramics, steel & alloy making	
Technical conditions and measures to control dispersion from source towards the worker	Worker in separate cabine without specific ventilation Use closed dosing, transfer, sampling and application systems including connectors.	

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	Where there are breaches in the closed system, such as pouring and removal of slag in metal production, LEV is used to control fumes.	
Organisational measures to prevent /limit releases, dispersion and exposure	Ensure operatives are trained to minimise exposures. Regular inspection and maintenance of equipment and machines. Workers in the risky process/areas identified should be trained a) to avoid to work without respiratory protection and b) to understand the irritating properties and, especially, the respiratory inhalation effects and c) to follow the safer procedures instructed by the employer.	
Conditions and measures related to personal protection, hygiene and health evaluation	Operatives wear overalls or heavy heat resistant clothing Wear protective gloves. Safety glasses Goggles In case of dust or aerosol formation: use respiratory protection with approved filter (P2) or Particle filter:P3 Use battery-powered air fed helmets These respirators, if worn correctly, with a good face fit, will provide sufficient protection Where tightly fitting RPE is used, the worker should be face fit tested to ensure that a good face seal can be obtained	
2.4 Contributing scenario controlling worker exposure for: PROC4, PROC5, PROC8b		
Activity	Covers reloading, mixing or compounding and associated activities in the Process Categories listed above	
Product characteristics	Concentration of the Substance in Mixture/Article	Covers percentage substance in the product up to 100 % (unless stated differently).
	Physical Form (at time of use)	Powdered substance, granules
Amount used	Would vary by requirements and by facility	
Frequency and duration of use	Exposure duration per day	60 min
Other operational conditions affecting workers exposure	Indoor use.	
	Assumes activities are at ambient temperature.	
Technical conditions and measures to control dispersion from source towards the worker	Automate activity where possible. Use closed dosing, transfer, sampling and application systems including connectors. Provide local exhaust ventilation (LEV). Single use bags can be opened by the use of sharp prongs at the discharge hopper. When the big bag is placed at the discharge hopper and lowered, the prongs cut into the base of the bag releasing the substance into the hopper. This removes the operator from the immediate vicinity and contributes to a reduction in exposure	
Organisational measures to prevent /limit releases, dispersion and exposure	Ensure operatives are trained to minimise exposures. Regular inspection and maintenance of equipment and machines.	
Conditions and measures related to personal protection, hygiene and health evaluation	Wear protective clothing. Wear protective gloves. Safety glasses Goggles In case of dust or aerosol formation: use respiratory protection with approved filter (P2) or Particle filter:P3 These respirators, if worn correctly, with a good face fit, will provide sufficient protection Where tightly fitting RPE is used, the worker should be face fit tested to ensure that a good face seal can be obtained	

BORIC ACID**2.5 Contributing scenario controlling worker exposure for: PROC8a, PROC8b**

Activity	Equipment maintenance	
Product characteristics	Concentration of the Substance in Mixture/Article	Covers percentage substance in the product up to 100 % (unless stated differently).
	Physical Form (at time of use)	Powdered substance, granules
Amount used	Would vary by requirements and by facility	
Frequency and duration of use	Covers daily exposures up to 8 hours (unless stated differently).	
Other operational conditions affecting workers exposure	Indoor and outdoor use.	
Technical conditions and measures to control dispersion from source towards the worker	Use closed dosing, transfer, sampling and application systems including connectors. Worker in separate cabine without specific ventilation Provide local exhaust ventilation (LEV).	
Organisational measures to prevent /limit releases, dispersion and exposure	Ensure operatives are trained to minimise exposures. Regular inspection and maintenance of equipment and machines.	
Conditions and measures related to personal protection, hygiene and health evaluation	Wear protective clothing. Safety shoes Safety glasses Wear protective gloves. In case of dust or aerosol formation: use respiratory protection with approved filter (P2) or Particle filter:P3	

2.6 Contributing scenario controlling worker exposure for: PROC8b

large scale

Activity	Bulk loading (including marine vessel/barge, rail/road car and IBC loading)	
Product characteristics	Concentration of the Substance in Mixture/Article	Covers percentage substance in the product up to 100 % (unless stated differently).
	Physical Form (at time of use)	Powdered substance, granular-like
Amount used	Amount per Use	40000 kg
Frequency and duration of use	Application duration	120 min
Other operational conditions affecting workers exposure	Indoor Assumes activities are at ambient temperature.	
Technical conditions and measures to control dispersion from source towards the worker	Use closed dosing, transfer, sampling and application systems including connectors. Provide dust filtration for air displaced from the silo during filling. Provide local exhaust ventilation (LEV).	
Organisational measures to prevent /limit releases, dispersion and exposure	Ensure operatives are trained to minimise exposures. Regular inspection and maintenance of equipment and machines.	
Conditions and measures related to personal protection, hygiene and health evaluation	Wear protective clothing. Wear protective gloves. Safety glasses or Goggles	

2.7 Contributing scenario controlling worker exposure for: PROC9

Product characteristics	Concentration of the Substance in Mixture/Article	Concentration of substance in product: 0,11% - 8,6%
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	Physical Form (at time of use)	solid, liquid, pasty
Amount used	Amount per Day	10000 kg
Frequency and duration of use	Covers daily exposures up to 8 hours (unless stated differently).	
Technical conditions and measures to control dispersion from source towards the worker	Automate activity where possible. Provide local exhaust ventilation (LEV).	
Organisational measures to prevent /limit releases, dispersion and exposure	Ensure operatives are trained to minimise exposures. Regular inspection and maintenance of equipment and machines.	
Conditions and measures related to personal protection, hygiene and health evaluation	Wear protective clothing. Safety shoes Safety glasses In case of dust or aerosol formation: use respiratory protection with approved filter (P2) or Particle filter:P3	

2.8 Contributing scenario controlling worker exposure for: PROC14

Product characteristics	Concentration of the Substance in Mixture/Article	Covers percentage substance in the product up to 100 % (unless stated differently).
	Physical Form (at time of use)	Powdered substance, granules
Amount used	Would vary by requirements and by facility	
Frequency and duration of use	Covers daily exposures up to 8 hours (unless stated differently).	
Other operational conditions affecting workers exposure	Indoor use.	
Technical conditions and measures to control dispersion from source towards the worker	Minimise exposure by partial enclosure of the operation or equipment and provide extract ventilation at openings. Provide local exhaust ventilation (LEV).	
Organisational measures to prevent /limit releases, dispersion and exposure	Ensure operatives are trained to minimise exposures. Regular inspection and maintenance of equipment and machines.	
Conditions and measures related to personal protection, hygiene and health evaluation	Wear protective clothing. Safety shoes Safety glasses Wear protective gloves. In case of dust or aerosol formation: use respiratory protection with approved filter (P2) or Particle filter:P3	

2.9 Contributing scenario controlling worker exposure for: PROC15

Product characteristics	Concentration of the Substance in Mixture/Article	Covers percentage substance in the product up to 100 % (unless stated differently).
	Physical Form (at time of use)	Powdered substance, granules
Amount used	Amount per Application	1 kg
Frequency and duration of use	Sometimes during the working day, only for short periods of time	
Technical conditions and measures to control dispersion from source towards the worker	Handle within a fume cupboard or implement suitable equivalent methods to minimise exposure.	
Organisational measures to prevent /limit releases, dispersion and exposure	Ensure operatives are trained to minimise exposures. Regular inspection and maintenance of equipment and machines.	

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Conditions and measures related to personal protection, hygiene and health evaluation

Wear a laboratory coat
Safety shoes
Safety glasses
Wear protective gloves.

3. Exposure estimation and reference to its source**Environment**

ERC1, ERC6a, ERC6b: Estimation based on workplace measurements

Contributing Scenario	Specific conditions	Compartment	Value	Level of Exposure	RCR
ERC1, ERC6a, ERC6b	Dilution of 10	Fresh water	PEC	1956µg/L	0.969
ERC1, ERC6a, ERC6b	Dilution of 10	Soil	PEC	0.86mg/kg dry weight (d.w.)	0.158
ERC1, ERC6a, ERC6b	Dilution of 100	Fresh water	PEC	1206µg/L	0.597
ERC1, ERC6a, ERC6b	Dilution of 100	Soil	PEC	5.15mg/kg dry weight (d.w.)	0.954

Workers

PROC8b: Advanced REACH Tool (ART model)

PROC9, PROC14: Advanced REACH Tool (ART model) (inhalative exposure)

PROC2, PROC4, PROC8a, PROC9, PROC14: MEASE

PROC1, PROC2, PROC3, PROC4, PROC5, PROC8a, PROC8b, PROC9, PROC14, PROC15: Workplace measurements

Contributing Scenario	Specific conditions	Exposure routes	Level of Exposure	RCR
PROC1, PROC2, PROC3	90th percentile value, without respiratory protection	Inhalation worker exposure	0.08mg/m ³	0.06
PROC2	Solid, high dustiness., during 15 mins - 1 hour	Dermal worker exposure	0.048mg/kg bw/day	< 0.001
PROC1, PROC2, PROC3	90th percentile value, without respiratory protection	Inhalation worker exposure	0.08mg/m ³	---
PROC2	Solid, high dustiness., during 15 mins - 1 hour	Dermal worker exposure	0.048mg/kg bw/day	< 0.001
PROC4, PROC5, PROC8b	90th percentile value, With respiratory protection, half mask	Inhalation worker exposure	0.2mg/m ³	0.14
PROC4	Solid, high dustiness., during 15 mins - 1 hour, with local exhaust ventilation	Dermal worker exposure	4.8mg/kg bw/day	0.001
PROC8a, PROC8b	90th percentile value, no respiratory protection (RPE), Equipment maintenance	Inhalation worker exposure	1.33mg/m ³	0.92
PROC8a	Equipment maintenance, during 1 - 4 hours	Dermal worker exposure	0.173mg/kg bw/day	< 0.001
PROC8b	---	Inhalation worker exposure	0.016mg/m ³	0.011

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PROC8b	with local exhaust ventilation, 90th percentile value	Inhalation worker exposure	0.03mg/m ³	0.021
PROC2	Solid, high dustiness., during <15 mins	Dermal worker exposure	0.024mg/kg bw/day	< 0.001
PROC9	90th percentile value, solid, with local exhaust ventilation, With respiratory protection	Inhalation worker exposure	0.4mg/m ³	0.28
PROC9	90th percentile value, liquid, with local exhaust ventilation	Inhalation worker exposure	0.01mg/m ³	0.007
PROC9	Concentration of substance in product: 5% - 25%, Solid, high dustiness.	Dermal worker exposure	1.44mg/kg bw/day	< 0.001
PROC9	Concentration of substance in product: 5% - 25%, liquid	Dermal worker exposure	0.144mg/kg bw/day	< 0.001
PROC14	---	Inhalation worker exposure	1.3mg/m ³	0.9
PROC14	90th percentile value, with local exhaust ventilation	Inhalation worker exposure	0.15mg/m ³	0.10
PROC14	Solid, high dustiness.	Dermal worker exposure	2.4mg/kg bw/day	< 0.001
PROC15	90th percentile value	Inhalation worker exposure	0.16mg/m ³	0.11
PROC14	Solid, high dustiness., Concentration of substance in product: 5% - 25%	Dermal worker exposure	0.014mg/kg bw/day	< 0.001

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

Guidance is based on assumed operating conditions which may not be applicable to all sites; thus, scaling may be necessary to define appropriate site-specific risk management measures.

Where other Risk Management Measures/Operational Conditions are adopted, then users should ensure that risks are managed to at least equivalent levels.

Only properly trained persons shall make use of scaling methods while checking whether the OC and RMM are within the boundaries set by the ES

Tonnage calculations have been based on boron such that no RCR exceeds 0.97, using back calculations with the relevant PNEC's when necessary. The equivalent tonnage of product handled on site should be calculated from the conversion factors detailed in the product table. For those operations that handle a combination of borate compounds, the boron equivalent of the combined tonnage cannot exceed the site tonnage value.

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Substance	Formula	Conversion factor for the equivalent dose of B (multiply by)
Boric acid	H_3BO_3	0,1748
Boric oxide	B_2O_3	0,311
Disodium tetraborate anhydrous	$Na_2B_4O_7$	0,2149
Disodium tetraborate pentahydrate	$Na_2B_4O_7 \times 5H_2O$	0,1484
Disodium tetraborate decahydrate	$Na_2B_4O_7 \times 10H_2O$	0,1134
Disodium octaborate tetrahydrate	$Na_2B_8O_{13} \times 4H_2O$	0,2096
Sodium metaborate (anhydrous)	$NaBO_2$	0,1643
Sodium metaborate (dihydrate)	$NaBO_2 \times 2H_2O$	0,1062
Sodium metaborate (tetrahydrate)	$NaBO_2 \times 4H_2O$	0,0784
Sodium pentaborate (anhydrous)	NaB_5O_8	0,2636
Sodium pentaborate (pentahydrate)	$NaB_5O_8 \times 5H_2O$	0,1832

If measured data are not available, the DU may make use of an appropriate scaling tool such as MEASE (www.ebrc.de/mease.html) to estimate the associated exposure.

For further information on the assessment method, see: <http://www.advancedreachtool.com>

Additional good practice advice beyond the REACH Chemical Safety Assessment

Take care for general good hygiene and housekeeping.

BORIC ACID**1. Short title of Exposure Scenario 3: Formulation & (re)packing of substances and mixtures**

Main User Groups	SU 3: Industrial uses: Uses of substances as such or in preparations at industrial sites
Process categories	PROC1: Use in closed process, no likelihood of exposure PROC2: Use in closed, continuous process with occasional controlled exposure PROC3: Use in closed batch process (synthesis or formulation) PROC4: Use in batch and other process (synthesis) where opportunity for exposure arises PROC5: Mixing or blending in batch processes for formulation of preparations and articles (multistage and/ or significant contact) PROC8a: Transfer of substance or preparation (charging/ discharging) from/ to vessels/ large containers at non-dedicated facilities PROC8b: Transfer of substance or preparation (charging/ discharging) from/ to vessels/ large containers at dedicated facilities PROC9: Transfer of substance or preparation into small containers (dedicated filling line, including weighing) PROC14: Production of preparations or articles by tableting, compression, extrusion, pelletisation PROC15: Use as laboratory reagent
Environmental Release Categories	ERC2: Formulation of preparations

2.1 Contributing scenario controlling environmental exposure for: ERC2

Activity	Formulation of substance in adhesives	
Product characteristics	Concentration of the Substance in Mixture/Article	Covers percentage substance in the product up to 100 % (unless stated differently).
Amount used	Annual amount per site	1000 ton(s)/year (No water emissions ERC2)
Frequency and duration of use	Continuous exposure	240 days/year
Other given operational conditions affecting environmental exposure	Emission or Release Factor: Air	50 g/ton of product
	Emission or Release Factor: Water	0 g/ton of product
Technical conditions and measures at process level (source) to prevent release Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil Organizational measures to prevent/limit release from the site	Air	Substance specific waste air treatment; Electrostatic precipitation, Cyclones, ceramic filters, Bag filters, Fabric filter
	Water	Substance specific waste water treatment, Reverse osmosis, Ion exchange (Degradation effectiveness: 40 - 90 %)
Conditions and measures related to sewage treatment plant	Wastewater emission controls are not applicable as there is no direct release to wastewater.	
Conditions and measures related to external treatment of waste for disposal	Waste treatment	Send back to the process
	Disposal methods	Vacuum up spillage and collect in suitable containers for disposal., Dispose of as hazardous waste in compliance with local and national regulations.
Conditions and measures related to external recovery of waste	Recovery Methods	There is no envisaged external recovery of waste.

2.2 Contributing scenario controlling environmental exposure for: ERC2

Activity	Formulation of substance into detergents	
Product characteristics	Concentration of the Substance in	Covers percentage substance in the product up to 100 % (unless stated differently).

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	Mixture/Article	
Amount used	Annual amount per site	15000 ton(s)/year (No water emissions ERC2)
Frequency and duration of use	Continuous exposure	255 days/year
Environment factors not influenced by risk management	Dilution Factor (River)	500
	Dilution Factor (Coastal Areas)	100
	Other data. Other information	Local freshwater dilution factor:10
Other given operational conditions affecting environmental exposure	Emission or Release Factor: Air	200 g/ton of product
	Emission or Release Factor: Water	0 g/ton of product
Technical conditions and measures at process level (source) to prevent release Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil Organizational measures to prevent/limit release from the site	Air	Substance specific waste air treatment:, Electrostatic precipitation, Cyclones, ceramic filters, Bag filters, Fabric filter
	Water	Substance specific waste water treatment, Reverse osmosis, Ion exchange (Degradation effectiveness: 40 - 90 %)
Conditions and measures related to sewage treatment plant	Wastewater emission controls are not applicable as there is no direct release to wastewater., The concentration of the substance should not exceed 1,75 mg/L in the municipal STP	
Conditions and measures related to external treatment of waste for disposal	Waste treatment	Send back to the process
	Disposal methods	Vacuum up spillage and collect in suitable containers for disposal., Dispose of as hazardous waste in compliance with local and national regulations.

2.3 Contributing scenario controlling environmental exposure for: ERC2

Activity	Formulation, packing and re-packing of the substance and its mixtures in batch or continuous operations, including storage, materials transfers, mixing, tableting, compression, pelletisation, extrusion, large and small scale packing, sampling, maintenance and associated laboratory activities.	
Product characteristics	Concentration of the Substance in Mixture/Article	Covers percentage substance in the product up to 100 % (unless stated differently).
Amount used	Annual tonnage	15000 ton(s)/year (No water emissions ERC2)
Frequency and duration of use	Continuous exposure	200 days/year
Environment factors not influenced by risk management	Dilution Factor (River)	500
	Dilution Factor (Coastal Areas)	100
	Other data. Other information	Local freshwater dilution factor:10
Other given operational conditions affecting environmental exposure	Emission or Release Factor: Air	400 g/ton of product
Technical conditions and measures at process level (source) to prevent release Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil	Air	Substance specific waste air treatment:, Electrostatic precipitation, Cyclones, Bag filters, Fabric filter, Ceramic & metal mash filters, PM10 particles are removed
	Water	Substance specific waste water treatment, Reverse osmosis, Ion exchange (Degradation effectiveness: 40 - 90 %)

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Organizational measures to prevent/limit release from the site		
Conditions and measures related to sewage treatment plant	Not applicable as there is no release to wastewater., If sites discharge to a municipal STP the concentration of the substance should not exceed 10 mg/l in the municipal STP	
Conditions and measures related to external treatment of waste for disposal	Waste treatment	Send back to the process
	Disposal methods	Vacuum up spillage and collect in suitable containers for disposal., Dispose of as hazardous waste in compliance with local and national regulations.

2.4 Contributing scenario controlling worker exposure for: PROC1, PROC2, PROC3

Product characteristics	Concentration of the Substance in Mixture/Article	Covers percentage substance in the product up to 100 % (unless stated differently).
	Physical Form (at time of use)	granules, Powder
Amount used	per shift:	1000 kg
Frequency and duration of use	Covers daily exposures up to 8 hours (unless stated differently).	
Other operational conditions affecting workers exposure	Indoor use.	
	Assumes activities are at ambient temperature.	
Technical conditions and measures to control dispersion from source towards the worker	Handle substance within a closed system. Where there are breaches in the closed system, such as pouring and removal of slag in metal production, LEV is used to control fumes.	
Organisational measures to prevent /limit releases, dispersion and exposure	Ensure operatives are trained to minimise exposures.	
	Regular inspection and maintenance of equipment and machines.	
Conditions and measures related to personal protection, hygiene and health evaluation	Wear protective clothing.	
	Safety shoes Safety glasses In case of dust or aerosol formation: use respiratory protection with approved filter (P2) or Particle filter:P3	

2.5 Contributing scenario controlling worker exposure for: PROC5

Activity	Handling and dilution of metalworking fluid concentrates	
Product characteristics	Concentration of the Substance in Mixture/Article	Covers concentrations up to 5,5%
	Physical Form (at time of use)	Solid in solution
Amount used	The amount used per worker varies from activity to activity	
Frequency and duration of use	Exposure duration	60 min
Other operational conditions affecting workers exposure	Indoor use.	
	Assumes activities are at ambient temperature.	
Technical conditions and measures to control dispersion from source towards the worker	Provide local exhaust ventilation (LEV). Closed and semi-closed process where appropriate Ensure that task is semi-automated or automated	
Organisational measures to prevent /limit releases, dispersion and exposure	Ensure operatives are trained to minimise exposures.	
	Regular inspection and maintenance of equipment and machines.	
Conditions and measures related to personal protection, hygiene and health evaluation	Wear protective clothing.	
	In case of dust or aerosol formation: use respiratory protection with approved filter (P2) or	

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Particle filter:P3

2.6 Contributing scenario controlling worker exposure for: PROC2, PROC3, PROC4, PROC5, PROC8b, PROC9

Activity	Formulation of substance in adhesives	
Product characteristics	Concentration of the Substance in Mixture/Article	Covers concentrations up to 1,5%
	Physical Form (at time of use)	granules, Powder, liquid
Amount used	Amount per Day	300 kg
	The amount used per worker varies from activity to activity	
Frequency and duration of use	Continuous exposure	
Other operational conditions affecting workers exposure	Indoor use.	
Technical conditions and measures to control dispersion from source towards the worker	Provide local exhaust ventilation (LEV).	
	Ensure that task is semi-automated or automated	
Organisational measures to prevent /limit releases, dispersion and exposure	Workers in the risky process/areas identified should be trained a) to avoid to work without respiratory protection and b) to understand the irritating properties and, especially, the respiratory inhalation effects and c) to follow the safer procedures instructed by the employer. Regular inspection and maintenance of equipment and machines.	
Conditions and measures related to personal protection, hygiene and health evaluation	Wear protective clothing. If no adequate ventilation is available: Wear air purifying mask APF4 or Wear air purifying half mask APF10 Where tightly fitting RPE is used, the worker should be face fit tested to ensure that a good face seal can be obtained	

2.7 Contributing scenario controlling worker exposure for: PROC8a, PROC8b

Activity	Equipment maintenance	
Product characteristics	Concentration of the Substance in Mixture/Article	Covers percentage substance in the product up to 100 % (unless stated differently).
	Physical Form (at time of use)	granules, Powder
Amount used	Would vary by requirements and by facility	
Frequency and duration of use	Covers daily exposures up to 8 hours (unless stated differently).	
Other operational conditions affecting workers exposure	Indoor and outdoor use.	
	Assumes activities are at ambient temperature.	
Technical conditions and measures to control dispersion from source towards the worker	Provide local exhaust ventilation (LEV).	
	Automate activity where possible.	
Organisational measures to prevent /limit releases, dispersion and exposure	Ensure operatives are trained to minimise exposures.	
	Regular inspection and maintenance of equipment and machines.	
Conditions and measures related to personal protection, hygiene and health evaluation	Wear protective clothing. Safety shoes Safety glasses In case of dust or aerosol formation: use respiratory protection with approved filter (P2) or Particle filter:P3	

2.8 Contributing scenario controlling worker exposure for: PROC8b

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large scale

Activity	Bulk loading (including marine vessel/barge, rail/road car and IBC loading)	
Product characteristics	Concentration of the Substance in Mixture/Article	Covers percentage substance in the product up to 100 % (unless stated differently).
	Physical Form (at time of use)	granules, Powder
Amount used	Amount per Use	40000 kg
Frequency and duration of use	Exposure duration	60 - 120 min
Other operational conditions affecting workers exposure	Indoor use.	
	Assumes activities are at ambient temperature.	
Technical conditions and measures to control dispersion from source towards the worker	Automate activity where possible. Provide dust filtration for air displaced from the silo during filling. Use in closed process	
Organisational measures to prevent /limit releases, dispersion and exposure	Ensure operatives are trained to minimise exposures. Regular inspection and maintenance of equipment and machines.	
Conditions and measures related to personal protection, hygiene and health evaluation	Wear protective clothing. Safety glasses Wear chemically resistant gloves. Safety goggles	

2.9 Contributing scenario controlling worker exposure for: PROC4, PROC5, PROC8b

Activity	Covers reloading, mixing or compounding and associated activities in the Process Categories listed above	
Product characteristics	Concentration of the Substance in Mixture/Article	Covers percentage substance in the product up to 100 % (unless stated differently).
	Physical Form (at time of use)	granules, Powder
Amount used	Would vary by requirements and by facility	
Frequency and duration of use	Exposure duration	60 min
Other operational conditions affecting workers exposure	Indoor use.	
	Assumes activities are at ambient temperature.	
Technical conditions and measures to control dispersion from source towards the worker	Provide local exhaust ventilation (LEV). Ensure that task is semi-automated or automated Single use bags can be opened by the use of sharp prongs at the discharge hopper. When the big bag is placed at the discharge hopper and lowered, the prongs cut into the base of the bag releasing the substance into the hopper. This removes the operator from the immediate vicinity and contributes to a reduction in exposure	
Organisational measures to prevent /limit releases, dispersion and exposure	Ensure operatives are trained to minimise exposures. Regular inspection and maintenance of equipment and machines. Workers in the risky process/areas identified should be trained a) to avoid to work without respiratory protection and b) to understand the irritating properties and, especially, the respiratory inhalation effects and c) to follow the safer procedures instructed by the employer.	
Conditions and measures related to personal protection, hygiene and health evaluation	Wear protective clothing. Wear protective gloves. Safety glasses Goggles In case of dust or aerosol formation: use respiratory protection with approved filter (P2) or Particle filter:P3 These respirators, if worn correctly, with a good face fit, will provide sufficient	

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	protection Where tightly fitting RPE is used, the worker should be face fit tested to ensure that a good face seal can be obtained
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2.10 Contributing scenario controlling worker exposure for: PROC14

Product characteristics	Concentration of the Substance in Mixture/Article	Covers percentage substance in the product up to 100 % (unless stated differently).
	Physical Form (at time of use)	granules, Powder
Amount used	The amount used per worker varies from activity to activity	
Frequency and duration of use	Covers daily exposures up to 8 hours (unless stated differently).	
Other operational conditions affecting workers exposure	Indoor use.	
Technical conditions and measures to control dispersion from source towards the worker	Provide local exhaust ventilation (LEV).	
Organisational measures to prevent /limit releases, dispersion and exposure	Ensure operatives are trained to minimise exposures. Regular inspection and maintenance of equipment and machines.	
Conditions and measures related to personal protection, hygiene and health evaluation	Wear protective clothing. Safety shoes Safety glasses In case of dust or aerosol formation: use respiratory protection with approved filter (P2) or Particle filter:P3	

2.11 Contributing scenario controlling worker exposure for: PROC15

Product characteristics	Concentration of the Substance in Mixture/Article	Covers percentage substance in the product up to 100 % (unless stated differently).
	Physical Form (at time of use)	granules, Powder
Amount used	Amount per Use	1 kg
Frequency and duration of use	Several times during the working day, only for short periods of time	
Technical conditions and measures to control dispersion from source towards the worker	Handle within a fume cupboard or implement suitable equivalent methods to minimise exposure.	
Organisational measures to prevent /limit releases, dispersion and exposure	Ensure operatives are trained to minimise exposures. Regular inspection and maintenance of equipment and machines.	
Conditions and measures related to personal protection, hygiene and health evaluation	Wear protective clothing. Safety shoes Safety glasses Wear protective gloves.	

2.12 Contributing scenario controlling worker exposure for: PROC9

Product characteristics	Concentration of the Substance in Mixture/Article	Concentration of substance in product: 0,11% - 8,6%
	Physical Form (at time of use)	solid, liquid, pasty
Amount used	Amount per Day	10000 kg
	The amount used per worker varies from activity to activity	
Frequency and duration of use	Covers daily exposures up to 8 hours (unless stated differently).	
Technical conditions and	Provide extraction ventilation at points where emissions occur.	

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measures to control dispersion from source towards the worker	Automate activity where possible.
Organisational measures to prevent /limit releases, dispersion and exposure	Ensure operatives are trained to minimise exposures. Regular inspection and maintenance of equipment and machines.
Conditions and measures related to personal protection, hygiene and health evaluation	Wear protective clothing. Use suitable eye protection. In case of dust or aerosol formation: use respiratory protection with approved filter (P2) or Particle filter:P3

3. Exposure estimation and reference to its source**Environment**

ERC2: METALS EUSES IT tool

Contributing Scenario	Specific conditions	Compartment	Value	Level of Exposure	RCR
ERC2	No water discharge to the environment	Soil	PEC	0.01mg/kg dry weight (d.w.)	0.002
ERC2	No water discharge to the environment, Detergent powders, liquid detergents	Soil	PEC	0.37mg/kg dry weight (d.w.)	0.069
ERC2	No water discharge to the environment	Soil	PEC	0.74mg/kg dry weight (d.w.)	0.137

FEICA spERC 2.1a.v1 has been used to evaluate the exposure for the environment. AISE spERC 2.1 has been used to evaluate the exposure for the environment.

Workers

PROC9: Advanced REACH Tool (ART model)

PROC4, PROC5, PROC9, PROC15: Workplace measurements

PROC2, PROC4, PROC8a, PROC8b, PROC14: MEASE

PROC1, PROC2, PROC3, PROC8a, PROC8b, PROC9, PROC14: Advanced REACH Tool (ART model) (inhalative exposure)

Contributing Scenario	Specific conditions	Exposure routes	Level of Exposure	RCR
PROC1, PROC2, PROC3	90th percentile value, no respiratory protection (RPE)	Inhalation worker exposure	0.08mg/m ³	0.06
PROC2	Solid, high dustiness., during 15 mins - 1 hour	Dermal worker exposure	0.048mg/kg bw/day	< 0.001
PROC8b	liquid, Concentration: 1%, during 15 mins - 1 hour	Dermal worker exposure	0.005mg/kg bw/day	< 0.001
PROC8a, PROC8b	90th percentile value, Equipment maintenance, no respiratory protection (RPE)	Inhalation worker exposure	1.33mg/m ³	0.92
PROC8a	Equipment maintenance, during 1 - 4 hours	Dermal worker exposure	0.173mg/kg/day	< 0.001
PROC8b	Dedicated facility, Large task, with local exhaust ventilation	Inhalation worker exposure	0.03mg/m ³	0.021
PROC2	material transfers, Solid,	Dermal worker exposure	0.024mg/kg bw/day	< 0.001

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	high dustiness., during <15 mins			
PROC4, PROC5	90th percentile value, Direct discharge, small scale	Inhalation worker exposure	0.78mg/m ³	0.54
PROC4	Solid, high dustiness., during 15 mins - 1 hour, small scale	Dermal worker exposure	0.48mg/kg bw/day	< 0.001
PROC4, PROC5, PROC8b	90th percentile value, large scale, With respiratory protection, half mask	Inhalation worker exposure	0.2mg/m ³	0.14
PROC4	Solid, high dustiness., large scale	Dermal worker exposure	4.8mg/kg bw/day	< 0.001
PROC14	90th percentile value, with local exhaust ventilation	Inhalation worker exposure	0.15mg/m ³	< 0.001
PROC14	Solid, high dustiness., > 4 h (half tour)	Dermal worker exposure	2.4mg/kg/day	< 0.001
PROC14	Solid, high dustiness., Concentration of substance in product: 5% - 25%, > 4 h (half tour)	Dermal worker exposure	0.014mg/kg bw/day	< 0.001
PROC15	90th percentile value, 8 hours/day	Inhalation worker exposure	0.16mg/m ³	0.11
PROC9	with local exhaust ventilation, 90th percentile value	Inhalation worker exposure	0.01mg/m ³	0.007
PROC9	with local exhaust ventilation, without respiratory protection	Inhalation worker exposure	0.4mg/m ³	0.28
PROC9	90th percentile value, Solid, high dustiness.	Dermal worker exposure	1.44mg/m ³	< 0.001
PROC9	90th percentile value, liquid	Dermal worker exposure	0.144mg/m ³	< 0.001

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

Tonnage calculations have been based on boron such that no RCR exceeds 0.97, using back calculations with the relevant PNEC's when necessary. The equivalent tonnage of product handled on site should be calculated from the conversion factors detailed in the product table. For those operations that handle a combination of borate compounds, the boron equivalent of the combined tonnage cannot exceed the site tonnage value. Guidance is based on assumed operating conditions which may not be applicable to all sites; thus, scaling may be necessary to define appropriate site-specific risk management measures. Where other Risk Management Measures/Operational Conditions are adopted, then users should ensure that risks are managed to at least equivalent levels. Only properly trained persons shall make use of scaling methods while checking whether the OC and RMM are within the boundaries set by the ES

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Substance	Formula	Conversion factor for the equivalent dose of B (multiply by)
Boric acid	H_3BO_3	0,1748
Boric oxide	B_2O_3	0,311
Disodium tetraborate anhydrous	$\text{Na}_2\text{B}_4\text{O}_7$	0,2149
Disodium tetraborate pentahydrate	$\text{Na}_2\text{B}_4\text{O}_7 \times 5\text{H}_2\text{O}$	0,1484
Disodium tetraborate decahydrate	$\text{Na}_2\text{B}_4\text{O}_7 \times 10\text{H}_2\text{O}$	0,1134
Disodium octaborate tetrahydrate	$\text{Na}_2\text{B}_8\text{O}_{13} \times 4\text{H}_2\text{O}$	0,2096
Sodium metaborate (anhydrous)	NaBO_2	0,1643
Sodium metaborate (dihydrate)	$\text{NaBO}_2 \times 2\text{H}_2\text{O}$	0,1062
Sodium metaborate (tetrahydrate)	$\text{NaBO}_2 \times 4\text{H}_2\text{O}$	0,0784
Sodium pentaborate (anhydrous)	$\text{NaB}_5\text{O}_{10}$	0,2636
Sodium pentaborate (pentahydrate)	$\text{NaB}_5\text{O}_{10} \times 5\text{H}_2\text{O}$	0,1832

BORIC ACID**1. Short title of Exposure Scenario 4: Use as additive**

Main User Groups	SU 21: Consumer uses: Private households (= general public = consumers)
Chemical product category	PC35: Washing and cleaning products (including solvent based products)
Environmental Release Categories	ERC8a: Wide dispersive indoor use of processing aids in open systems

2.1 Contributing scenario controlling environmental exposure for: ERC8a

Product characteristics	Concentration of the Substance in Mixture/Article	Covers percentage substance in the product up to 100 % (unless stated differently).
Amount used	Regional use tonnage (tons/year):	93.2 ton(s)/year
	Amounts used in the EU (tonnes/year)	35000 ton(s)/year
Frequency and duration of use	Continuous exposure	365 days/year, Dispersive use.
Environment factors not influenced by risk management	Other data.Other information	Local freshwater dilution factor:: 10
Other given operational conditions affecting environmental exposure	Emission or Release Factor: Water	1000000 g/ton of product
Conditions and measures related to sewage treatment plant	Type of Sewage Treatment Plant	Municipal sewage treatment plant
	Flow rate of sewage treatment plant effluent	2,000 m3/d
	The concentration of the substance should not exceed 1,75 mg/L in the municipal STP	

2.2 Contributing scenario controlling consumer exposure for: PC35: Laundry and dish washing products

Product characteristics	Concentration of the Substance in Mixture/Article	Covers percentage substance in the product up to 1 %.
	Physical Form (at time of use)	liquid
Frequency and duration of use	Exposure duration	10 min
	Frequency of use	10 Times per week
Human factors not influenced by risk management	Exposed skin areas	Covers skin contact area up to 1980 cm²
	Body weight	60 kg
Conditions and measures related to protection of consumer (e.g. behavioural advice, personal protection and hygiene)	Consumer Measures	Instructions addressed to the consumer via product labelling Wear suitable gloves.

3. Exposure estimation and reference to its source**Environment**

ERC8a, ERC8d: Estimation based on workplace measurements

Contributing Scenario	Specific conditions	Compartment	Value	Level of Exposure	RCR
ERC8a, ERC8d	---	Sewage treatment plant (STP)	PEC	9589µg/L	0.959
ERC8a, ERC8d	---	Fresh water	PEC	1015µg/L	0.503

BORIC ACID**Consumers**

PC35: Workplace measurements

Contributing Scenario	Specific conditions	Exposure routes	Level of Exposure	RCR
PC35	worst-case, Hand wash	Consumer dermal exposure	0.14mg/kg bw/day	---
PC35	worst-case, Laundry bleaching/pre-treatment	Consumer dermal exposure	5.84mg/kg bw/day	---
PC35	worst-case, Laundry regular	Consumer dermal exposure	0.58mg/kg bw/day	---

Estimated inhalative exposure value is regarded to be negligible.

4. Guidance to Downstream User to evaluate whether he works inside the boundaries set by the Exposure ScenarioFor scaling see: [http://www.arche-consulting.be/metal-CSA-toolbox/du-scaling tool](http://www.arche-consulting.be/metal-CSA-toolbox/du-scaling%20tool)

If measured data are not available, the DU may make use of an appropriate scaling tool such as EASE

Guidance is based on assumed operating conditions which may not be applicable to all sites; thus, scaling may be necessary to define appropriate site-specific risk management measures.

Where other Risk Management Measures/Operational Conditions are adopted, then users should ensure that risks are managed to at least equivalent levels.

Only properly trained persons shall make use of scaling methods while checking whether the OC and RMM are within the boundaries set by the ES

Tonnage calculations have been based on boron such that no RCR exceeds 0.97, using back calculations with the relevant PNEC's when necessary. The equivalent tonnage of product handled on site should be calculated from the conversion factors detailed in the product table. For those operations that handle a combination of borate compounds, the boron equivalent of the combined tonnage cannot exceed the site tonnage value.

Substance	Formula	Conversion factor for the equivalent dose of B (multiply by)
Boric acid	H ₃ BO ₃	0,1748
Boric oxide	B ₂ O ₃	0,311
Disodium tetraborate anhydrous	Na ₂ B ₄ O ₇	0,2149
Disodium tetraborate pentahydrate	Na ₂ B ₄ O ₇ x 5H ₂ O	0,1484
Disodium tetraborate decahydrate	Na ₂ B ₄ O ₇ x 10H ₂ O	0,1134
Disodium octaborate tetrahydrate	Na ₂ B ₈ O ₁₃ x 4H ₂ O	0,2096
Sodium metaborate (anhydrous)	NaBO ₂	0,1643
Sodium metaborate (dihydrate)	NaBO ₂ x 2H ₂ O	0,1062
Sodium metaborate (tetrahydrate)	NaBO ₂ x 4H ₂ O	0,0784
Sodium pentaborate (anhydrous)	NaB ₅ O ₈	0,2636
Sodium pentaborate (pentahydrate)	NaB ₅ O ₈ x 5H ₂ O	0,1832

BORIC ACID**1. Short title of Exposure Scenario 5: Use as additive**

Main User Groups	SU 22: Professional uses: Public domain (administration, education, entertainment, services, craftsmen)
Process categories	PROC21: Low energy manipulation of substances bound in materials and/ or articles
Environmental Release Categories	ERC10a: Wide dispersive outdoor use of long-life articles and materials with low release ERC11a: Wide dispersive indoor use of long-life articles and materials with low release

2.1 Contributing scenario controlling environmental exposure for: ERC10a, ERC11a

Product characteristics	Concentration of the Substance in Mixture/Article	Covers percentage substance in the product up to 100 % (unless stated differently).
Amount used	Amounts used in the EU (tonnes/year)	1.1 Million tonnes/year
Frequency and duration of use	Continuous exposure	365 days/year
Environment factors not influenced by risk management	Other data. Other information	Local freshwater dilution factor:: 10
Other given operational conditions affecting environmental exposure	Emission or Release Factor: Water	32000 g/ton of product
Technical conditions and measures at process level (source) to prevent release Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil Organizational measures to prevent/limit release from the site	The substance is not released during its life cycle.	
Conditions and measures related to sewage treatment plant	Type of Sewage Treatment Plant	Municipal sewage treatment plant
	Flow rate of sewage treatment plant effluent	2,000 m3/d
Conditions and measures related to external treatment of waste for disposal	Disposal methods	Dispose of waste in accordance with environmental legislation.

2.2 Contributing scenario controlling worker exposure for: PROC21

Product characteristics	Concentration of the Substance in Mixture/Article	Concentration of substance in product: 1,5% - 3,6%
	Physical Form (at time of use)	solid
Amount used	The amount used per worker varies from activity to activity	
Frequency and duration of use	Covers daily exposures up to 8 hours (unless stated differently).	
Other operational conditions affecting workers exposure	Indoor use.	
	All processes are carried out in confined areas	
Technical conditions and measures to control dispersion from source towards the worker	Ensure adequate ventilation, especially in confined areas.	
Organisational measures to prevent /limit releases, dispersion and exposure	Ensure operatives are trained to minimise exposures.	

BORIC ACID

Conditions and measures related to personal protection, hygiene and health evaluation	Wear protective clothing. In case of dust or aerosol formation: use respiratory protection with approved filter (P2) or FFP1 mask
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3. Exposure estimation and reference to its source**Environment**

ERC10a, ERC11a: METALS EUSES IT tool

Contributing Scenario	Specific conditions	Compartment	Value	Level of Exposure	RCR
ERC10a, ERC11a	---	Water	PEC	1021µg/L	0.505
ERC10a, ERC11a	---	Sewage treatment plant (STP)	PEC	9644µg/L	0.964

Workers

PROC21: Estimation based on workplace measurements

PROC21: MEASE

Contributing Scenario	Specific conditions	Exposure routes	Level of Exposure	RCR
PROC21	90th percentile value	Inhalation worker exposure	0.3mg/m ³	0.21
PROC21	Concentration: 1%, Installation of cellulose insulation	Dermal worker exposure	0.99mg/m ³	< 0.001
PROC21	Concentration: 1%, Cutting of plasterboard	Inhalation worker exposure	0.005mg/m ³	0.0034

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

Guidance is based on assumed operating conditions which may not be applicable to all sites; thus, scaling may be necessary to define appropriate site-specific risk management measures.

Where other Risk Management Measures/Operational Conditions are adopted, then users should ensure that risks are managed to at least equivalent levels.

Only properly trained persons shall make use of scaling methods while checking whether the OC and RMM are within the boundaries set by the ES

Tonnage calculations have been based on boron such that no RCR exceeds 0.97, using back calculations with the relevant PNEC's when necessary. The equivalent tonnage of product handled on site should be calculated from the conversion factors detailed in the product table. For those operations that handle a combination of borate compounds, the boron equivalent of the combined tonnage cannot exceed the site tonnage value.

BORIC ACID

Substance	Formula	Conversion factor for the equivalent dose of B (multiply by)
Boric acid	H_3BO_3	0,1748
Boric oxide	B_2O_3	0,311
Disodium tetraborate anhydrous	$\text{Na}_2\text{B}_4\text{O}_7$	0,2149
Disodium tetraborate pentahydrate	$\text{Na}_2\text{B}_4\text{O}_7 \times 5\text{H}_2\text{O}$	0,1484
Disodium tetraborate decahydrate	$\text{Na}_2\text{B}_4\text{O}_7 \times 10\text{H}_2\text{O}$	0,1134
Disodium octaborate tetrahydrate	$\text{Na}_2\text{B}_8\text{O}_{13} \times 4\text{H}_2\text{O}$	0,2096
Sodium metaborate (anhydrous)	NaBO_2	0,1643
Sodium metaborate (dihydrate)	$\text{NaBO}_2 \times 2\text{H}_2\text{O}$	0,1062
Sodium metaborate (tetrahydrate)	$\text{NaBO}_2 \times 4\text{H}_2\text{O}$	0,0784
Sodium pentaborate (anhydrous)	$\text{NaB}_5\text{O}_{10}$	0,2636
Sodium pentaborate (pentahydrate)	$\text{NaB}_5\text{O}_{10} \times 5\text{H}_2\text{O}$	0,1832

BORIC ACID**1. Short title of Exposure Scenario 6: Use in Cleaning Agents**

Main User Groups	SU 3: Industrial uses: Uses of substances as such or in preparations at industrial sites
Process categories	<p>PROC1: Use in closed process, no likelihood of exposure</p> <p>PROC2: Use in closed, continuous process with occasional controlled exposure</p> <p>PROC3: Use in closed batch process (synthesis or formulation)</p> <p>PROC4: Use in batch and other process (synthesis) where opportunity for exposure arises</p> <p>PROC5: Mixing or blending in batch processes for formulation of preparations and articles (multistage and/ or significant contact)</p> <p>PROC6: Calendering operations</p> <p>PROC7: Industrial spraying</p> <p>PROC8a: Transfer of substance or preparation (charging/ discharging) from/ to vessels/ large containers at non-dedicated facilities</p> <p>PROC8b: Transfer of substance or preparation (charging/ discharging) from/ to vessels/ large containers at dedicated facilities</p> <p>PROC9: Transfer of substance or preparation into small containers (dedicated filling line, including weighing)</p> <p>PROC10: Roller application or brushing</p> <p>PROC12: Use of blowing agents in manufacture of foam</p> <p>PROC13: Treatment of articles by dipping and pouring</p> <p>PROC18: Greasing at high energy conditions</p> <p>PROC19: Hand-mixing with intimate contact and only PPE available</p> <p>PROC23: Open processing and transfer operations with minerals/ metals at elevated temperature</p> <p>PROC24: High (mechanical) energy work-up of substances bound in materials and/ or articles</p>
Environmental Release Categories	ERC4: Industrial use of processing aids in processes and products, not becoming part of articles

2.1 Contributing scenario controlling environmental exposure for: ERC4

Product characteristics	Concentration of the Substance in Mixture/Article	Covers percentage substance in the product up to 100 % (unless stated differently).
Amount used	Regional use tonnage (tons/year):	93.2 ton(s)/year
Frequency and duration of use	Continuous exposure	365 days/year, Dispersive use.
Conditions and measures related to sewage treatment plant	Type of Sewage Treatment Plant	Municipal sewage treatment plant
	Flow rate of sewage treatment plant effluent	2,000 m ³ /d
	The concentration of the substance should not exceed 1,75 mg/L in the municipal STP	

2.2 Contributing scenario controlling worker exposure for: PROC1, PROC2, PROC3, PROC5, PROC6, PROC8a, PROC8b, PROC9, PROC10, PROC12, PROC13, PROC18, PROC19, PROC23, PROC24

Product characteristics	Concentration of the Substance in Mixture/Article	Covers concentrations up to 2%
	Physical Form (at time of use)	liquid
Amount used	The amount used per worker varies from activity to activity	
Frequency and duration of use	Exposure duration per day	5 min
	Frequency of use	10 Times per day

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Other operational conditions affecting workers exposure	Indoor use.
Technical conditions and measures to control dispersion from source towards the worker	Ensure that task is semi-automated or automated
Organisational measures to prevent /limit releases, dispersion and exposure	Ensure operatives are trained to minimise exposures. Regular inspection and maintenance of equipment and machines.
Conditions and measures related to personal protection, hygiene and health evaluation	Use suitable eye protection. Wear protective gloves.

2.3 Contributing scenario controlling worker exposure for: PROC7

Product characteristics	Concentration of the Substance in Mixture/Article	Covers percentage substance in the product up to 1 %.
	Physical Form (at time of use)	liquid
Frequency and duration of use	Exposure duration per day	> 240 min
Conditions and measures related to personal protection, hygiene and health evaluation	Wear protective gloves.	

3. Exposure estimation and reference to its source**Environment**

ERC4: Estimation based on workplace measurements

Contributing Scenario	Specific conditions	Compartment	Value	Level of Exposure	RCR
ERC4	---	Sewage treatment plant (STP)	PEC	0.06mg/L	0.04
ERC4	---	Fresh water	PEC	63µg/L	0.05
ERC4	---	Fresh water sediment	PEC	0.37mg/kg dry weight (d.w.)	0.20

Workers

PROC7, PROC19: MEASE

Contributing Scenario	Specific conditions	Exposure routes	Level of Exposure	RCR
PROC19	Hand wash, during 15 mins - 1 hour, Concentration: 1%, with gloves	Dermal worker exposure	0.005mg/kg bw/day	---
PROC7	with gloves	Dermal worker exposure	0.002mg/kg bw/day	---

Inhalative exposure is regarded to be not relevant.

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

Guidance is based on assumed operating conditions which may not be applicable to all sites; thus, scaling may be necessary to define appropriate site-specific risk management measures.

Where other Risk Management Measures/Operational Conditions are adopted, then users should ensure that risks are managed to at least equivalent levels.

Only properly trained persons shall make use of scaling methods while checking whether the OC and RMM are within the boundaries set by the ES

BORIC ACID

Tonnage calculations have been based on boron such that no RCR exceeds 0.97, using back calculations with the relevant PNEC's when necessary. The equivalent tonnage of product handled on site should be calculated from the conversion factors detailed in the product table. For those operations that handle a combination of borate compounds, the boron equivalent of the combined tonnage cannot exceed the site tonnage value.

Substance	Formula	Conversion factor for the equivalent dose of B (multiply by)
Boric acid	H_3BO_3	0,1748
Boric oxide	B_2O_3	0,311
Disodium tetraborate anhydrous	$\text{Na}_2\text{B}_4\text{O}_7$	0,2149
Disodium tetraborate pentahydrate	$\text{Na}_2\text{B}_4\text{O}_7 \times 5\text{H}_2\text{O}$	0,1484
Disodium tetraborate decahydrate	$\text{Na}_2\text{B}_4\text{O}_7 \times 10\text{H}_2\text{O}$	0,1134
Disodium octaborate tetrahydrate	$\text{Na}_2\text{B}_8\text{O}_{13} \times 4\text{H}_2\text{O}$	0,2096
Sodium metaborate (anhydrous)	NaBO_2	0,1643
Sodium metaborate (dihydrate)	$\text{NaBO}_2 \times 2\text{H}_2\text{O}$	0,1062
Sodium metaborate (tetrahydrate)	$\text{NaBO}_2 \times 4\text{H}_2\text{O}$	0,0784
Sodium pentaborate (anhydrous)	$\text{NaB}_5\text{O}_{13}$	0,2636
Sodium pentaborate (pentahydrate)	$\text{NaB}_5\text{O}_{13} \times 5\text{H}_2\text{O}$	0,1832

If measured data are not available, the DU may make use of an appropriate scaling tool such as MEASE (www.ebrc.de/mease.html) to estimate the associated exposure.

Additional good practice advice beyond the REACH Chemical Safety Assessment

Take care for general good hygiene and housekeeping.

BORIC ACID**1. Short title of Exposure Scenario 7: Use in Cleaning Agents**

Main User Groups	SU 22: Professional uses: Public domain (administration, education, entertainment, services, craftsmen)
Process categories	PROC1: Use in closed process, no likelihood of exposure PROC2: Use in closed, continuous process with occasional controlled exposure PROC3: Use in closed batch process (synthesis or formulation) PROC10: Roller application or brushing PROC11: Non industrial spraying PROC13: Treatment of articles by dipping and pouring PROC19: Hand-mixing with intimate contact and only PPE available
Environmental Release Categories	ERC8a: Wide dispersive indoor use of processing aids in open systems ERC8d: Wide dispersive outdoor use of processing aids in open systems

2.1 Contributing scenario controlling environmental exposure for: ERC8a, ERC8d

Product characteristics	Concentration of the Substance in Mixture/Article	Covers percentage substance in the product up to 100 % (unless stated differently).
Amount used	Regional use tonnage (tons/year):	93.2 ton(s)/year
	Amounts used in the EU (tonnes/year)	35000 ton(s)/year (Dilution of 10 ERC8a, ERC8d)
Frequency and duration of use	Continuous exposure	365 days/year, Dispersive use.
Environment factors not influenced by risk management	Other data. Other information	Local freshwater dilution factor:: 10
Other given operational conditions affecting environmental exposure	Emission or Release Factor: Water	1000000 g/ton of product
Conditions and measures related to sewage treatment plant	Type of Sewage Treatment Plant	Municipal sewage treatment plant
	Flow rate of sewage treatment plant effluent	2,000 m3/d
	The concentration of the substance should not exceed 1,75 mg/L in the municipal STP	

2.2 Contributing scenario controlling worker exposure for: PROC1, PROC2, PROC3, PROC10, PROC11, PROC13, PROC19

Product characteristics	Concentration of the Substance in Mixture/Article	Covers concentrations up to 0,5%
	Physical Form (at time of use)	liquid
Amount used	The amount used per worker varies from activity to activity	
Frequency and duration of use	Exposure duration per day	1 min
	Frequency of use	5 Times per day
Other operational conditions affecting workers exposure	Indoor use.	
Technical conditions and measures to control dispersion from source towards the worker	Ensure that task is semi-automated or automated	
Organisational measures to prevent /limit releases, dispersion and exposure	Regular inspection and maintenance of equipment and machines. Ensure operatives are trained to minimise exposures.	
Conditions and measures related to personal protection, hygiene	Use suitable eye protection. Wear protective gloves.	

BORIC ACID

and health evaluation

2.3 Contributing scenario controlling worker exposure for: PROC11, PROC13

Product characteristics	Concentration of the Substance in Mixture/Article	Covers concentrations up to 0,5%
	Physical Form (at time of use)	liquid
Amount used	The amount used per worker varies from activity to activity	
Frequency and duration of use	Covers daily exposures up to 8 hours (unless stated differently).	
Technical conditions and measures to control dispersion from source towards the worker	Use product in a well-ventilated area only. Where possible use of specific dispensers and pumps specifically designed to prevent splashes/spills/exposure to occur.	
Organisational measures to prevent /limit releases, dispersion and exposure	Ensure operatives are trained to minimise exposures.	

3. Exposure estimation and reference to its source**Environment**

ERC8a, ERC8d: Workplace measurements

Contributing Scenario	Specific conditions	Compartment	Value	Level of Exposure	RCR
ERC8a, ERC8d	---	Sewage treatment plant (STP)	PEC	9589µg/L	0.959
ERC8a, ERC8d	---	Water	PEC	1015µg/L	0.503

Workers

PROC11: Advanced REACH Tool (ART model) (inhalative exposure)

PROC19: MEASE

Contributing Scenario	Specific conditions	Exposure routes	Level of Exposure	RCR
PROC19	Hand wash, liquid, Concentration: 1%, during 15 mins - 1 hour	Dermal worker exposure	0.048mg/kg bw/day	< 0.001
PROC11	liquid detergents, Spraying, large scale	Inhalation worker exposure	0.01mg/m ³	0.007

Inhalative exposure is regarded to be not relevant.

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

Guidance is based on assumed operating conditions which may not be applicable to all sites; thus, scaling may be necessary to define appropriate site-specific risk management measures.

Where other Risk Management Measures/Operational Conditions are adopted, then users should ensure that risks are managed to at least equivalent levels.

Only properly trained persons shall make use of scaling methods while checking whether the OC and RMM are within the boundaries set by the ES

Tonnage calculations have been based on boron such that no RCR exceeds 0.97, using back calculations with the relevant PNEC's when necessary. The equivalent tonnage of product handled on site should be calculated from the conversion factors detailed in the product table. For those operations that handle a combination of borate compounds, the boron equivalent of the combined tonnage cannot exceed the site tonnage value.

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Substance	Formula	Conversion factor for the equivalent dose of B (multiply by)
Boric acid	H_3BO_3	0,1748
Boric oxide	B_2O_3	0,311
Disodium tetraborate anhydrous	$Na_2B_4O_7$	0,2149
Disodium tetraborate pentahydrate	$Na_2B_4O_7 \times 5H_2O$	0,1484
Disodium tetraborate decahydrate	$Na_2B_4O_7 \times 10H_2O$	0,1134
Disodium octaborate tetrahydrate	$Na_2B_8O_{13} \times 4H_2O$	0,2096
Sodium metaborate (anhydrous)	$NaBO_2$	0,1643
Sodium metaborate (dihydrate)	$NaBO_2 \times 2H_2O$	0,1062
Sodium metaborate (tetrahydrate)	$NaBO_2 \times 4H_2O$	0,0784
Sodium pentaborate (anhydrous)	NaB_5O_8	0,2636
Sodium pentaborate (pentahydrate)	$NaB_5O_8 \times 5H_2O$	0,1832

If measured data are not available, the DU may make use of an appropriate scaling tool such as MEASE (www.ebrc.de/mease.html) to estimate the associated exposure.

For further information on the assessment method, see: <http://www.advancedreachtool.com>

Additional good practice advice beyond the REACH Chemical Safety Assessment

Take care for general good hygiene and housekeeping.

BORIC ACID**1. Short title of Exposure Scenario 8: Use as processing aid**

Main User Groups	SU 3: Industrial uses: Uses of substances as such or in preparations at industrial sites
Process categories	<p>PROC1: Use in closed process, no likelihood of exposure</p> <p>PROC2: Use in closed, continuous process with occasional controlled exposure</p> <p>PROC3: Use in closed batch process (synthesis or formulation)</p> <p>PROC4: Use in batch and other process (synthesis) where opportunity for exposure arises</p> <p>PROC5: Mixing or blending in batch processes for formulation of preparations and articles (multistage and/ or significant contact)</p> <p>PROC8a: Transfer of substance or preparation (charging/ discharging) from/ to vessels/ large containers at non-dedicated facilities</p> <p>PROC8b: Transfer of substance or preparation (charging/ discharging) from/ to vessels/ large containers at dedicated facilities</p> <p>PROC9: Transfer of substance or preparation into small containers (dedicated filling line, including weighing)</p> <p>PROC13: Treatment of articles by dipping and pouring</p> <p>PROC14: Production of preparations or articles by tableting, compression, extrusion, pelletisation</p> <p>PROC15: Use as laboratory reagent</p> <p>PROC17: Lubrication at high energy conditions and in partly open process</p> <p>PROC18: Greasing at high energy conditions</p> <p>PROC19: Hand-mixing with intimate contact and only PPE available</p> <p>PROC22: Potentially closed processing operations with minerals/ metals at elevated temperature; Industrial setting</p> <p>PROC23: Open processing and transfer operations with minerals/ metals at elevated temperature</p> <p>PROC24: High (mechanical) energy work-up of substances bound in materials and/ or articles</p>
Environmental Release Categories	ERC4: Industrial use of processing aids in processes and products, not becoming part of articles

2.1 Contributing scenario controlling environmental exposure for: ERC4

Product characteristics	Concentration of the Substance in Mixture/Article	Covers percentage substance in the product up to 100 % (unless stated differently).
Amount used	Annual site tonnage (tons/year):	14 ton(s)/year (Dilution of 10 ERC4)
	Annual site tonnage (tons/year):	140 ton(s)/year (Dilution of 100 ERC4)
	Annual site tonnage (tons/year):	1150 ton(s)/year (Dilution of 1000 ERC4)
Frequency and duration of use	Continuous exposure	365 days/year
Environment factors not influenced by risk management	Other data. Other information	Local freshwater dilution factor:: 10
	Other data. Other information	Local marine water dilution factor:: 100
	Dilution Factor (River)	500
Other given operational conditions affecting environmental exposure	Emission or Release Factor: Air	36562 g/ton of product
	Emission or Release Factor: Water	1000000 g/ton of product
Technical conditions and measures at process level (source) to prevent release	Air	Apply technical measures aiming at reducing releases to air., Electrostatic precipitation, Cyclones, Treatment of air emissions by bag filters, fabric filter and wet scrubber, Ceramic & metal
Technical onsite conditions and		

BORIC ACID

measures to reduce or limit discharges, air emissions and releases to soil Organizational measures to prevent/limit release from the site		mash filters, PM10 particles are removed
	Water	Substance specific waste water treatment, Ion exchange, Reverse osmosis (Degradation effectiveness: 40 - 90 %)
Conditions and measures related to sewage treatment plant	Type of Sewage Treatment Plant	Municipal sewage treatment plant
	The concentration of the substance should not exceed 1,75 mg/L in the municipal STP	
Conditions and measures related to external treatment of waste for disposal	Waste treatment	Send back to the process, Substance containing waste shall be handled as hazardous waste and removed by licensed waste removal company, incinerated or recycled
	Disposal methods	Vacuum up spillage and collect in suitable containers for disposal., Waste product and empty containers should be disposed of as hazardous waste in accordance with all local and national regulations.

2.2 Contributing scenario controlling worker exposure for: PROC1, PROC2, PROC3, PROC22, PROC23

Activity	Potentially closed processing operations at elevated temperature.	
Product characteristics	Concentration of the Substance in Mixture/Article	Covers percentage substance in the product up to 100 % (unless stated differently).
	Physical Form (at time of use)	Powdered substance, granules
Amount used	The amount used per worker varies from activity to activity	
Frequency and duration of use	Frequency of use	24 hours/day
	Frequency of use	365 days/year
Other operational conditions affecting workers exposure	Indoor use.	
	The process temperatures are mainly very high, as these processes include glass making, ceramics, steel & alloy making	
Technical conditions and measures to control dispersion from source towards the worker	Use in closed process, no likelihood of exposure Ensure that the worker is in a separated (control) room with independent air supply Where there are breaches in the closed system, such as pouring and removal of slag in metal production, LEV is used to control fumes.	
Organisational measures to prevent /limit releases, dispersion and exposure	Ensure operatives are trained to minimise exposures. Regular inspection and maintenance of equipment and machines. Workers in the risky process/areas identified should be trained a) to avoid to work without respiratory protection and b) to understand the corrosive properties and, especially, the respiratory inhalation effects and c) to follow the safety procedures instructed by the employer.	
Conditions and measures related to personal protection, hygiene and health evaluation	Equipment cleaning and maintenance	Wear protective gloves. Safety glasses or Goggles Operatives wear overalls or heavy heat resistant clothing
	In case of dust or aerosol formation: use respiratory protection with approved filter (P2) or Particle filter:P3 Use battery-powered air fed helmets These respirators, if worn correctly, with a good face fit, will provide sufficient protection	

BORIC ACID**2.3 Contributing scenario controlling worker exposure for: PROC1, PROC2, PROC2**

Product characteristics	Concentration of the Substance in Mixture/Article	Covers percentage substance in the product up to 100 % (unless stated differently).
	Physical Form (at time of use)	Powdered substance, granules
Amount used	per shift:	1000 kg
Other operational conditions affecting workers exposure	Indoor use.	
	Assumes activities are at ambient temperature.	
Technical conditions and measures to control dispersion from source towards the worker	Handle substance within a closed system. Provide extract ventilation to points where emissions occur. Where there are breaches in the closed system, such as pouring and removal of slag in metal production, LEV is used to control fumes.	
Organisational measures to prevent /limit releases, dispersion and exposure	Ensure operatives are trained to minimise exposures. Regular inspection and maintenance of equipment and machines.	
Conditions and measures related to personal protection, hygiene and health evaluation	Wear protective clothing. Safety shoes Safety glasses	
	In case of dust or aerosol formation: use respiratory protection with approved filter (P2) or Particle filter:P3	

2.4 Contributing scenario controlling worker exposure for: PROC2

Product characteristics	Concentration of the Substance in Mixture/Article	Covers concentrations more than 25%
	Physical Form (at time of use)	Solid, high dustiness
Frequency and duration of use	Exposure duration per day	< 15 min
Conditions and measures related to personal protection, hygiene and health evaluation	Wear protective gloves.	

2.5 Contributing scenario controlling worker exposure for: PROC4

Product characteristics	Concentration of the Substance in Mixture/Article	Covers concentrations more than 25%
	Physical Form (at time of use)	Solid, high dustiness
Frequency and duration of use	Exposure duration per day	15 - 60 min
Other operational conditions affecting workers exposure	Indoor use.	
	The process temperatures are mainly very high, as these processes include glass making, ceramics, steel & alloy making	
Technical conditions and measures to control dispersion from source towards the worker	Provide local exhaust ventilation (LEV).	
Organisational measures to prevent /limit releases, dispersion and exposure	Ensure operatives are trained to minimise exposures.	
Conditions and measures related to personal protection, hygiene and health evaluation	Wear protective gloves.	
	If technical exhaust or ventilation measures are not possible or insufficient, respiratory protection must be worn.	

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	Particle filter:P2 Particle filter:P3 Use battery-powered air fed helmets These respirators, if worn correctly, with a good face fit, will provide sufficient protection Where tightly fitting RPE is used, the worker should be face fit tested to ensure that a good face seal can be obtained
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2.6 Contributing scenario controlling worker exposure for: PROC4, PROC5, PROC8b

Activity	Covers reloading, mixing or compounding and associated activities in the Process Categories listed above	
Product characteristics	Concentration of the Substance in Mixture/Article	Covers percentage substance in the product up to 100 % (unless stated differently).
	Physical Form (at time of use)	Powdered substance, granules
Amount used	Would vary by requirements and by facility	
Frequency and duration of use	Exposure duration per day	60 min
Other operational conditions affecting workers exposure	Indoor use.	
	Assumes activities are at ambient temperature.	
Technical conditions and measures to control dispersion from source towards the worker	Local exhaust ventilation on furnaces and other work areas with potential dust generation, dust capturing and removal techniques Closed and semi-closed process where appropriate Discharge sacks via suitable vented charge chute. Automate activity where possible. Single use bags can be opened by the use of sharp prongs at the discharge hopper. When the big bag is placed at the discharge hopper and lowered, the prongs cut into the base of the bag releasing the substance into the hopper. This removes the operator from the immediate vicinity and contributes to a reduction in exposure	
Organisational measures to prevent /limit releases, dispersion and exposure	Ensure operatives are trained to minimise exposures. Regular inspection and maintenance of equipment and machines.	
Conditions and measures related to personal protection, hygiene and health evaluation	Wear protective clothing. Wear protective gloves. Safety glasses or Goggles	
	In case of dust or aerosol formation: use respiratory protection with approved filter (P2) or Particle filter:P3 These respirators, if worn correctly, with a good face fit, will provide sufficient protection Where tightly fitting RPE is used, the worker should be face fit tested to ensure that a good face seal can be obtained	

2.7 Contributing scenario controlling worker exposure for: PROC5

Product characteristics	Concentration of the Substance in Mixture/Article	Covers concentrations up to 5,5%
	Physical Form (at time of use)	Solids in solution
Amount used	The amount used per worker varies from activity to activity	
Frequency and duration of use	Only for certain activities with the substance in solution	
Other operational conditions affecting workers exposure	Indoor use.	

BORIC ACID

	Assumes activities are at ambient temperature.
Technical conditions and measures to control dispersion from source towards the worker	Ensure that task is semi-automated or automated
Organisational measures to prevent /limit releases, dispersion and exposure	Ensure operatives are trained to minimise exposures. Regular inspection and maintenance of equipment and machines. Replacing, where appropriated, manual processes by automated and/or closed processes. This would avoid irritating mists, sprayings and subsequent potential splashes.
Conditions and measures related to personal protection, hygiene and health evaluation	Wear suitable protective clothing. Wear protective gloves. Safety glasses or Goggles

2.8 Contributing scenario controlling worker exposure for: PROC8a, PROC8b

Activity	Relevant for Cleaning and Maintenance	
Product characteristics	Concentration of the Substance in Mixture/Article	Covers percentage substance in the product up to 100 % (unless stated differently).
	Physical Form (at time of use)	Powdered substance, granules
Amount used	Would vary by requirements and by facility	
Frequency and duration of use	Covers daily exposures up to 8 hours (unless stated differently).	
Other operational conditions affecting workers exposure	Indoor and outdoor use.	
Technical conditions and measures to control dispersion from source towards the worker	Use closed dosing, transfer, sampling and application systems including connectors. Worker in separate cabine without specific ventilation Provide extract ventilation to points where emissions occur.	
Organisational measures to prevent /limit releases, dispersion and exposure	Ensure operatives are trained to minimise exposures. Regular inspection and maintenance of equipment and machines.	
Conditions and measures related to personal protection, hygiene and health evaluation	Wear protective clothing. Safety shoes Safety glasses Wear protective gloves.	
	In case of dust or aerosol formation: use respiratory protection with approved filter (P2) or Particle filter:P3	

2.9 Contributing scenario controlling worker exposure for: PROC8b

large scale

Activity	Loading (including marine vessel/barge, rail/road car and IBC loading) and repacking (including drums and small packs) of substance, including its sampling, storage, unloading, distribution and associated laboratory activities.	
Product characteristics	Concentration of the Substance in Mixture/Article	Covers percentage substance in the product up to 100 % (unless stated differently).
	Physical Form (at time of use)	Powdered substance, granules
Amount used	Amount per Use	40000 kg
Frequency and duration of use	Exposure duration per day	60 - 120 min
Other operational conditions affecting workers exposure	Indoor use.	
	Assumes activities are at ambient temperature.	

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Technical conditions and measures to control dispersion from source towards the worker	Use closed dosing, transfer, sampling and application systems including connectors. Provide dust filtration for air displaced from the silo during filling.
Organisational measures to prevent /limit releases, dispersion and exposure	Ensure operatives are trained to minimise exposures. Regular inspection and maintenance of equipment and machines.
Conditions and measures related to personal protection, hygiene and health evaluation	Wear suitable protective clothing. Wear protective gloves. Safety glasses or Goggles

2.10 Contributing scenario controlling worker exposure for: PROC8b

Product characteristics	Concentration of the Substance in Mixture/Article	Covers the percentage of the substance in the product up to 100 % (unless stated differently).
	Physical Form (at time of use)	Powdered substance, granules
Amount used	Amount per Use	25 - 200 kg
Frequency and duration of use	Exposure duration	30 min
Other operational conditions affecting workers exposure	Indoor use.	
Technical conditions and measures to control dispersion from source towards the worker	Canopy hoods over the baths capture and remove steam	
Organisational measures to prevent /limit releases, dispersion and exposure	Ensure operatives are trained to minimise exposures. Regular inspection and maintenance of equipment and machines.	
Conditions and measures related to personal protection, hygiene and health evaluation	Complete suit protecting against chemicals Wear chemically resistant gloves. Safety goggles Wear face protective shield.	
	Respiratory protection is not required but is recommended. Particle filter: the filter grade (P1 - P3) has to be established depending on work-place related limit values and the actual exposition In case of dust or aerosol formation: use respiratory protection with approved filter (P2) or Particle filter:P3	

2.11 Contributing scenario controlling worker exposure for: PROC9

Product characteristics	Concentration of the Substance in Mixture/Article	Concentration of substance in product: 0,11% - 8,6%
	Physical Form (at time of use)	solid, liquid, pasty
Amount used	Amount per Day	10000 kg
Frequency and duration of use	Covers daily exposures up to 8 hours (unless stated differently).	
Other operational conditions affecting workers exposure	Indoor use.	
Technical conditions and measures to control dispersion from source towards the worker	Automate activity where possible.	
	LEV not required	
	Handling of solids	Provide local exhaust ventilation (LEV).
Organisational measures to prevent /limit releases, dispersion and exposure	Ensure operatives are trained to minimise exposures. Regular inspection and maintenance of equipment and machines.	
Conditions and measures related to personal protection, hygiene	Wear protective clothing. Safety shoes	

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and health evaluation	Safety glasses In case of dust or aerosol formation: use respiratory protection with approved filter (P2) or Particle filter:P3 Wear protective gloves.
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2.12 Contributing scenario controlling worker exposure for: PROC13

Metal working fluids

Product characteristics	Concentration of the Substance in Mixture/Article	Covers concentrations up to 1%
	Physical Form (at time of use)	Solids in solution
Amount used	Amount per Use	25 - 200 kg
Frequency and duration of use	Application duration	60 min
Other operational conditions affecting workers exposure	Indoor use.	
	Process temperature	60 °C
Technical conditions and measures to control dispersion from source towards the worker	Canopy hoods over the baths capture and remove steam	
Organisational measures to prevent /limit releases, dispersion and exposure	Ensure operatives are trained to minimise exposures. Regular inspection and maintenance of equipment and machines.	
Conditions and measures related to personal protection, hygiene and health evaluation	Wear chemically resistant gloves. Safety goggles or Wear face protective shield. Complete suit protecting against chemicals	

2.13 Contributing scenario controlling worker exposure for: PROC13

Product characteristics	Concentration of the Substance in Mixture/Article	Covers percentage substance in the product up to 1 %.
	Physical Form (at time of use)	Solid in solution
Amount used	Amount per Application	50 l
Frequency and duration of use	Exposure duration	12 min
Other operational conditions affecting workers exposure	Indoor use.	
Technical conditions and measures to control dispersion from source towards the worker	Ensure that task is semi-automated or automated	
Organisational measures to prevent /limit releases, dispersion and exposure	Ensure operatives are trained to minimise exposures.	

2.14 Contributing scenario controlling worker exposure for: PROC14

Product characteristics	Concentration of the Substance in Mixture/Article	Covers percentage substance in the product up to 100 % (unless stated differently).
	Physical Form (at time of use)	Powdered substance, granules
Amount used	The amount used per worker varies from activity to activity	
Frequency and duration of use	Covers daily exposures up to 8 hours (unless stated differently).	
Other operational conditions affecting workers exposure	Indoor use.	

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Technical conditions and measures to control dispersion from source towards the worker	Use closed dosing, transfer, sampling and application systems including connectors. Provide local exhaust ventilation (LEV). Provide a good standard of general ventilation. Natural ventilation is from doors, windows etc. Controlled ventilation means air is supplied or removed by a powered fan.
Organisational measures to prevent /limit releases, dispersion and exposure	Ensure operatives are trained to minimise exposures. Regular inspection and maintenance of equipment and machines.
Conditions and measures related to personal protection, hygiene and health evaluation	Wear protective clothing. Safety shoes Safety glasses In case of dust or aerosol formation: use respiratory protection with approved filter (P2) or Particle filter:P3

2.15 Contributing scenario controlling worker exposure for: PROC15

Product characteristics	Concentration of the Substance in Mixture/Article	Covers percentage substance in the product up to 100 % (unless stated differently).
	Physical Form (at time of use)	Powdered substance, granules
Amount used	Amount per Use	1 kg
Frequency and duration of use	Sometimes during the working day, only for short periods of time	
Technical conditions and measures to control dispersion from source towards the worker	Handle within a fume cupboard or implement suitable equivalent methods to minimise exposure.	
Organisational measures to prevent /limit releases, dispersion and exposure	Ensure operatives are trained to minimise exposures. Regular inspection and maintenance of equipment and machines.	
Conditions and measures related to personal protection, hygiene and health evaluation	Wear suitable protective clothing. Safety shoes Safety glasses Wear protective gloves.	

2.16 Contributing scenario controlling worker exposure for: PROC17, PROC24

Product characteristics	Concentration of the Substance in Mixture/Article	Covers concentrations up to 5,5%
	Physical Form (at time of use)	Solids in solution
Amount used	The amount used per worker varies from activity to activity	
Frequency and duration of use	Covers daily exposures up to 8 hours (unless stated differently).	
Other operational conditions affecting workers exposure	Indoor use.	
	Process may involve high temperature	
Technical conditions and measures to control dispersion from source towards the worker	Provide local exhaust ventilation (LEV). Closed process and closed circuits where relevant and possible A switch integrated with the machine should prevent the enclosure being opened while the machine is used There should also be a time delay so that the LEV has time to remove the aerosol before the enclosure is opened	
Organisational measures to prevent /limit releases, dispersion and exposure	Replacing, where appropriated, manual processes by automated and/or closed processes. This would avoid irritating mists, sprayings and subsequent potential splashes. Ensure operatives are trained to minimise exposures. Regular inspection and maintenance of equipment and machines.	
Conditions and measures related	Wear protective clothing.	

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to personal protection, hygiene and health evaluation

Wear protective gloves.

Safety glasses

or

Safety goggles

In case of dust or aerosol formation: use respiratory protection with approved filter (P2)

or

Particle filter:P3

2.17 Contributing scenario controlling worker exposure for: PROC18

Product characteristics	Concentration of the Substance in Mixture/Article	Concentration of substance in product: 0% - 0,01%
	Physical Form (at time of use)	pasty
Amount used	The amount used per worker varies from activity to activity	
Frequency and duration of use	Covers daily exposures up to 8 hours (unless stated differently).	
Other operational conditions affecting workers exposure	Indoor use.	
	Process may involve high temperature	
Technical conditions and measures to control dispersion from source towards the worker	Provide local exhaust ventilation (LEV). Use a receptor hood for fumes/vapours. Closed and semi-closed process where appropriate There should also be a time delay so that the LEV has time to remove the aerosol before the enclosure is opened	
Organisational measures to prevent /limit releases, dispersion and exposure	Ensure operatives are trained to minimise exposures. Regular inspection and maintenance of equipment and machines.	
Conditions and measures related to personal protection, hygiene and health evaluation	Wear protective clothing. Wear protective gloves. Safety goggles or Wear face protective shield.	

2.18 Contributing scenario controlling worker exposure for: PROC19

Product characteristics	Concentration of the Substance in Mixture/Article	Covers percentage substance in the product up to 5 %.
	Physical Form (at time of use)	solid, liquid
Amount used	Amount per Application	50 l
Frequency and duration of use	Application duration	5 - 10 min
Other operational conditions affecting workers exposure	Indoor use.	
Technical conditions and measures to control dispersion from source towards the worker	Provide a good standard of general ventilation. Natural ventilation is from doors, windows etc. Controlled ventilation means air is supplied or removed by a powered fan.	
Organisational measures to prevent /limit releases, dispersion and exposure	Ensure operatives are trained to minimise exposures.	

3. Exposure estimation and reference to its source**Environment**

ERC4: Estimation based on workplace measurements

Contributing Scenario	Specific conditions	Compartment	Value	Level of Exposure	RCR
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ERC4	Dilution of 10, Dilution of 100	Water	PEC	1974µg/L	0.977
ERC4	Dilution of 10	Soil	PEC	0.07mg/kg dry weight (d.w.)	0.013
ERC4	Dilution of 1000	Water	PEC	1575µg/L	0.954
ERC4	Dilution of 1000	Soil	PEC	5.15mg/kg dry weight (d.w.)	0.954
ERC4	Dilution of 100	Soil	PEC	0.63mg/kg dry weight (d.w.)	0.117

Workers

PROC4, PROC8b, PROC9: Advanced REACH Tool (ART model)

PROC1, PROC2, PROC3, PROC14, PROC15, PROC18, PROC19, PROC22, PROC23: Advanced REACH Tool (ART model) (inhalative exposure)

PROC2, PROC4, PROC5, PROC8a, PROC8b, PROC9, PROC10, PROC14, PROC15, PROC17, PROC19, PROC23: MEASE

PROC1, PROC2, PROC3, PROC4, PROC5, PROC8a, PROC8b, PROC9, PROC14, PROC15, PROC17, PROC22, PROC23, PROC24: Workplace measurements

Contributing Scenario	Specific conditions	Exposure routes	Level of Exposure	RCR
PROC1, PROC2, PROC3, PROC22, PROC23	90th percentile value, without respiratory protection, Elevated process temperature	Inhalation worker exposure	0.08mg/m ³	0.06
PROC23	with local exhaust ventilation, With face shield, Elevated process temperature	Inhalation worker exposure	0.01mg/m ³	0.0069
PROC2	Solid, high dustiness., during 15 mins - 1 hour, Elevated process temperature	Dermal worker exposure	0.048mg/kg bw/day	< 0.001
PROC1, PROC2, PROC3	90th percentile value	Inhalation worker exposure	0.08mg/m ³	0.06
PROC2	Solid, high dustiness., during 15 mins - 1 hour	Dermal worker exposure	0.048mg/kg bw/day	< 0.001
PROC2	---	Dermal worker exposure	0.002mg/kg bw/day	---
PROC4	---	Dermal worker exposure	0.48mg/kg bw/day	---
PROC4, PROC5	90th percentile value, small scale	Inhalation worker exposure	0.78mg/m ³	0.54
PROC4	Solid, high dustiness., during 15 mins - 1 hour, small scale	Dermal worker exposure	0.48mg/kg bw/day	< 0.001
PROC4, PROC5, PROC8b	90th percentile value, With respiratory protection, half mask, large scale	Inhalation worker exposure	0.2mg/m ³	0.14
PROC4	Solid, high dustiness., during 15 mins - 1 hour, with local exhaust ventilation, large scale	Dermal worker exposure	4.8mg/kg bw/day	0.001
PROC5	during 15 mins - 1 hour, Concentration: 1%	Dermal worker exposure	0.005mg/kg bw/day	< 0.001
PROC8a,	90th percentile value, no	Inhalation worker	1.33mg/m ³	0.92

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PROC8b	respiratory protection (RPE), Relevant for Cleaning and Maintenance	exposure		
PROC8a	Solid, high dustiness., during 1 - 4 hours, Relevant for Cleaning and Maintenance	Dermal worker exposure	0.173mg/kg bw/day	< 0.001
PROC8b	large scale	Inhalation worker exposure	0.016mg/m ³	0.011
PROC8b	with local exhaust ventilation, 90th percentile value, large scale	Inhalation worker exposure	0.03mg/kg bw/day	0.021
PROC2	Solid, high dustiness., during <15 mins, large scale	Dermal worker exposure	0.024mg/kg bw/day	< 0.001
PROC8b	without respiratory protection	Inhalation worker exposure	0.78mg/m ³	0.54
PROC8b	Solid, high dustiness., during 15 mins - 1 hour, Concentration of substance in product: 5% - 25%	Dermal worker exposure	0.288mg/kg bw/day	< 0.001
PROC9	with local exhaust ventilation, Small package filling, solid	Inhalation worker exposure	0.4mg/m ³	0.28
PROC9	liquid, with local exhaust ventilation	Dermal worker exposure	0.01mg/m ³	0.007
PROC9	Solid, high dustiness.	Dermal worker exposure	1.44mg/kg bw/day	< 0.001
PROC9	liquid	Dermal worker exposure	0.144mg/kg bw/day	< 0.001
PROC4	liquid, Concentration: 1%, during 15 mins - 1 hour, Manual, Additive premixing, Plating	Inhalation worker exposure	0.048mg/kg bw/day	< 0.001
PROC19	application as solution, Concentration: 1%, without gloves, during <15 mins	Dermal worker exposure	0.024mg/kg bw/day	< 0.001
PROC14	Measured exposure data	Inhalation worker exposure	1.3mg/m ³	0.9
PROC14	90th percentile value, with local exhaust ventilation	Inhalation worker exposure	0.15mg/m ³	0.10
PROC14	Solid, high dustiness.	Dermal worker exposure	2.4mg/kg bw/day	< 0.001
PROC15	90th percentile value	Inhalation worker exposure	0.16mg/m ³	0.11
PROC15	Solid, high dustiness., Concentration of substance in product: 5% - 25%, without gloves	Dermal worker exposure	0.014mg/kg bw/day	< 0.001
PROC17, PROC24	90th percentile value	Inhalation worker exposure	< 0.01mg/m ³	0.007
PROC17, PROC24	---	Inhalation worker exposure	0.07mg/m ³	0.048

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PROC17	Concentration: 1%, without gloves, liquid	Dermal worker exposure	2.4mg/kg bw/day	< 0.001
PROC18	with local exhaust ventilation	Inhalation worker exposure	0.0017mg/m ³	0.0012
PROC10	during 15 mins - 1 hour, Concentration: 1%, liquid, Manual, Application	Dermal worker exposure	0.048mg/kg bw/day	< 0.001
PROC19	Powdery developer formulations, Powdery fixer formulation	Inhalation worker exposure	0.001mg/m ³	< 0.001
PROC19	Solid, high dustiness., during <15 mins, Concentration of substance in product : 0% - 5%	Dermal worker exposure	0.198mg/kg bw/day	< 0.001
PROC19	application as solution, Concentration of substance in product : 0% - 5%, during <15 mins	Dermal worker exposure	0.024mg/kg bw/day	< 0.001

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

Guidance is based on assumed operating conditions which may not be applicable to all sites; thus, scaling may be necessary to define appropriate site-specific risk management measures.

Predicted exposures are not expected to exceed the applicable exposure limits when the operational conditions/risk management measures given in section 2 are implemented.

Where other Risk Management Measures/Operational Conditions are adopted, then users should ensure that risks are managed to at least equivalent levels.

Only properly trained persons shall make use of scaling methods while checking whether the OC and RMM are within the boundaries set by the ES

Tonnage calculations have been based on boron such that no RCR exceeds 0.97, using back calculations with the relevant PNEC's when necessary. The equivalent tonnage of product handled on site should be calculated from the conversion factors detailed in the product table. For those operations that handle a combination of borate compounds, the boron equivalent of the combined tonnage cannot exceed the site tonnage value.

Substance	Formula	Conversion factor for the equivalent dose of B (multiply by)
Boric acid	H ₃ BO ₃	0,1748
Boric oxide	B ₂ O ₃	0,311
Disodium tetraborate anhydrous	Na ₂ B ₄ O ₇	0,2149
Disodium tetraborate pentahydrate	Na ₂ B ₄ O ₇ x 5H ₂ O	0,1484
Disodium tetraborate decahydrate	Na ₂ B ₄ O ₇ x 10H ₂ O	0,1134
Disodium octaborate tetrahydrate	Na ₂ B ₈ O ₁₃ x 4H ₂ O	0,2096
Sodium metaborate (anhydrous)	NaBO ₂	0,1643
Sodium metaborate (dihydrate)	NaBO ₂ x 2H ₂ O	0,1062
Sodium metaborate (tetrahydrate)	NaBO ₂ x 4H ₂ O	0,0784
Sodium pentaborate (anhydrous)	NaB ₅ O ₈	0,2636
Sodium pentaborate (pentahydrate)	NaB ₅ O ₈ x 5H ₂ O	0,1832

If measured data are not available, the DU may make use of an appropriate scaling tool such as MEASE (www.ebrc.de/mease.html) to estimate the associated exposure.

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For further information on the assessment method, see: <http://www.advancedreachtool.com>

Additional good practice advice beyond the REACH Chemical Safety Assessment

Take care for general good hygiene and housekeeping.

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1. Short title of Exposure Scenario 9: Use as reactive process agent or use as catalyst

Main User Groups	SU 3: Industrial uses: Uses of substances as such or in preparations at industrial sites
Sectors of end-use	SU8: Manufacture of bulk, large scale chemicals (including petroleum products) SU9: Manufacture of fine chemicals
Process categories	PROC1: Use in closed process, no likelihood of exposure PROC2: Use in closed, continuous process with occasional controlled exposure PROC3: Use in closed batch process (synthesis or formulation) PROC4: Use in batch and other process (synthesis) where opportunity for exposure arises PROC8a: Transfer of substance or preparation (charging/ discharging) from/ to vessels/ large containers at non-dedicated facilities PROC8b: Transfer of substance or preparation (charging/ discharging) from/ to vessels/ large containers at dedicated facilities
Environmental Release Categories	ERC1: Manufacture of substances ERC6a: Industrial use resulting in manufacture of another substance (use of intermediates) ERC6b: Industrial use of reactive processing aids

2.1 Contributing scenario controlling environmental exposure for: ERC1, ERC6a, ERC6b

Activity	Application in a closed system	
Product characteristics	Concentration of the Substance in Mixture/Article	Covers percentage substance in the product up to 1 %.
Amount used	Typical amount of one batch	3 tonnes
Frequency and duration of use	Continuous exposure	7 - 21 days/year
Environment factors not influenced by risk management	Other data. Other information	Local freshwater dilution factor:: 10
Technical conditions and measures at process level (source) to prevent release Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil Organizational measures to prevent/limit release from the site	No releases	
Conditions and measures related to sewage treatment plant	Not applicable as there is no release to wastewater.	
Conditions and measures related to external treatment of waste for disposal	Disposal methods	Solid wastes contaminated are collected into containers and sent to external waste disposal facilities

2.2 Contributing scenario controlling worker exposure for: PROC1, PROC2, PROC3, PROC4, PROC8a, PROC8b

No exposure assessment presented for human health

3. Exposure estimation and reference to its source

Environment

No exposure assessment presented for the environment.

Workers

no exposure expected.

BORIC ACID**4. Guidance to Downstream User to evaluate whether he works inside the boundaries set by the Exposure Scenario**

Guidance is based on assumed operating conditions which may not be applicable to all sites; thus, scaling may be necessary to define appropriate site-specific risk management measures.

Where other Risk Management Measures/Operational Conditions are adopted, then users should ensure that risks are managed to at least equivalent levels.

Only properly trained persons shall make use of scaling methods while checking whether the OC and RMM are within the boundaries set by the ES

Tonnage calculations have been based on boron such that no RCR exceeds 0.97, using back calculations with the relevant PNEC's when necessary. The equivalent tonnage of product handled on site should be calculated from the conversion factors detailed in the product table. For those operations that handle a combination of borate compounds, the boron equivalent of the combined tonnage cannot exceed the site tonnage value.

Substance	Formula	Conversion factor for the equivalent dose of B (multiply by)
Boric acid	H_3BO_3	0,1748
Boric oxide	B_2O_3	0,311
Disodium tetraborate anhydrous	$Na_2B_4O_7$	0,2149
Disodium tetraborate pentahydrate	$Na_2B_4O_7 \times 5H_2O$	0,1484
Disodium tetraborate decahydrate	$Na_2B_4O_7 \times 10H_2O$	0,1134
Disodium octaborate tetrahydrate	$Na_2B_8O_{13} \times 4H_2O$	0,2096
Sodium metaborate (anhydrous)	$NaBO_2$	0,1643
Sodium metaborate (dihydrate)	$NaBO_2 \times 2H_2O$	0,1062
Sodium metaborate (tetrahydrate)	$NaBO_2 \times 4H_2O$	0,0784
Sodium pentaborate (anhydrous)	NaB_5O_8	0,2636
Sodium pentaborate (pentahydrate)	$NaB_5O_8 \times 5H_2O$	0,1832

If measured data are not available, the DU may make use of an appropriate scaling tool such as MEASE (www.ebrc.de/mease.html) to estimate the associated exposure.

For further information on the assessment method, see: <http://www.ecetoc.org/tra>

BORIC ACID**1. Short title of Exposure Scenario 10: Manufacture of catalysts**

Main User Groups	SU 3: Industrial uses: Uses of substances as such or in preparations at industrial sites
Process categories	PROC3: Use in closed batch process (synthesis or formulation) PROC4: Use in batch and other process (synthesis) where opportunity for exposure arises PROC5: Mixing or blending in batch processes for formulation of preparations and articles (multistage and/ or significant contact) PROC8a: Transfer of substance or preparation (charging/ discharging) from/ to vessels/ large containers at non-dedicated facilities PROC8b: Transfer of substance or preparation (charging/ discharging) from/ to vessels/ large containers at dedicated facilities PROC9: Transfer of substance or preparation into small containers (dedicated filling line, including weighing) PROC14: Production of preparations or articles by tableting, compression, extrusion, pelletisation
Environmental Release Categories	ERC1: Manufacture of substances ERC3: Formulation in materials ERC6a: Industrial use resulting in manufacture of another substance (use of intermediates) ERC6b: Industrial use of reactive processing aids

2.1 Contributing scenario controlling environmental exposure for: ERC1, ERC3, ERC6a, ERC6b

Product characteristics	Concentration of the Substance in Mixture/Article	Covers percentage substance in the product up to 100 % (unless stated differently).
Amount used	Annual tonnage	200 ton(s)/year
Frequency and duration of use	Continuous exposure	330 days/year
Technical conditions and measures at process level (source) to prevent release Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil Organizational measures to prevent/limit release from the site	Water	No discharge of substance into waste water
Conditions and measures related to external treatment of waste for disposal	Disposal methods	Vacuum up spillage and collect in suitable containers for disposal.

2.2 Contributing scenario controlling environmental exposure for: ERC1, ERC3, ERC6a, ERC6b

Activity	Manufacture of catalysts	
Product characteristics	Concentration of the Substance in Mixture/Article	Covers percentage substance in the product up to 100 % (unless stated differently).
Amount used	Annual amount per site	200 ton(s)/year
Frequency and duration of use	Continuous exposure	330 days/year
Environment factors not influenced by risk management	Other data. Other information	Local freshwater dilution factor:: 10
Other given operational conditions affecting environmental exposure	Emission or Release Factor: Air	2.7 g/ton of product
Technical conditions and measures at process level (source) to prevent release	Air	Treatment of air emissions by bag filters, fabric filter and wet scrubber, High efficiency particulate air filter (HEPA filter), ceramic filters

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Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil Organizational measures to prevent/limit release from the site	Water	Maximize waste water reuse.
	Procedural and/or control technologies are required to minimize emissions and the resulting exposure during cleaning and maintenance procedures	
Conditions and measures related to sewage treatment plant	Type of Sewage Treatment Plant	On-site waste water treatment
Conditions and measures related to external treatment of waste for disposal	Waste treatment	Substance containing waste shall be handled as hazardous waste and removed by licensed waste removal company, incinerated or recycled
	Disposal methods	Vacuum up spillage and collect in suitable containers for disposal.

2.3 Contributing scenario controlling worker exposure for: PROC3

Product characteristics	Concentration of the Substance in Mixture/Article	Covers percentage substance in the product up to 100 % (unless stated differently).
	Physical Form (at time of use)	Powdered substance, granules
Amount used	Amount per Shift	1000 kg
Frequency and duration of use	Covers daily exposures up to 8 hours (unless stated differently).	
Other operational conditions affecting workers exposure	Indoor use.	
Technical conditions and measures to control dispersion from source towards the worker	Use in closed process Where there are breaches in the closed system, such as pouring and removal of slag in metal production, LEV is used to control fumes.	
Organisational measures to prevent /limit releases, dispersion and exposure	Ensure operatives are trained to minimise exposures. Regular inspection and maintenance of equipment and machines.	
Conditions and measures related to personal protection, hygiene and health evaluation	Wear protective clothing. In case of dust or aerosol formation: use respiratory protection with approved filter (P2) or Particle filter:P3	

2.4 Contributing scenario controlling worker exposure for: PROC4, PROC5, PROC8b

Activity	Covers reloading, mixing or compounding and associated activities in the Process Categories listed above	
Product characteristics	Concentration of the Substance in Mixture/Article	Covers percentage substance in the product up to 100 % (unless stated differently).
	Physical Form (at time of use)	Powdered substance, granules
Amount used	Would vary by requirements and by facility	
Frequency and duration of use	Exposure duration	60 min
Other operational conditions affecting workers exposure	Indoor use.	
	Assumes activities are at ambient temperature.	
Technical conditions and measures to control dispersion from source towards the worker	Use in closed process Provide extract ventilation to points where emissions occur. Single use bags can be opened by the use of sharp prongs at the discharge hopper. When the big bag is placed at the discharge hopper and lowered, the prongs cut into the base of the bag releasing the substance into the hopper. This removes the operator from the immediate vicinity and contributes to a reduction in exposure	
Organisational measures to prevent /limit releases, dispersion	Ensure operatives are trained to minimise exposures. Regular inspection and maintenance of equipment and machines.	

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and exposure

Conditions and measures related to personal protection, hygiene and health evaluation

Wear suitable protective clothing.
 In case of dust or aerosol formation: use respiratory protection with approved filter (P2)
 or
 Particle filter:P3

2.5 Contributing scenario controlling worker exposure for: PROC8b

large scale

Product characteristics	Concentration of the Substance in Mixture/Article	Covers percentage substance in the product up to 100 % (unless stated differently).
	Physical Form (at time of use)	Powdered substance, granules
Amount used	Amount per Use	40000 kg
Frequency and duration of use	Exposure duration	120 min
Other operational conditions affecting workers exposure	Indoor use.	
	Assumes activities are at ambient temperature.	
Technical conditions and measures to control dispersion from source towards the worker	Use in closed process	
Organisational measures to prevent /limit releases, dispersion and exposure	Ensure operatives are trained to minimise exposures.	
	Regular inspection and maintenance of equipment and machines.	
Conditions and measures related to personal protection, hygiene and health evaluation	Wear suitable protective clothing.	

2.6 Contributing scenario controlling worker exposure for: PROC8a, PROC8b

Activity	Relevant for Cleaning and Maintenance	
Product characteristics	Concentration of the Substance in Mixture/Article	Covers percentage substance in the product up to 100 % (unless stated differently).
	Physical Form (at time of use)	Powdered substance, granules
Amount used	Would vary by requirements and by facility	
Frequency and duration of use	Covers daily exposures up to 8 hours (unless stated differently).	
Other operational conditions affecting workers exposure	Indoor and outdoor use.	
Technical conditions and measures to control dispersion from source towards the worker	Worker in separate cabine without specific ventilation	
	Provide extract ventilation to material transfer points and other openings.	
Organisational measures to prevent /limit releases, dispersion and exposure	Ensure operatives are trained to minimise exposures.	
	Regular inspection and maintenance of equipment and machines.	
Conditions and measures related to personal protection, hygiene and health evaluation	Wear suitable protective clothing.	
	Safety shoes Safety glasses In case of dust or aerosol formation: use respiratory protection with approved filter (P2) or Particle filter:P3	

2.7 Contributing scenario controlling worker exposure for: PROC9

Product characteristics	Concentration of the Substance in Mixture/Article	Concentration of substance in product: 0,11% - 8,6%
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	Physical Form (at time of use)	solid, liquid, pasty
Amount used	Amount per Use	10000 kg
Frequency and duration of use	Covers daily exposures up to 8 hours (unless stated differently).	
Technical conditions and measures to control dispersion from source towards the worker	Handling of solids	Provide local exhaust ventilation (LEV).
Organisational measures to prevent /limit releases, dispersion and exposure	Ensure operatives are trained to minimise exposures.	
	Regular inspection and maintenance of equipment and machines.	
Conditions and measures related to personal protection, hygiene and health evaluation	Wear protective clothing.	
	In case of dust or aerosol formation: use respiratory protection with approved filter (P2) or Particle filter:P3	

2.8 Contributing scenario controlling worker exposure for: PROC14

Product characteristics	Concentration of the Substance in Mixture/Article	Covers percentage substance in the product up to 100 % (unless stated differently).
	Physical Form (at time of use)	Powdered substance, granules
Amount used	The amount used per worker varies from activity to activity	
Frequency and duration of use	Covers daily exposures up to 8 hours (unless stated differently).	
Other operational conditions affecting workers exposure	Indoor use.	
Technical conditions and measures to control dispersion from source towards the worker	Handle substance within a closed system.	
Organisational measures to prevent /limit releases, dispersion and exposure	Ensure operatives are trained to minimise exposures.	
	Regular inspection and maintenance of equipment and machines.	
Conditions and measures related to personal protection, hygiene and health evaluation	Wear suitable protective clothing.	
	In case of dust or aerosol formation: use respiratory protection with approved filter (P2) or Particle filter:P3	

3. Exposure estimation and reference to its source**Environment**

ERC1, ERC3, ERC6a, ERC6b: MEASE

ERC1, ERC3, ERC6a, ERC6b: Workplace measurements

Contributing Scenario	Specific conditions	Compartment	Value	Level of Exposure	RCR
ERC1, ERC3, ERC6a, ERC6b	---	Soil	PEC	0.01mg/kg dry weight (d.w.)	0.001
ERC1, ERC3, ERC6a, ERC6b	---	Soil	PEC	0.01mg/kg dry weight (d.w.)	0.001

Workers

PROC8a, PROC8b, PROC9, PROC14: Advanced REACH Tool (ART model)

PROC2, PROC4, PROC8a, PROC8b, PROC9, PROC14: MEASE

PROC1, PROC2, PROC3, PROC4, PROC5, PROC8b, PROC9, PROC14: Workplace measurements

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Contributing Scenario	Specific conditions	Exposure routes	Level of Exposure	RCR
PROC1, PROC2, PROC3	90th percentile value, no respiratory protection (RPE)	Inhalation worker exposure	0.08mg/m ³	0.06
PROC2	Solid, high dustiness., during 15 mins - 1 hour	Dermal worker exposure	0.048mg/kg bw/day	< 0.001
PROC4	Solid, high dustiness., during 15 mins - 1 hour	Dermal worker exposure	0.48mg/kg bw/day	< 0.001
PROC4, PROC5	90th percentile value, small scale	Inhalation worker exposure	0.78mg/m ³	0.54
PROC4, PROC5, PROC8b	90th percentile value, With respiratory protection, half mask, large scale	Inhalation worker exposure	0.2mg/m ³	0.14
PROC4	Solid, high dustiness., during 15 mins - 1 hour, large scale	Dermal worker exposure	4.8mg/kg bw/day	0.001
PROC8b	---	Inhalation worker exposure	0.016mg/m ³	0.011
PROC8b	90th percentile value, with local exhaust ventilation	Dermal worker exposure	0.03mg/m ³	0.021
PROC8b	Solid, high dustiness., during <15 mins	Dermal worker exposure	0.024µg/kg bw/day	< 0.001
PROC8a, PROC8b	90th percentile value, no respiratory protection (RPE)	Inhalation worker exposure	1.33mg/m ³	0.92
PROC8a	Solid, high dustiness., during 1 - 4 hours	Dermal worker exposure	0.173mg/kg bw/day	< 0.001
PROC9	90th percentile value, with local exhaust ventilation, no respiratory protection (RPE)	Inhalation worker exposure	0.4mg/m ³	0.28
PROC9	90th percentile value, with local exhaust ventilation	Inhalation worker exposure	0.01mg/m ³	0.007
PROC9	Solid, high dustiness., Concentration of substance in product: 5% - 25%	Dermal worker exposure	1.44mg/kg bw/day	< 0.001
PROC9	application as solution, Concentration of substance in product: 5% - 25%	Dermal worker exposure	0.144mg/kg bw/day	< 0.001
PROC14	---	Inhalation worker exposure	1.3mg/m ³	0.9
PROC14	with local exhaust ventilation, 90th percentile value	Inhalation worker exposure	0.15mg/m ³	0.1
PROC14	Solid, high dustiness.	Dermal worker exposure	2.4mg/kg bw/day	< 0.001

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

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If measured data are not available, the DU may make use of an appropriate scaling tool such as MEASE (www.ebrc.de/mease.html) to estimate the associated exposure.

For further information on the assessment method, see: <http://www.advancedreachtool.com>

Guidance is based on assumed operating conditions which may not be applicable to all sites; thus, scaling may be necessary to define appropriate site-specific risk management measures.

Where other Risk Management Measures/Operational Conditions are adopted, then users should ensure that risks are managed to at least equivalent levels.

Only properly trained persons shall make use of scaling methods while checking whether the OC and RMM are within the boundaries set by the ES

Tonnage calculations have been based on boron such that no RCR exceeds 0.97, using back calculations with the relevant PNEC's when necessary. The equivalent tonnage of product handled on site should be calculated from the conversion factors detailed in the product table. For those operations that handle a combination of borate compounds, the boron equivalent of the combined tonnage cannot exceed the site tonnage value.

Substance	Formula	Conversion factor for the equivalent dose of B (multiply by)
Boric acid	H_3BO_3	0,1748
Boric oxide	B_2O_3	0,311
Disodium tetraborate anhydrous	$\text{Na}_2\text{B}_4\text{O}_7$	0,2149
Disodium tetraborate pentahydrate	$\text{Na}_2\text{B}_4\text{O}_7 \times 5\text{H}_2\text{O}$	0,1484
Disodium tetraborate decahydrate	$\text{Na}_2\text{B}_4\text{O}_7 \times 10\text{H}_2\text{O}$	0,1134
Disodium octaborate tetrahydrate	$\text{Na}_2\text{B}_8\text{O}_{13} \times 4\text{H}_2\text{O}$	0,2096
Sodium metaborate (anhydrous)	NaBO_2	0,1643
Sodium metaborate (dihydrate)	$\text{NaBO}_2 \times 2\text{H}_2\text{O}$	0,1062
Sodium metaborate (tetrahydrate)	$\text{NaBO}_2 \times 4\text{H}_2\text{O}$	0,0784
Sodium pentaborate (anhydrous)	$\text{NaB}_5\text{O}_{10}$	0,2636
Sodium pentaborate (pentahydrate)	$\text{NaB}_5\text{O}_{10} \times 5\text{H}_2\text{O}$	0,1832

BORIC ACID**1. Short title of Exposure Scenario 11: Use as a process chemical**

Main User Groups	SU 3: Industrial uses: Uses of substances as such or in preparations at industrial sites
Process categories	<p>PROC1: Use in closed process, no likelihood of exposure</p> <p>PROC2: Use in closed, continuous process with occasional controlled exposure</p> <p>PROC3: Use in closed batch process (synthesis or formulation)</p> <p>PROC4: Use in batch and other process (synthesis) where opportunity for exposure arises</p> <p>PROC5: Mixing or blending in batch processes for formulation of preparations and articles (multistage and/ or significant contact)</p> <p>PROC8a: Transfer of substance or preparation (charging/ discharging) from/ to vessels/ large containers at non-dedicated facilities</p> <p>PROC8b: Transfer of substance or preparation (charging/ discharging) from/ to vessels/ large containers at dedicated facilities</p> <p>PROC9: Transfer of substance or preparation into small containers (dedicated filling line, including weighing)</p> <p>PROC14: Production of preparations or articles by tableting, compression, extrusion, pelletisation</p> <p>PROC15: Use as laboratory reagent</p> <p>PROC22: Potentially closed processing operations with minerals/ metals at elevated temperature; Industrial setting</p> <p>PROC23: Open processing and transfer operations with minerals/ metals at elevated temperature</p>
Environmental Release Categories	ERC6b: Industrial use of reactive processing aids

2.1 Contributing scenario controlling environmental exposure for: ERC6b

Product characteristics	Concentration of the Substance in Mixture/Article	Covers percentage substance in the product up to 100 % (unless stated differently).
Amount used	Annual amount per site	29 ton(s)/year
Frequency and duration of use	Continuous exposure	358 days/year
Environment factors not influenced by risk management	Other data. Other information	Local freshwater dilution factor:: 10
	Other data. Other information	Local marine water dilution factor:: 100
	Dilution Factor (River)	500
Other given operational conditions affecting environmental exposure	Emission or Release Factor: Air	1000 g/ton of product
	Emission or Release Factor: Water	50000 g/ton of product
Technical conditions and measures at process level (source) to prevent release Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil Organizational measures to prevent/limit release from the site	Air	Electrostatic precipitation, Cyclones, Treatment of air emissions by bag filters, fabric filter and wet scrubber, Ceramic & metal mash filters, PM10 particles are removed
	Water	Substance specific waste water treatment, Ion exchange, Reverse osmosis (Degradation effectiveness: 40 - 90 %)
Conditions and measures related to sewage treatment plant	Type of Sewage Treatment Plant	Municipal sewage treatment plant
	The concentration of the substance should not exceed 1,75 mg/L in the municipal STP	
Conditions and measures related to external treatment of waste for	Waste treatment	Send back to the process, Substance containing waste shall be handled as hazardous waste and

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disposal		removed by licensed waste removal company, incinerated or recycled
	Disposal methods	Vacuum up spillage and collect in suitable containers for disposal.

2.2 Contributing scenario controlling worker exposure for: PROC1, PROC2, PROC3

Product characteristics	Concentration of the Substance in Mixture/Article	Covers percentage substance in the product up to 100 % (unless stated differently).
	Physical Form (at time of use)	Powdered substance, granules
Amount used	Amount per Shift	1000 kg
Frequency and duration of use	Covers daily exposures up to 8 hours (unless stated differently).	
Other operational conditions affecting workers exposure	Indoor use.	
	Assumes activities are at ambient temperature.	
Technical conditions and measures to control dispersion from source towards the worker	Use product only in closed system. Use closed dosing, transfer, sampling and application systems including connectors. Where there are breaches in the closed system, such as pouring and removal of slag in metal production, LEV is used to control fumes.	
Organisational measures to prevent /limit releases, dispersion and exposure	Ensure operatives are trained to minimise exposures. Regular inspection and maintenance of equipment and machines.	
Conditions and measures related to personal protection, hygiene and health evaluation	Wear protective clothing. Safety shoes Safety glasses In case of dust or aerosol formation: use respiratory protection with approved filter (P2) or Particle filter:P3	

2.3 Contributing scenario controlling worker exposure for: PROC1, PROC2, PROC3, PROC22, PROC23

Activity	Potentially closed processing operations at elevated temperature.	
Product characteristics	Concentration of the Substance in Mixture/Article	Covers percentage substance in the product up to 100 % (unless stated differently).
	Physical Form (at time of use)	Powdered substance, granules
Amount used	The amount used per worker varies from activity to activity	
Frequency and duration of use	Frequency of use	24 hours/day
	Frequency of use	365 days/year
Other operational conditions affecting workers exposure	Indoor use.	
	The process temperatures are mainly very high, as these processes include glass making, ceramics, steel & alloy making	
Technical conditions and measures to control dispersion from source towards the worker	Use closed dosing, transfer, sampling and application systems including connectors. Worker in separate cabine without specific ventilation Where there are breaches in the closed system, such as pouring and removal of slag in metal production, LEV is used to control fumes.	
Organisational measures to prevent /limit releases, dispersion and exposure	Ensure operatives are trained to minimise exposures. Regular inspection and maintenance of equipment and machines. Workers in the risky process/areas identified should be trained a) to avoid to work without respiratory protection and b) to understand the irritating properties and, especially, the respiratory inhalation effects and c) to follow the safer procedures instructed by the employer.	

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Conditions and measures related to personal protection, hygiene and health evaluation	Operatives wear overalls or heavy heat resistant clothing In case of dust or aerosol formation: use respiratory protection with approved filter (P2) or Particle filter:P3 Use battery-powered air fed helmets These respirators, if worn correctly, with a good face fit, will provide sufficient protection Where tightly fitting RPE is used, the worker should be face fit tested to ensure that a good face seal can be obtained	
	Equipment cleaning and maintenance	Wear protective gloves. Safety glasses Safety goggles

2.4 Contributing scenario controlling worker exposure for: PROC4, PROC5, PROC8b

Activity	Covers reloading, mixing or compounding and associated activities in the Process Categories listed above	
Product characteristics	Concentration of the Substance in Mixture/Article	Covers percentage substance in the product up to 100 % (unless stated differently).
	Physical Form (at time of use)	Powdered substance, granules
Amount used	Would vary by requirements and by facility	
Frequency and duration of use	Application duration	60 min
Other operational conditions affecting workers exposure	Indoor use.	
	Assumes activities are at ambient temperature.	
Technical conditions and measures to control dispersion from source towards the worker	Automate activity where possible. Provide local exhaust ventilation (LEV). Discharge sacks via suitable vented charge chute. Single use bags can be opened by the use of sharp prongs at the discharge hopper. When the big bag is placed at the discharge hopper and lowered, the prongs cut into the base of the bag releasing the substance into the hopper. This removes the operator from the immediate vicinity and contributes to a reduction in exposure	
Organisational measures to prevent /limit releases, dispersion and exposure	Ensure operatives are trained to minimise exposures. Regular inspection and maintenance of equipment and machines.	
Conditions and measures related to personal protection, hygiene and health evaluation	Wear suitable protective clothing. Wear protective gloves. Safety glasses Safety goggles In case of dust or aerosol formation: use respiratory protection with approved filter (P2) or Particle filter:P3	

2.5 Contributing scenario controlling worker exposure for: PROC8a, PROC8b

Activity	Equipment maintenance	
Product characteristics	Concentration of the Substance in Mixture/Article	Covers percentage substance in the product up to 100 % (unless stated differently).
	Physical Form (at time of use)	Powdered substance, granules
Amount used	Would vary by requirements and by facility	
Frequency and duration of use	Covers daily exposures up to 8 hours (unless stated differently).	
Other operational conditions affecting workers exposure	Indoor and outdoor use.	

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Technical conditions and measures to control dispersion from source towards the worker	Use closed dosing, transfer, sampling and application systems including connectors. Worker in separate cabine without specific ventilation Provide extract ventilation to points where emissions occur.
Organisational measures to prevent /limit releases, dispersion and exposure	Ensure operatives are trained to minimise exposures. Regular inspection and maintenance of equipment and machines.
Conditions and measures related to personal protection, hygiene and health evaluation	Wear protective clothing. Wear protective shoes. Safety glasses In case of dust or aerosol formation: use respiratory protection with approved filter (P2) or Particle filter:P3

2.6 Contributing scenario controlling worker exposure for: PROC8b

large scale

Activity	Bulk loading (including marine vessel/barge, rail/road car and IBC loading)	
Product characteristics	Concentration of the Substance in Mixture/Article	Covers percentage substance in the product up to 100 % (unless stated differently).
	Physical Form (at time of use)	Powdered substance, granules
Amount used	Amount per Application	40000 kg
Frequency and duration of use	Application duration	120 min
Other operational conditions affecting workers exposure	Indoor use.	
	Assumes activities are at ambient temperature.	
Technical conditions and measures to control dispersion from source towards the worker	Use closed dosing, transfer, sampling and application systems including connectors. Automate activity where possible. Provide dust filtration for air displaced from the silo during filling. Provide local exhaust ventilation (LEV).	
Organisational measures to prevent /limit releases, dispersion and exposure	Ensure operatives are trained to minimise exposures. Regular inspection and maintenance of equipment and machines.	
Conditions and measures related to personal protection, hygiene and health evaluation	Wear protective clothing. Wear protective gloves. Safety glasses Goggles	

2.7 Contributing scenario controlling worker exposure for: PROC9

Product characteristics	Concentration of the Substance in Mixture/Article	Concentration of substance in product: 0,11% - 8,6%
	Physical Form (at time of use)	solid, liquid, pasty
Amount used	Amount per Day	10000 kg
Frequency and duration of use	Covers daily exposures up to 8 hours (unless stated differently).	
Technical conditions and measures to control dispersion from source towards the worker	Automate activity where possible. Provide local exhaust ventilation (LEV).	
Organisational measures to prevent /limit releases, dispersion and exposure	Ensure operatives are trained to minimise exposures. Regular inspection and maintenance of equipment and machines.	
Conditions and measures related to personal protection, hygiene and health evaluation	Wear protective clothing. Safety shoes Safety glasses	

BORIC ACID

	In case of dust or aerosol formation: use respiratory protection with approved filter (P2) or Particle filter:P3
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2.8 Contributing scenario controlling worker exposure for: PROC14

Product characteristics	Concentration of the Substance in Mixture/Article	Covers percentage substance in the product up to 100 % (unless stated differently).
	Physical Form (at time of use)	Powdered substance, granules
Amount used	The amount used per worker varies from activity to activity	
Frequency and duration of use	Covers daily exposures up to 8 hours (unless stated differently).	
Other operational conditions affecting workers exposure	Indoor use.	
Technical conditions and measures to control dispersion from source towards the worker	Use closed dosing, transfer, sampling and application systems including connectors. Provide local exhaust ventilation (LEV).	
Organisational measures to prevent /limit releases, dispersion and exposure	Ensure operatives are trained to minimise exposures. Regular inspection and maintenance of equipment and machines.	
Conditions and measures related to personal protection, hygiene and health evaluation	Wear suitable protective clothing. Safety shoes Safety glasses In case of dust or aerosol formation: use respiratory protection with approved filter (P2) or Particle filter:P3	

2.9 Contributing scenario controlling worker exposure for: PROC15

Product characteristics	Concentration of the Substance in Mixture/Article	Covers percentage substance in the product up to 100 % (unless stated differently).
	Physical Form (at time of use)	Powdered substance, granules
Amount used	Amount per Application	1 kg
Frequency and duration of use	Sometimes during the working day, only for short periods of time	
Technical conditions and measures to control dispersion from source towards the worker	Handle in a fume cupboard or under extract ventilation.	
Organisational measures to prevent /limit releases, dispersion and exposure	Ensure operatives are trained to minimise exposures. Regular inspection and maintenance of equipment and machines.	
Conditions and measures related to personal protection, hygiene and health evaluation	Wear a laboratory coat Safety shoes Safety glasses Wear protective gloves.	

3. Exposure estimation and reference to its source**Environment**

ERC6b: Estimation based on workplace measurements

Contributing Scenario	Specific conditions	Compartment	Value	Level of Exposure	RCR
ERC6b	---	Fresh water	PEC	259µg/L	0.19
ERC6b	---	Fresh water sediment	PEC	1.74mg/kg	0.97

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ERC6b	---	Soil	PEC	0.008mg/kg	0.001
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Workers

PROC8b: Advanced REACH Tool (ART model)

PROC1, PROC2, PROC3, PROC9, PROC14: Advanced REACH Tool (ART model) (inhalative exposure)

PROC2, PROC4, PROC8a, PROC8b, PROC9, PROC14, PROC23: MEASE

PROC1, PROC2, PROC3, PROC8a, PROC8b, PROC9, PROC14, PROC15, PROC22, PROC23: Workplace measurements

Contributing Scenario	Specific conditions	Exposure routes	Level of Exposure	RCR
PROC1, PROC2, PROC3	90th percentile value, no respiratory protection (RPE)	Inhalation worker exposure	0.08mg/m ³	0.06
PROC2	Solid, high dustiness., during 15 mins - 1 hour	Dermal worker exposure	0.048mg/kg bw/day	< 0.001
PROC1, PROC2, PROC3, PROC22, PROC23	90th percentile value, no respiratory protection (RPE)	Inhalation worker exposure	0.08mg/m ³	0.06
PROC23	Solid, low dustiness., during <15 mins, With face shield	Inhalation worker exposure	0.01mg/kg bw/day	0.0069
PROC2	Solid, high dustiness., during 15 mins - 1 hour	Dermal worker exposure	0.048mg/kg bw/day	< 0.001
PROC8a, PROC8b	90th percentile value, small scale	Inhalation worker exposure	0.78mg/m ³	0.54
PROC4	Solid, high dustiness., during 15 mins - 1 hour	Dermal worker exposure	0.48mg/kg bw/day	< 0.001
PROC8a, PROC8b	90th percentile value, no respiratory protection (RPE)	Inhalation worker exposure	1.33mg/m ³	0.92
PROC8a, PROC8b	Solid, high dustiness., during 1 - 4 hours	Dermal worker exposure	0.173mg/kg bw/day	< 0.001
PROC8b	---	Inhalation worker exposure	0.016mg/m ³	0.011
PROC8b	Outdoor use., with local exhaust ventilation, 90th percentile value	Inhalation worker exposure	0.03mg/m ³	0.021
PROC2	Solid, high dustiness., during <15 mins	Dermal worker exposure	0.024mg/kg bw/day	< 0.001
PROC9	with local exhaust ventilation, no respiratory protection (RPE)	Inhalation worker exposure	0.4mg/m ³	0.28
PROC9	90th percentile value, liquid, with local exhaust ventilation	Inhalation worker exposure	0.01mg/m ³	0.007
PROC9	Solid, high dustiness., Concentration of substance in product: 5% - 25%	Dermal worker exposure	1.44mg/kg bw/day	< 0.001
PROC9	liquid, Concentration of substance in product: 5% - 25%	Dermal worker exposure	0.144mg/kg bw/day	< 0.001

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PROC14	---	Inhalation worker exposure	1.3mg/m ³	0.90
PROC14	90th percentile value, with local exhaust ventilation	Inhalation worker exposure	0.15mg/m ³	0.10
PROC14	Solid, high dustiness.	Dermal worker exposure	2.4mg/kg bw/day	< 0.001
PROC15	90th percentile value	Inhalation worker exposure	0.16mg/m ³	0.11
PROC14	Solid, high dustiness., Concentration of substance in product: 5% - 25%	Dermal worker exposure	0.014mg/kg bw/day	< 0.001

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

Guidance is based on assumed operating conditions which may not be applicable to all sites; thus, scaling may be necessary to define appropriate site-specific risk management measures.

Where other Risk Management Measures/Operational Conditions are adopted, then users should ensure that risks are managed to at least equivalent levels.

Only properly trained persons shall make use of scaling methods while checking whether the OC and RMM are within the boundaries set by the ES

Tonnage calculations have been based on boron such that no RCR exceeds 0.97, using back calculations with the relevant PNEC's when necessary. The equivalent tonnage of product handled on site should be calculated from the conversion factors detailed in the product table. For those operations that handle a combination of borate compounds, the boron equivalent of the combined tonnage cannot exceed the site tonnage value.

Substance	Formula	Conversion factor for the equivalent dose of B (multiply by)
Boric acid	H ₃ BO ₃	0,1748
Boric oxide	B ₂ O ₃	0,311
Disodium tetraborate anhydrous	Na ₂ B ₄ O ₇	0,2149
Disodium tetraborate pentahydrate	Na ₂ B ₄ O ₇ x 5H ₂ O	0,1484
Disodium tetraborate decahydrate	Na ₂ B ₄ O ₇ x 10H ₂ O	0,1134
Disodium octaborate tetrahydrate	Na ₂ B ₈ O ₁₃ x 4H ₂ O	0,2096
Sodium metaborate (anhydrous)	NaBO ₂	0,1643
Sodium metaborate (dihydrate)	NaBO ₂ x 2H ₂ O	0,1062
Sodium metaborate (tetrahydrate)	NaBO ₂ x 4H ₂ O	0,0784
Sodium pentaborate (anhydrous)	NaB ₅ O ₈	0,2636
Sodium pentaborate (pentahydrate)	NaB ₅ O ₈ x 5H ₂ O	0,1832

Additional good practice advice beyond the REACH Chemical Safety Assessment

Take care for general good hygiene and housekeeping.

BORIC ACID**1. Short title of Exposure Scenario 12: Use in glass production**

Main User Groups	SU 3: Industrial uses: Uses of substances as such or in preparations at industrial sites
Process categories	PROC1: Use in closed process, no likelihood of exposure PROC2: Use in closed, continuous process with occasional controlled exposure PROC3: Use in closed batch process (synthesis or formulation) PROC8a: Transfer of substance or preparation (charging/ discharging) from/ to vessels/ large containers at non-dedicated facilities PROC8b: Transfer of substance or preparation (charging/ discharging) from/ to vessels/ large containers at dedicated facilities PROC15: Use as laboratory reagent PROC22: Potentially closed processing operations with minerals/ metals at elevated temperature; Industrial setting PROC23: Open processing and transfer operations with minerals/ metals at elevated temperature
Environmental Release Categories	ERC2: Formulation of preparations ERC5: Industrial use resulting in inclusion into or onto a matrix ERC6a: Industrial use resulting in manufacture of another substance (use of intermediates)

2.1 Contributing scenario controlling environmental exposure for: ERC2, ERC5, ERC6a

Activity	Glass wool production	
Product characteristics	Concentration of the Substance in Mixture/Article	Covers percentage substance in the product up to 100 % (unless stated differently).
Amount used	Annual amount per site	15000 ton(s)/year
Frequency and duration of use	Continuous exposure	365 days/year
Other given operational conditions affecting environmental exposure	Emission or Release Factor: Air	2827 g/ton of product
	Emission or Release Factor: Water	0 g/ton of product
Technical conditions and measures at process level (source) to prevent release Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil Organizational measures to prevent/limit release from the site	Air	Substance specific waste air treatment:, Electrostatic precipitation, Cyclones, ceramic filters, Bag filters, Fabric filter
	Water	Substance specific waste water treatment, Reverse osmosis, Ion exchange (Degradation effectiveness: 40 - 90 %)
Conditions and measures related to sewage treatment plant	Not applicable as there is no release to wastewater.	
Conditions and measures related to external treatment of waste for disposal	Disposal methods	Vacuum up spillage and collect in suitable containers for disposal., Prevent environmental discharge consistent with regulatory requirements.

2.2 Contributing scenario controlling environmental exposure for: ERC2, ERC5, ERC6a

Activity	Glass made by electric melting	
Product characteristics	Concentration of the Substance in Mixture/Article	Covers the percentage of the substance in the product up to 100 % (unless stated differently).
Amount used	Annual amount per site	15000 ton(s)/year (No water emissions ERC2, ERC5, ERC6a)
Frequency and duration of use	Continuous exposure	365 days/year
Other given operational	Emission or Release	392 g/ton of product

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conditions affecting environmental exposure	Factor: Air	
	Emission or Release Factor: Water	0 g/ton of product
Technical conditions and measures at process level (source) to prevent release Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil Organizational measures to prevent/limit release from the site	Air	Substance specific waste air treatment:, Electrostatic precipitation, Cyclones, ceramic filters, Bag filters, Fabric filter (Efficiency: 64 - 99 %)
	Water	Substance specific waste water treatment, Reverse osmosis, Ion exchange (Degradation effectiveness: 40 - 90 %)
Conditions and measures related to sewage treatment plant	Not applicable as there is no release to wastewater.	
Conditions and measures related to external treatment of waste for disposal	Waste treatment	Send back to the process
	Disposal methods	Vacuum up spillage and collect in suitable containers for disposal., Prevent environmental discharge consistent with regulatory requirements.

2.3 Contributing scenario controlling environmental exposure for: ERC2, ERC5, ERC6a

Activity	Glass with a high alkali ratio, gas melting	
Product characteristics	Concentration of the Substance in Mixture/Article	Covers percentage substance in the product up to 100 % (unless stated differently).
Amount used	Annual amount per site	5300 ton(s)/year (No water emissions ERC2, ERC5, ERC6a)
Frequency and duration of use	Continuous exposure	365 days/year
Other given operational conditions affecting environmental exposure	Emission or Release Factor: Air	10896 g/ton of product
	Emission or Release Factor: Water	0 g/ton of product
Technical conditions and measures at process level (source) to prevent release Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil Organizational measures to prevent/limit release from the site	Air	Substance specific waste air treatment:, Electrostatic precipitation, Cyclones, ceramic filters, Bag filters, Fabric filter (Efficiency: 85 - 99 %)
	Water	Substance specific waste water treatment, Reverse osmosis, Ion exchange (Degradation effectiveness: 40 - 90 %)
Conditions and measures related to sewage treatment plant	Not applicable as there is no release to wastewater.	
Conditions and measures related to external treatment of waste for disposal	Waste treatment	Substance containing waste shall be handled as hazardous waste and removed by licensed waste removal company, incinerated or recycled
	Disposal methods	Vacuum up spillage and collect in suitable containers for disposal., Prevent environmental discharge consistent with regulatory requirements.

2.4 Contributing scenario controlling environmental exposure for: ERC2, ERC5, ERC6a

Activity	Glass with a low alkali ratio, gas melting	
Product characteristics	Concentration of the Substance in Mixture/Article	Covers percentage substance in the product up to 100 % (unless stated differently).
Amount used	Annual amount per site	1150 ton(s)/year (No water emissions ERC2, ERC5, ERC6a)

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Frequency and duration of use	Continuous exposure	365 days/year
Other given operational conditions affecting environmental exposure	Emission or Release Factor: Air	36562 g/ton of product
	Emission or Release Factor: Water	0 g/ton of product
Technical conditions and measures at process level (source) to prevent release Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil Organizational measures to prevent/limit release from the site	Air	Substance specific waste air treatment:, Electrostatic precipitation, Cyclones, ceramic filters, Bag filters, Fabric filter (Efficiency: 36 - 52 %)
	Water	Substance specific waste water treatment, Reverse osmosis, Ion exchange (Degradation effectiveness: 40 - 90 %)
Conditions and measures related to sewage treatment plant	Not applicable as there is no release to wastewater.	
Conditions and measures related to external treatment of waste for disposal	Waste treatment	Send back to the process, Treat all waste as hazardous waste, Substance containing waste shall be handled as hazardous waste and removed by licensed waste removal company, incinerated or recycled
	Disposal methods	Vacuum up spillage and collect in suitable containers for disposal., Prevent environmental discharge consistent with regulatory requirements.

2.5 Contributing scenario controlling worker exposure for: PROC8a, PROC8b

Activity	Equipment maintenance	
Product characteristics	Concentration of the Substance in Mixture/Article	Covers percentage substance in the product up to 100 % (unless stated differently).
	Physical Form (at time of use)	granules, Powder
Amount used	Would vary by requirements and by facility	
Frequency and duration of use	Covers daily exposures up to 8 hours (unless stated differently).	
Other operational conditions affecting workers exposure	Indoor and outdoor use.	
Technical conditions and measures to control dispersion from source towards the worker	Use closed dosing, transfer, sampling and application systems including connectors. Worker in separate cabine without specific ventilation	
Organisational measures to prevent /limit releases, dispersion and exposure	Ensure operatives are trained to minimise exposures. Regular inspection and maintenance of equipment and machines.	
Conditions and measures related to personal protection, hygiene and health evaluation	Wear protective clothing. Safety shoes Safety glasses Wear respiratory protection. Particle filter:P2 or Particle filter:P3	

2.6 Contributing scenario controlling worker exposure for: PROC8b

large scale		
Activity	Loading (including marine vessel/barge, rail/road car and IBC loading) and repacking (including drums and small packs) of substance, including its sampling, storage, unloading, distribution and associated laboratory activities.	
Product characteristics	Concentration of the Substance in	Covers percentage substance in the product up to 100 % (unless stated differently).

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	Mixture/Article	
	Physical Form (at time of use)	granules, Powder
Amount used	Amount per Use	40000 kg
Frequency and duration of use	Exposure duration	120 min
Other operational conditions affecting workers exposure	Indoor use.	
	Assumes activities are at ambient temperature.	
Technical conditions and measures to control dispersion from source towards the worker	Provide dust filtration for air displaced from the silo during filling.	
Organisational measures to prevent /limit releases, dispersion and exposure	Ensure operatives are trained to minimise exposures.	
	Regular inspection and maintenance of equipment and machines.	
Conditions and measures related to personal protection, hygiene and health evaluation	Wear protective clothing. Safety glasses Safety goggles Wear protective gloves.	

2.7 Contributing scenario controlling worker exposure for: PROC15

Product characteristics	Concentration of the Substance in Mixture/Article	Covers percentage substance in the product up to 100 % (unless stated differently).
	Physical Form (at time of use)	granules, Powder
Amount used	Amount per Use	1 kg
Frequency and duration of use	Several times during the working day, only for short periods of time	
Technical conditions and measures to control dispersion from source towards the worker	Handle in a fume cupboard or under extract ventilation.	
Organisational measures to prevent /limit releases, dispersion and exposure	Ensure operatives are trained to minimise exposures.	
	Regular inspection and maintenance of equipment and machines.	
Conditions and measures related to personal protection, hygiene and health evaluation	Wear protective clothing. Safety shoes Safety glasses Wear protective gloves.	

2.8 Contributing scenario controlling worker exposure for: PROC1, PROC2, PROC3, PROC22, PROC23

Activity	Potentially closed processing operations at elevated temperature.	
Product characteristics	Concentration of the Substance in Mixture/Article	Covers percentage substance in the product up to 100 % (unless stated differently).
	Physical Form (at time of use)	granules, Powder
Amount used	The amount used per worker varies from activity to activity	
Frequency and duration of use	Frequency of use	24 hours/day
	Frequency of use	365 days/year
Other operational conditions affecting workers exposure	Indoor use.	
	The process temperatures are mainly very high, as these processes include glass making, ceramics, steel & alloy making	
Technical conditions and measures to control dispersion from source towards the worker	Worker in separate cabine without specific ventilation Minimise exposure by partial enclosure of the operation or equipment and provide extract ventilation at openings. Where there are breaches in the closed system, such as pouring and removal of	

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	slag in metal production, LEV is used to control fumes. Use product only in closed system.
Organisational measures to prevent /limit releases, dispersion and exposure	Ensure operatives are trained to minimise exposures. Regular inspection and maintenance of equipment and machines.
Conditions and measures related to personal protection, hygiene and health evaluation	Wear protective clothing. Wear protective gloves. Safety glasses Safety goggles If no adequate ventilation is available: Wear respiratory protection. Particle filter:P2 or Particle filter:P3

2.9 Contributing scenario controlling worker exposure for: PROC1, PROC2, PROC3

Product characteristics	Concentration of the Substance in Mixture/Article	Covers percentage substance in the product up to 100 % (unless stated differently).
	Physical Form (at time of use)	granules, Powder
Amount used	Amount per Shift	1000 kg
Frequency and duration of use	Exposure duration per day	60 - 240 min
Human factors not influenced by risk management	Exposed skin surface	1980 cm ²
Other operational conditions affecting workers exposure	Indoor use.	
	Assumes activities are at ambient temperature.	
Technical conditions and measures to control dispersion from source towards the worker	Provide local exhaust ventilation (LEV). Where there are breaches in the closed system, such as pouring and removal of slag in metal production, LEV is used to control fumes.	
Organisational measures to prevent /limit releases, dispersion and exposure	Ensure operatives are trained to minimise exposures. Regular inspection and maintenance of equipment and machines.	
Conditions and measures related to personal protection, hygiene and health evaluation	Wear protective clothing. Safety shoes Safety glasses Wear respiratory protection. In case of dust or aerosol formation: use respiratory protection with approved filter (P2) or Particle filter:P3	

3. Exposure estimation and reference to its source**Environment**

ERC2, ERC5, ERC6a: METALS EUSES IT tool

Contributing Scenario	Specific conditions	Compartment	Value	Level of Exposure	RCR
ERC2, ERC5, ERC6a	No water discharge to the environment, Production of glass wool	Soil	PEC	5.20mg/kg dry weight (d.w.)	0.962
ERC2, ERC5, ERC6a	Glass made by electric melting, No water discharge to the environment	Soil	PEC	0.54mg/kg dry weight (d.w.)	0.100

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ERC2, ERC5, ERC6a	Glass with a high alkali ratio, gas melting, No water discharge to the environment	Soil	PEC	5.25mg/kg dry weight (d.w.)	0.97
ERC2, ERC5, ERC6a	Glass with a low alkali ratio, gas melting	Soil	PEC	5.26mg/kg dry weight (d.w.)	0.97

Workers

PROC8b: Advanced REACH Tool (ART model)

PROC2, PROC8a, PROC14, PROC23: MEASE

PROC1, PROC2, PROC3, PROC8a, PROC8b, PROC15, PROC22: Workplace measurements

Contributing Scenario	Specific conditions	Exposure routes	Level of Exposure	RCR
PROC8a, PROC8b	90th percentile value, without respiratory protection	Inhalation worker exposure	1.33mg/m ³	0.92
PROC8a	Solid, high dustiness., during 1 - 4 hours	Dermal worker exposure	0.173mg/kg bw/day	< 0.001
PROC8b	Indoor use., with local exhaust ventilation, 90th percentile value	Inhalation worker exposure	0.03mg/m ³	0.021
PROC2	Solid, high dustiness., during <15 mins	Dermal worker exposure	0.024mg/kg bw/day	< 0.001
PROC15	90th percentile value	Inhalation worker exposure	0.16mg/m ³	0.11
PROC14	without gloves, Solid, high dustiness., Concentration of substance in product: 5% - 25%	Dermal worker exposure	0.014mg/kg bw/day	< 0.001
PROC22	without respiratory protection, 90th percentile value	Inhalation worker exposure	0.08mg/m ³	0.06
PROC23	Solid, low dustiness., Concentration of substance in product : 0% - 5%, With face shield	Inhalation worker exposure	0.01mg/m ³	0.0069
PROC2	Solid, high dustiness., Concentration of substance in product: 5% - 25%, during 15 mins - 1 hour	Dermal worker exposure	0.048mg/kg bw/day	< 0.001
PROC2	Solid, high dustiness., during 15 mins - 1 hour	Dermal worker exposure	0.048mg/kg/day	< 0.001
PROC1, PROC2, PROC3	90th percentile value, without respiratory protection	Inhalation worker exposure	0.08mg/m ³	0.06

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

If measured data are not available, the DU may make use of an appropriate scaling tool such as MEASE (www.ebrc.de/mease.html) to estimate the associated exposure.

For further information on the assessment method, see: <http://www.ebrc.de/mease.html>

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For scaling see: [http://www.arche-consulting.be/metal-CSA-toolbox/du-scaling tool](http://www.arche-consulting.be/metal-CSA-toolbox/du-scaling%20tool)

Guidance is based on assumed operating conditions which may not be applicable to all sites; thus, scaling may be necessary to define appropriate site-specific risk management measures.

Where other Risk Management Measures/Operational Conditions are adopted, then users should ensure that risks are managed to at least equivalent levels.

Only properly trained persons shall make use of scaling methods while checking whether the OC and RMM are within the boundaries set by the ES

Tonnage calculations have been based on boron such that no RCR exceeds 0.97, using back calculations with the relevant PNEC's when necessary. The equivalent tonnage of product handled on site should be calculated from the conversion factors detailed in the product table. For those operations that handle a combination of borate compounds, the boron equivalent of the combined tonnage cannot exceed the site tonnage value.

Substance	Formula	Conversion factor for the equivalent dose of B (multiply by)
Boric acid	H_3BO_3	0,1748
Boric oxide	B_2O_3	0,311
Disodium tetraborate anhydrous	$Na_2B_4O_7$	0,2149
Disodium tetraborate pentahydrate	$Na_2B_4O_7 \times 5H_2O$	0,1484
Disodium tetraborate decahydrate	$Na_2B_4O_7 \times 10H_2O$	0,1134
Disodium octaborate tetrahydrate	$Na_2B_8O_{13} \times 4H_2O$	0,2096
Sodium metaborate (anhydrous)	$NaBO_2$	0,1643
Sodium metaborate (dihydrate)	$NaBO_2 \times 2H_2O$	0,1062
Sodium metaborate (tetrahydrate)	$NaBO_2 \times 4H_2O$	0,0784
Sodium pentaborate (anhydrous)	NaB_5O_8	0,2636
Sodium pentaborate (pentahydrate)	$NaB_5O_8 \times 5H_2O$	0,1832

BORIC ACID**1. Short title of Exposure Scenario 13: Use in nuclear power plants**

Main User Groups	SU 3: Industrial uses: Uses of substances as such or in preparations at industrial sites
Process categories	PROC1: Use in closed process, no likelihood of exposure PROC2: Use in closed, continuous process with occasional controlled exposure PROC3: Use in closed batch process (synthesis or formulation) PROC4: Use in batch and other process (synthesis) where opportunity for exposure arises PROC5: Mixing or blending in batch processes for formulation of preparations and articles (multistage and/ or significant contact) PROC8b: Transfer of substance or preparation (charging/ discharging) from/ to vessels/ large containers at dedicated facilities PROC15: Use as laboratory reagent
Environmental Release Categories	ERC7: Industrial use of substances in closed systems

2.1 Contributing scenario controlling environmental exposure for: ERC7

Use in nuclear power plants without releases to water

Product characteristics	Concentration of the Substance in Mixture/Article	Covers percentage substance in the product up to 100 % (unless stated differently).
Amount used	Annual amount per site	15000 ton(s)/year
Frequency and duration of use	Continuous exposure	75 days/year
Other given operational conditions affecting environmental exposure	Emission or Release Factor: Air	400 g/ton of product
	Emission or Release Factor: Water	0 g/ton of product
Technical conditions and measures at process level (source) to prevent release Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil Organizational measures to prevent/limit release from the site	Air	Electrostatic precipitation, Cyclones, Treatment of air emissions by bag filters, fabric filter and wet scrubber, Ceramic & metal mesh filters, PM10 particles are removed
	Water	Wastewater emission controls are not applicable as there is no direct release to wastewater.
Conditions and measures related to external treatment of waste for disposal	Waste treatment	Send back to the process
	Disposal methods	Vacuum up spillage and collect in suitable containers for disposal., Waste product and empty containers should be disposed of as hazardous waste in accordance with all local and national regulations.
Conditions and measures related to external recovery of waste	Recovery Methods	There is no envisaged external recovery of waste.

2.2 Contributing scenario controlling environmental exposure for: ERC7

Use in nuclear power plants with releases to water after onsite treatment

Product characteristics	Concentration of the Substance in Mixture/Article	Covers percentage substance in the product up to 100 % (unless stated differently).
Amount used	Annual amount per site	13000 ton(s)/year
Frequency and duration of use	Continuous exposure	32 days/year
Environment factors not influenced by risk management	Other data. Other information	Local marine water dilution factor:1000

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Other given operational conditions affecting environmental exposure	Emission or Release Factor: Air	0 g/ton of product
	Emission or Release Factor: Water	13000 kg/year
Technical conditions and measures at process level (source) to prevent release Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil Organizational measures to prevent/limit release from the site	Water	Substance specific waste water treatment
	Use of closed filling equipment	
Conditions and measures related to external treatment of waste for disposal	Waste treatment	Send back to the process
	Disposal methods	Vacuum up spillage and collect in suitable containers for disposal., Waste product and empty containers should be disposed of as hazardous waste in accordance with all local and national regulations.
Conditions and measures related to external recovery of waste	Recovery Methods	There is no envisaged external recovery of waste.

2.3 Contributing scenario controlling worker exposure for: PROC1, PROC2, PROC3

Product characteristics	Concentration of the Substance in Mixture/Article	Covers percentage substance in the product up to 100 % (unless stated differently).
	Physical Form (at time of use)	Powdered substance, granules
Amount used	Amount per Shift	1000 kg
Frequency and duration of use	Covers daily exposures up to 8 hours (unless stated differently).	
Other operational conditions affecting workers exposure	Indoor use.	
Technical conditions and measures to control dispersion from source towards the worker	Use closed dosing, transfer, sampling and application systems including connectors. Where there are breaches in the closed system, such as pouring and removal of slag in metal production, LEV is used to control fumes.	
Organisational measures to prevent /limit releases, dispersion and exposure	Ensure operatives are trained to minimise exposures. Regular inspection and maintenance of equipment and machines.	
Conditions and measures related to personal protection, hygiene and health evaluation	Wear protective clothing. Safety shoes Safety glasses In case of dust or aerosol formation: use respiratory protection with approved filter (P2) or Particle filter:P3	

2.4 Contributing scenario controlling worker exposure for: PROC4, PROC5, PROC8b

Activity	Covers reloading, mixing or compounding and associated activities in the Process Categories listed above	
Product characteristics	Concentration of the Substance in Mixture/Article	Covers percentage substance in the product up to 100 % (unless stated differently).
	Physical Form (at time of use)	Powdered substance, granules
Amount used	Would vary by requirements and by facility	
Frequency and duration of use	Exposure duration per	60 min

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	day	
Other operational conditions affecting workers exposure	Indoor use.	
	Assumes activities are at ambient temperature.	
Technical conditions and measures to control dispersion from source towards the worker	Use only semi-automated and predominantly enclosed filling lines. Provide local exhaust ventilation (LEV). Provide appropriate exhaust ventilation at machinery and at places where dust can be generated. Single use bags can be opened by the use of sharp prongs at the discharge hopper. When the big bag is placed at the discharge hopper and lowered, the prongs cut into the base of the bag releasing the substance into the hopper. This removes the operator from the immediate vicinity and contributes to a reduction in exposure	
Organisational measures to prevent /limit releases, dispersion and exposure	Ensure operatives are trained to minimise exposures.	
	Regular inspection and maintenance of equipment and machines.	
Conditions and measures related to personal protection, hygiene and health evaluation	Wear protective clothing. Wear protective gloves. Safety glasses Safety goggles In case of dust or aerosol formation: use respiratory protection with approved filter (P2) or Particle filter:P3 These respirators, if worn correctly, with a good face fit, will provide sufficient protection Where tightly fitting RPE is used, the worker should be face fit tested to ensure that a good face seal can be obtained	

2.5 Contributing scenario controlling worker exposure for: PROC8b

large scale

Activity	Bulk loading (including marine vessel/barge, rail/road car and IBC loading)	
Product characteristics	Concentration of the Substance in Mixture/Article	Covers percentage substance in the product up to 100 % (unless stated differently).
	Physical Form (at time of use)	Powdered substance, granules
Amount used	Amount per Application	40000 kg
Frequency and duration of use	Exposure duration per day	120 min
Other operational conditions affecting workers exposure	Indoor use.	
	Assumes activities are at ambient temperature.	
Technical conditions and measures to control dispersion from source towards the worker	Use closed dosing, transfer, sampling and application systems including connectors. Provide dust filtration for air displaced from the silo during filling.	
Organisational measures to prevent /limit releases, dispersion and exposure	Ensure operatives are trained to minimise exposures.	
	Regular inspection and maintenance of equipment and machines.	
Conditions and measures related to personal protection, hygiene and health evaluation	Wear protective clothing. Wear protective gloves. Safety glasses Safety goggles	

2.6 Contributing scenario controlling worker exposure for: PROC15

Product characteristics	Concentration of the Substance in Mixture/Article	Covers percentage substance in the product up to 100 % (unless stated differently).
	Physical Form (at time of use)	Powdered substance, granules

BORIC ACID

	use)	
Amount used	Amount per Use	1 kg
Frequency and duration of use	Several times during the working day, only for short periods of time	
Technical conditions and measures to control dispersion from source towards the worker	Handle in a fume cupboard or under extract ventilation.	
Organisational measures to prevent /limit releases, dispersion and exposure	Ensure operatives are trained to minimise exposures. Regular inspection and maintenance of equipment and machines.	
Conditions and measures related to personal protection, hygiene and health evaluation	Wear a laboratory coat Wear protective shoes. Safety glasses Wear protective gloves.	

3. Exposure estimation and reference to its source**Environment**

ERC7: METALS EUSES IT tool

Contributing Scenario	Specific conditions	Compartment	Value	Level of Exposure	RCR
ERC7	Nuclear power plants, No water discharge to the environment	Soil	PEC	0.55mg/kg dry weight (d.w.)	0.10
ERC7	Nuclear power plants	Marine sediment	PEC	1.59mg/kg dry weight (d.w.)	0.88
ERC7	Nuclear power plants	Soil	PEC	0.01mg/kg dry weight (d.w.)	0.001
ERC7	Nuclear power plants	Marine water	PEC	221µg/L	0.16

Workers

PROC8b: Advanced REACH Tool (ART model) (inhalative exposure)

PROC2, PROC4, PROC14: MEASE

PROC1, PROC2, PROC3, PROC4, PROC5, PROC8b, PROC15: Workplace measurements

Contributing Scenario	Specific conditions	Exposure routes	Level of Exposure	RCR
PROC1, PROC2, PROC3	90th percentile value, no respiratory protection (RPE)	Inhalation worker exposure	0.08mg/m ³	0.06
PROC2	Solid, high dustiness., during 15 mins - 1 hour	Dermal worker exposure	0.048mg/kg bw/day	< 0.001
PROC4, PROC5	90th percentile value, small scale	Inhalation worker exposure	0.78mg/m ³	0.54
PROC4	Solid, high dustiness., during 15 mins - 1 hour, large scale	Dermal worker exposure	4.8mg/kg bw/day	0.001
PROC4	Solid, high dustiness., during 15 mins - 1 hour, small scale	Dermal worker exposure	0.48mg/kg bw/day	< 0.001
PROC4, PROC5, PROC8b	90th percentile value, half mask, large scale	Inhalation worker exposure	0.2mg/m ³	0.14
PROC8b	---	Inhalation worker exposure	0.016mg/m ³	0.011
PROC8b	Outdoor use., with local	Inhalation worker	0.03mg/m ³	0.021

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	exhaust ventilation, 90th percentile value	exposure		
PROC2	Solid, high dustiness., during <15 mins	Dermal worker exposure	0.024mg/kg bw/day	< 0.001
PROC15	90th percentile value	Inhalation worker exposure	0.16mg/m ³	0.11
PROC14	Solid, high dustiness., Concentration of substance in product: 5% - 25%, with local exhaust ventilation	Dermal worker exposure	0.014mg/kg bw/day	< 0.001

4. Guidance to Downstream User to evaluate whether he works inside the boundaries set by the Exposure Scenario**Additional good practice advice beyond the REACH Chemical Safety Assessment**

Take care for general good hygiene and housekeeping.

BORIC ACID**1. Short title of Exposure Scenario 14: Use of abrasives**

Main User Groups	SU 22: Professional uses: Public domain (administration, education, entertainment, services, craftsmen)
Process categories	PROC21: Low energy manipulation of substances bound in materials and/ or articles
Environmental Release Categories	ERC12a: Industrial processing of articles with abrasive techniques (low release)

2.1 Contributing scenario controlling environmental exposure for: ERC12a

The environmental release categories mentioned above are assumed to be the most important ones but other environmental release categories could also be possible.

Product characteristics	Concentration of the Substance in Mixture/Article	Covers percentage substance in the product up to 100 % (unless stated differently).
Amount used	Annual tonnage	30 ton(s)/year (Dilution of 10 ERC12a)
	Annual tonnage	300 ton(s)/year (Dilution of 100 ERC12a)
	Annual tonnage	1700 ton(s)/year (No water emissions ERC12a)
Frequency and duration of use	Continuous exposure	20 days/year
Environment factors not influenced by risk management	Other data. Other information	Local freshwater dilution factor:: 10
Other given operational conditions affecting environmental exposure	Emission or Release Factor: Air	25000 g/ton of product (Dilution of 10, Dilution of 100 ERC12a)
	Emission or Release Factor: Water	25000 g/ton of product (Dilution of 10, Dilution of 100 ERC12a)
	Emission or Release Factor: Air	25000 g/ton of product (No water emissions ERC12a)
Technical conditions and measures at process level (source) to prevent release Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil Organizational measures to prevent/limit release from the site	Air	Substance specific waste air treatment:, Electrostatic precipitation, Cyclones, Treatment of air emissions by bag filters, fabric filter and wet scrubber, Ceramic & metal mash filters, PM10 particles are removed
	Water	Substance specific waste water treatment, Ion exchange, Reverse osmosis (Degradation effectiveness: 40 - 90 %)
Conditions and measures related to sewage treatment plant	Type of Sewage Treatment Plant	Municipal sewage treatment plant
	The concentration of the substance should not exceed 1,75 mg/L in the municipal STP	
Conditions and measures related to external treatment of waste for disposal	Waste treatment	Waste are recycled into the process, Substance containing waste shall be handled as hazardous waste and removed by licensed waste removal company, incinerated or recycled
	Disposal methods	Vacuum up spillage and collect in suitable containers for disposal.

2.2 Contributing scenario controlling worker exposure for: PROC21

Activity	Installation of plasterboard, wood based boards and other products	
Product characteristics	Concentration of the Substance in Mixture/Article	Covers percentage substance in the product up to 1 %.
	Physical Form (at time of use)	solid

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Amount used	The amount used per worker varies from activity to activity
Frequency and duration of use	Covers daily exposures up to 8 hours (unless stated differently).
Other operational conditions affecting workers exposure	Indoor use.
Organisational measures to prevent /limit releases, dispersion and exposure	Ensure operatives are trained to minimise exposures.
Conditions and measures related to personal protection, hygiene and health evaluation	Wear suitable protective clothing.

3. Exposure estimation and reference to its source**Environment**

ERC12a: Estimation based on workplace measurements

Contributing Scenario	Specific conditions	Compartment	Value	Level of Exposure	RCR
ERC12a	Dilution of 10	Fresh water	PEC	1932µg/L	0.956
ERC12a	Dilution of 10	Soil	PEC	0.10mg/kg dry weight (d.w.)	0.018
ERC12a	Dilution of 100	Fresh water	PEC	1932µg/L	0.956
ERC12a	Dilution of 100	Soil	PEC	0.92mg/kg dry weight (d.w.)	0.171
ERC12a	No water discharge to the environment	Soil	PEC	5.4mg/kg dry weight (d.w.)	0.964

Workers

PROC21: MEASE

Contributing Scenario	Specific conditions	Exposure routes	Level of Exposure	RCR
PROC21	---	Dermal worker exposure	0.99mg/m ³	< 0.001
PROC21	---	Inhalation worker exposure	0.005mg/m ³	0.0034

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

Guidance is based on assumed operating conditions which may not be applicable to all sites; thus, scaling may be necessary to define appropriate site-specific risk management measures.

Where other Risk Management Measures/Operational Conditions are adopted, then users should ensure that risks are managed to at least equivalent levels.

Only properly trained persons shall make use of scaling methods while checking whether the OC and RMM are within the boundaries set by the ES

Tonnage calculations have been based on boron such that no RCR exceeds 0.97, using back calculations with the relevant PNEC's when necessary. The equivalent tonnage of product handled on site should be calculated from the conversion factors detailed in the product table. For those operations that handle a combination of borate compounds, the boron equivalent of the combined tonnage cannot exceed the site tonnage value.

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Substance	Formula	Conversion factor for the equivalent dose of B (multiply by)
Boric acid	H_3BO_3	0,1748
Boric oxide	B_2O_3	0,311
Disodium tetraborate anhydrous	$Na_2B_4O_7$	0,2149
Disodium tetraborate pentahydrate	$Na_2B_4O_7 \times 5H_2O$	0,1484
Disodium tetraborate decahydrate	$Na_2B_4O_7 \times 10H_2O$	0,1134
Disodium octaborate tetrahydrate	$Na_2B_8O_{13} \times 4H_2O$	0,2096
Sodium metaborate (anhydrous)	$NaBO_2$	0,1643
Sodium metaborate (dihydrate)	$NaBO_2 \times 2H_2O$	0,1062
Sodium metaborate (tetrahydrate)	$NaBO_2 \times 4H_2O$	0,0784
Sodium pentaborate (anhydrous)	NaB_5O_8	0,2636
Sodium pentaborate (pentahydrate)	$NaB_5O_8 \times 5H_2O$	0,1832

If measured data are not available, the DU may make use of an appropriate scaling tool such as MEASE (www.ebrc.de/mease.html) to estimate the associated exposure.

Additional good practice advice beyond the REACH Chemical Safety Assessment

Take care for general good hygiene and housekeeping.

BORIC ACID**1. Short title of Exposure Scenario 15: Use in agrochemicals**

Main User Groups	SU 22: Professional uses: Public domain (administration, education, entertainment, services, craftsmen)
Process categories	PROC2: Use in closed, continuous process with occasional controlled exposure PROC5: Mixing or blending in batch processes for formulation of preparations and articles (multistage and/ or significant contact) PROC8a: Transfer of substance or preparation (charging/ discharging) from/ to vessels/ large containers at non-dedicated facilities PROC9: Transfer of substance or preparation into small containers (dedicated filling line, including weighing) PROC13: Treatment of articles by dipping and pouring
Environmental Release Categories	ERC8a: Wide dispersive indoor use of processing aids in open systems ERC8c: Wide dispersive indoor use resulting in inclusion into or onto a matrix ERC8d: Wide dispersive outdoor use of processing aids in open systems ERC8f: Wide dispersive outdoor use resulting in inclusion into or onto a matrix

2.1 Contributing scenario controlling environmental exposure for: ERC8a, ERC8c, ERC8d, ERC8f

Product characteristics	Concentration of the Substance in Mixture/Article	Covers percentage substance in the product up to 100 % (unless stated differently).
Amount used	The quantity applied depends upon that necessary to raise the level in the soil to support the crop in question	
Frequency and duration of use	Continuous exposure	Fertilizers containing the substance are only used when there are insufficient substance levels in the soil to support crop growth. They tend not to be used in large quantities nor for long periods of time. The use of a substance containing fertiliser will depend upon the requirements of the crop being grown
Technical conditions and measures at process level (source) to prevent release Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil Organizational measures to prevent/limit release from the site	Water	There are no direct releases to adjacent surface waters, Drift should be minimized
	Soil	Used on soils which have low concentrations of the substance
Conditions and measures related to external treatment of waste for disposal	Waste treatment	Substance containing waste shall be handled as hazardous waste and removed by licensed waste removal company, incinerated or recycled

2.2 Contributing scenario controlling worker exposure for: PROC2

Activity	Fertigation using liquid fertiliser	
Product characteristics	Concentration of the Substance in Mixture/Article	Concentration of substance in product: 0,01 % - 36,0 %
	Physical Form (at time of use)	liquid
Amount used	The amount of fertiliser used at any one time will depend on the area to be fertilised, but is likely to be several tonnes	
Frequency and duration of use	The system runs constantly, with IBC's being changed over once or twice per week (PROC2)	
Technical conditions and measures to control dispersion from source towards the worker	IBC's or silos containing the liquid fertiliser should be connected to a fertigation system which automatically irrigates and fertilises plants in fields or greenhouses	

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	Use closed dosing, transfer, sampling and application systems including connectors.(PROC2)
Organisational measures to prevent /limit releases, dispersion and exposure	Ensure operatives are trained to minimise exposures. Regular inspection and maintenance of equipment and machines.

2.3 Contributing scenario controlling worker exposure for: PROC5, PROC8a

Product characteristics	Concentration of the Substance in Mixture/Article	Concentration of substance in product: 0,06% - 4,5%
	Physical Form (at time of use)	granules
Amount used	The amount of fertiliser used at any one time will depend on the area to be fertilised, but is likely to be several tonnes	
Frequency and duration of use	Exposure duration per day	60 min
	Frequency of use	2 days/year
Other operational conditions affecting workers exposure	Indoor and outdoor use.	
	Assumes activities are at ambient temperature.	
Technical conditions and measures to control dispersion from source towards the worker	Provide a good standard of general ventilation. Natural ventilation is from doors, windows etc. Controlled ventilation means air is supplied or removed by a powered fan.	
Organisational measures to prevent /limit releases, dispersion and exposure	Ensure operatives are trained to minimise exposures. Regular inspection and maintenance of equipment and machines.	
Conditions and measures related to personal protection, hygiene and health evaluation	In case of dust or aerosol formation: use respiratory protection with approved filter (P2)	
	or Particle filter:P3	
	These respirators, if worn correctly, with a good face fit, will provide sufficient protection	
	Where tightly fitting RPE is used, the worker should be face fit tested to ensure that a good face seal can be obtained (Efficiency: 90 - 95 %)	
	Wear suitable protective clothing.	
	Wear protective gloves.	

2.4 Contributing scenario controlling worker exposure for: PROC9

Activity	Transfer of liquid foliar fertilizer	
Product characteristics	Concentration of the Substance in Mixture/Article	Concentration of substance in product: 0,01 % - 36,0 %
	Physical Form (at time of use)	Aqueous solution
Amount used	The amount of fertiliser used at any one time will depend on the area to be fertilised, but is likely to be several tonnes	
Frequency and duration of use	Covers daily exposures up to 8 hours (unless stated differently)., The application of liquid foliar fertiliser could be carried out using a knapsack sprayer or a tractor-pulled spraybar, If spraying using a backpack, the worker may need to refill his backpack several times during a shift, probably from a tank taken to the field, If spraying using a spray bar, the tank may need to be refilled several times during a shift. This is likely to be pumped from a tank, or may be gravity filled	
Other operational conditions affecting workers exposure	Outdoor use.	
Organisational measures to prevent /limit releases, dispersion and exposure	Ensure operatives are trained to minimise exposures. Regular inspection and maintenance of equipment and machines.	

2.5 Contributing scenario controlling worker exposure for: PROC13

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Activity	Application of liquid foliar fertiliser	
Product characteristics	Concentration of the Substance in Mixture/Article	Concentration of substance in product: 0,01 % - 36,0 %
	Physical Form (at time of use)	liquid
Amount used	The amount of fertiliser used at any one time will depend on the area to be fertilised, but is likely to be several tonnes	
Frequency and duration of use	Covers daily exposures up to 8 hours (unless stated differently)., The application of liquid foliar fertiliser could be carried out using a knapsack sprayer or a tractor-pulled spraybar	
Other operational conditions affecting workers exposure	Outdoor use.	
Technical conditions and measures to control dispersion from source towards the worker	Use a tractor mounted spray bar with closed tractor cab and air condition	
Organisational measures to prevent /limit releases, dispersion and exposure	Ensure operatives are trained to minimise exposures. Regular inspection and maintenance of equipment and machines.	

3. Exposure estimation and reference to its source**Environment**

Significant emissions to the terrestrial environment are not expected.

Workers

PROC5, PROC8a: Advanced REACH Tool (ART model)

PROC5, PROC8a: Workplace measurements

PROC8a, PROC9: MEASE

Contributing Scenario	Specific conditions	Exposure routes	Level of Exposure	RCR
PROC8a	---	Dermal worker exposure	0.014mg/kg bw/day	< 0.001
PROC8a	without gloves, Concentration of substance in product : 0% - 5%	Dermal worker exposure	0.019mg/kg bw/day	< 0.001
PROC5, PROC8a	no respiratory protection (RPE), Direct discharge	Inhalation worker exposure	0.09mg/m ³	0.062
PROC5, PROC8a	Solid, high dustiness., (open systems)	Inhalation worker exposure	1.22mg/m ³	0.84
PROC9	application as solution, Concentration of substance in product : 0% - 5%, during 15 mins - 1 hour, material transfers	Inhalation worker exposure	0.29mg/m ³	< 0.001

There is no opportunity for inhalation exposure as the fertiliser is liquid and is fed via closed system to the soil. There may be the opportunity for dermal exposure during changeover of IBCs or during bulk deliveries of liquid fertilisers, when pipework is connected and disconnected.

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

Guidance is based on assumed operating conditions which may not be applicable to all sites; thus, scaling may

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be necessary to define appropriate site-specific risk management measures.

Where other Risk Management Measures/Operational Conditions are adopted, then users should ensure that risks are managed to at least equivalent levels.

Only properly trained persons shall make use of scaling methods while checking whether the OC and RMM are within the boundaries set by the ES

Tonnage calculations have been based on boron such that no RCR exceeds 0.97, using back calculations with the relevant PNEC's when necessary. The equivalent tonnage of product handled on site should be calculated from the conversion factors detailed in the product table. For those operations that handle a combination of borate compounds, the boron equivalent of the combined tonnage cannot exceed the site tonnage value.

Substance	Formula	Conversion factor for the equivalent dose of B (multiply by)
Boric acid	H_3BO_3	0,1748
Boric oxide	B_2O_3	0,311
Disodium tetraborate anhydrous	$Na_2B_4O_7$	0,2149
Disodium tetraborate pentahydrate	$Na_2B_4O_7 \times 5H_2O$	0,1484
Disodium tetraborate decahydrate	$Na_2B_4O_7 \times 10H_2O$	0,1134
Disodium octaborate tetrahydrate	$Na_2B_8O_{13} \times 4H_2O$	0,2096
Sodium metaborate (anhydrous)	$NaBO_2$	0,1643
Sodium metaborate (dihydrate)	$NaBO_2 \times 2H_2O$	0,1062
Sodium metaborate (tetrahydrate)	$NaBO_2 \times 4H_2O$	0,0784
Sodium pentaborate (anhydrous)	NaB_5O_8	0,2636
Sodium pentaborate (pentahydrate)	$NaB_5O_8 \times 5H_2O$	0,1832

If measured data are not available, the DU may make use of an appropriate scaling tool such as MEASE (www.ebrc.de/mease.html) to estimate the associated exposure.

For further information on the assessment method, see: <http://www.advancedreachtool.com>

Additional good practice advice beyond the REACH Chemical Safety Assessment

In line with the requirements of good agricultural practice, agricultural soil should be assessed prior to application of the substance and the application rate should be adjusted according to the results of the assessment and crop requirements.

Take care for general good hygiene and housekeeping.

BORIC ACID**1. Short title of Exposure Scenario 16: Industrial formulation**

Main User Groups	SU 3: Industrial uses: Uses of substances as such or in preparations at industrial sites
Process categories	<p>PROC1: Use in closed process, no likelihood of exposure</p> <p>PROC2: Use in closed, continuous process with occasional controlled exposure</p> <p>PROC3: Use in closed batch process (synthesis or formulation)</p> <p>PROC4: Use in batch and other process (synthesis) where opportunity for exposure arises</p> <p>PROC5: Mixing or blending in batch processes for formulation of preparations and articles (multistage and/ or significant contact)</p> <p>PROC8a: Transfer of substance or preparation (charging/ discharging) from/ to vessels/ large containers at non-dedicated facilities</p> <p>PROC8b: Transfer of substance or preparation (charging/ discharging) from/ to vessels/ large containers at dedicated facilities</p> <p>PROC9: Transfer of substance or preparation into small containers (dedicated filling line, including weighing)</p> <p>PROC14: Production of preparations or articles by tableting, compression, extrusion, pelletisation</p> <p>PROC15: Use as laboratory reagent</p> <p>PROC22: Potentially closed processing operations with minerals/ metals at elevated temperature; Industrial setting</p> <p>PROC23: Open processing and transfer operations with minerals/ metals at elevated temperature</p> <p>PROC26: Handling of solid inorganic substances at ambient temperature</p>
Environmental Release Categories	ERC3: Formulation in materials

2.1 Contributing scenario controlling environmental exposure for: ERC3

Product characteristics	Concentration of the Substance in Mixture/Article	Covers percentage substance in the product up to 100 % (unless stated differently).
Amount used	Annual amount per site	1150 ton(s)/year
Frequency and duration of use	Continuous exposure	100 days/year
Environment factors not influenced by risk management	Other data. Other information	Local freshwater dilution factor:: 10
Other given operational conditions affecting environmental exposure	Emission or Release Factor: Air	36562 g/ton of product
	Emission or Release Factor: Water	2000 g/ton of product
Technical conditions and measures at process level (source) to prevent release Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil Organizational measures to prevent/limit release from the site	Air	Required removal efficiency for air can be achieved using on-site technologies, either alone or in combination., Treatment of air emissions by bag filters, fabric filter and wet scrubber, Electrostatic precipitation, Cyclones, ceramic filters
	Water	Substance specific waste water treatment, Ion exchange, Reverse osmosis (Degradation effectiveness: 40 - 90 %)
Conditions and measures related to sewage treatment plant	Type of Sewage Treatment Plant	Municipal sewage treatment plant
	The concentration of the substance should not exceed 1,75 mg/L in the municipal STP	
Conditions and measures related to external treatment of waste for disposal	Waste treatment	Send back to the process
	Disposal methods	Vacuum up spillage and collect in suitable containers for disposal., Dispose of as hazardous waste in compliance with local and national

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regulations.

2.2 Contributing scenario controlling worker exposure for: PROC2, PROC4

Product characteristics	Concentration of the Substance in Mixture/Article	Covers concentrations more than 25%
	Physical Form (at time of use)	Solid, high dustiness
Amount used	The amount used per worker varies from activity to activity	
Frequency and duration of use	Exposure duration per day	60 min
Technical conditions and measures to control dispersion from source towards the worker	Provide local exhaust ventilation (LEV).(PROC4)	
Conditions and measures related to personal protection, hygiene and health evaluation	Wear protective gloves.	
	Limit the substance content in the mixture to 25 %.(PROC4)	

2.3 Contributing scenario controlling worker exposure for: PROC4, PROC5, PROC8b

Activity	Covers reloading, mixing or compounding and associated activities in the Process Categories listed above	
Product characteristics	Concentration of the Substance in Mixture/Article	Covers percentage substance in the product up to 25 %.
	Physical Form (at time of use)	Powdered substance, granules
Amount used	Would vary by requirements and by facility	
Frequency and duration of use	Exposure duration per day	60 min
Other operational conditions affecting workers exposure	Indoor use.	
	Assumes activities are at ambient temperature.	
Technical conditions and measures to control dispersion from source towards the worker	Provide extract ventilation to points where emissions occur. Use closed dosing, transfer, sampling and application systems including connectors. Single use bags can be opened by the use of sharp prongs at the discharge hopper. When the big bag is placed at the discharge hopper and lowered, the prongs cut into the base of the bag releasing the substance into the hopper. This removes the operator from the immediate vicinity and contributes to a reduction in exposure	
Organisational measures to prevent /limit releases, dispersion and exposure	Provide basic employee training to prevent/minimize exposures Regular inspection and maintenance of equipment and machines.	
Conditions and measures related to personal protection, hygiene and health evaluation	Wear suitable protective clothing. Safety shoes Safety glasses In case of dust or aerosol formation: use respiratory protection with approved filter (P2) or Particle filter:P3	

2.4 Contributing scenario controlling worker exposure for: PROC8a, PROC8b

Activity	Equipment maintenance	
Product characteristics	Concentration of the Substance in Mixture/Article	Covers percentage substance in the product up to 100 % (unless stated differently).
	Physical Form (at time of use)	Powdered substance, granules

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Amount used	Would vary by requirements and by facility
Frequency and duration of use	Covers daily exposures up to 8 hours (unless stated differently).
Other operational conditions affecting workers exposure	Indoor and outdoor use.
Technical conditions and measures to control dispersion from source towards the worker	Worker in separate cabine without specific ventilation Provide extract ventilation to material transfer points and other openings.
Organisational measures to prevent /limit releases, dispersion and exposure	Ensure operatives are trained to minimise exposures. Regular inspection and maintenance of equipment and machines.
Conditions and measures related to personal protection, hygiene and health evaluation	Wear suitable protective clothing. Safety shoes Safety glasses In case of dust or aerosol formation: use respiratory protection with approved filter (P2) or Particle filter:P3

2.5 Contributing scenario controlling worker exposure for: PROC8b

large scale

Activity	Bulk loading (including marine vessel/barge, rail/road car and IBC loading)	
Product characteristics	Concentration of the Substance in Mixture/Article	Covers percentage substance in the product up to 100 % (unless stated differently).
	Physical Form (at time of use)	Powdered substance, granular-like
Amount used	Amount per Use	40000 kg
Frequency and duration of use	Exposure duration	60 - 120 min
Other operational conditions affecting workers exposure	Indoor use. Assumes activities are at ambient temperature.	
Technical conditions and measures to control dispersion from source towards the worker	Transport over pipes, technical barrel filling/emptying of barrel with automatic systems (suction pumps etc.) Use closed dosing, transfer, sampling and application systems including connectors. Exhaust ventilation equipped with filters. Provide dust filtration for air displaced from the silo during filling.	
Organisational measures to prevent /limit releases, dispersion and exposure	Provide basic employee training to prevent/minimize exposures Regular inspection and maintenance of equipment and machines.	
Conditions and measures related to personal protection, hygiene and health evaluation	Wear protective clothing. Wear protective gloves. Safety glasses Safety goggles	

2.6 Contributing scenario controlling worker exposure for: PROC9

Product characteristics	Concentration of the Substance in Mixture/Article	Concentration of substance in product: 5% - 25%
	Physical Form (at time of use)	Solid, high dustiness, liquid
Frequency and duration of use	Exposure duration per day	> 240 min
Technical conditions and measures to control dispersion from source towards the worker	Provide local exhaust ventilation (LEV).	
Conditions and measures related to personal protection, hygiene	Wear protective gloves.	

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and health evaluation

2.7 Contributing scenario controlling worker exposure for: PROC9

small scale

Product characteristics	Concentration of the Substance in Mixture/Article	Covers percentage substance in the product up to 40 %
	Physical Form (at time of use)	solid, liquid, pasty
Amount used	The amount used per worker varies from activity to activity	
Frequency and duration of use	Covers daily exposures up to 8 hours (unless stated differently).	
Other operational conditions affecting workers exposure	Indoor use.	
Technical conditions and measures to control dispersion from source towards the worker	Automate activity where possible. Provide extract ventilation to points where emissions occur. Provide local exhaust ventilation (LEV). Provide a good standard of general ventilation. Natural ventilation is from doors, windows etc. Controlled ventilation means air is supplied or removed by a powered fan.	
Organisational measures to prevent /limit releases, dispersion and exposure	Ensure operatives are trained to minimise exposures. Regular inspection and maintenance of equipment and machines.	

2.8 Contributing scenario controlling worker exposure for: PROC14

Product characteristics	Concentration of the Substance in Mixture/Article	Covers percentage substance in the product up to 25 %.
	Physical Form (at time of use)	Powdered substance, granular-like
Amount used	The amount used per worker varies from activity to activity	
Frequency and duration of use	Covers daily exposures up to 8 hours (unless stated differently).	
Other operational conditions affecting workers exposure	Indoor use.	
Technical conditions and measures to control dispersion from source towards the worker	Transfer via enclosed lines. Provide local exhaust ventilation (LEV). Provide a good standard of general ventilation. Natural ventilation is from doors, windows etc. Controlled ventilation means air is supplied or removed by a powered fan.	
Organisational measures to prevent /limit releases, dispersion and exposure	Provide basic employee training to prevent/minimize exposures Regular inspection and maintenance of equipment and machines.	
Conditions and measures related to personal protection, hygiene and health evaluation	Wear suitable protective clothing. Safety shoes Safety glasses In case of dust or aerosol formation: use respiratory protection with approved filter (P2) or Particle filter:P3	

2.9 Contributing scenario controlling worker exposure for: PROC15

Product characteristics	Concentration of the Substance in Mixture/Article	Concentration of substance in product: 5% - 25%
	Physical Form (at time of use)	Powdered substance, granular-like
Amount used	Amount per Use	1 kg
Frequency and duration of use	Covers daily exposures up to 8 hours (unless stated differently).	

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Technical conditions and measures to control dispersion from source towards the worker	Handle in a fume cupboard or under extract ventilation.
Organisational measures to prevent /limit releases, dispersion and exposure	Ensure operatives are trained to minimise exposures. Regular inspection and maintenance of equipment and machines.
Conditions and measures related to personal protection, hygiene and health evaluation	Wear suitable protective clothing. Safety shoes Safety glasses Wear protective gloves.

2.10 Contributing scenario controlling worker exposure for: PROC1, PROC2, PROC3, PROC22, PROC23

Activity	Potentially closed processing operations at elevated temperature.	
Product characteristics	Concentration of the Substance in Mixture/Article	Covers percentage substance in the product up to 100 % (unless stated differently).
	Physical Form (at time of use)	Powdered substance, granules
Amount used	The amount used per worker varies from activity to activity	
Frequency and duration of use	Frequency of use	24 hours/day
	Frequency of use	365 days/year
Other operational conditions affecting workers exposure	Indoor use.	
	Operation is carried out at elevated temperature (> 20 °C above ambient temperature).	
Technical conditions and measures to control dispersion from source towards the worker	Automate activity where possible. Provide local exhaust ventilation with enclosure of the source Where there are breaches in the closed system, such as pouring and removal of slag in metal production, LEV is used to control fumes. Worker in separate cabine without specific ventilation	
Organisational measures to prevent /limit releases, dispersion and exposure	Provide basic employee training to prevent/minimize exposures Regular inspection and maintenance of equipment and machines. Workers in the risky process/areas identified should be trained a) to avoid to work without respiratory protection and b) to understand the irritating properties and, especially, the respiratory inhalation effects and c) to follow the safer procedures instructed by the employer.	
Conditions and measures related to personal protection, hygiene and health evaluation	In case of dust or aerosol formation: use respiratory protection with approved filter (P2) or Particle filter:P3 Use battery-powered air fed helmets Operatives wear overalls or heavy heat resistant clothing	
	Equipment cleaning and maintenance	Wear protective gloves. Safety glasses Safety goggles

2.11 Contributing scenario controlling worker exposure for: PROC23

Product characteristics	Concentration of the Substance in Mixture/Article	Concentration of substance in product: 1% - 5%
	Physical Form (at time of use)	Solid, low dustiness
Frequency and duration of use	Exposure duration per day	< 15 min
Technical conditions and measures to control dispersion from source towards the worker	Provide local exhaust ventilation (LEV).	

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Conditions and measures related to personal protection, hygiene and health evaluation

Wear respiratory protection.
With respiratory mask APF 40

2.12 Contributing scenario controlling worker exposure for: PROC1, PROC2, PROC3

Product characteristics	Concentration of the Substance in Mixture/Article	Covers percentage substance in the product up to 100 % (unless stated differently).
	Physical Form (at time of use)	Powdered substance, granules
Amount used	Amount per Shift	1000 kg
	The amount used per worker varies from activity to activity	
Other operational conditions affecting workers exposure	Indoor use.	
	Assumes activities are at ambient temperature.	
Technical conditions and measures to control dispersion from source towards the worker	Use closed dosing, transfer, sampling and application systems including connectors. Provide extraction ventilation at points where emissions occur. Where there are breaches in the closed system, such as pouring and removal of slag in metal production, LEV is used to control fumes.	
Organisational measures to prevent /limit releases, dispersion and exposure	Provide basic employee training to prevent/minimize exposures	
	Regular inspection and maintenance of equipment and machines.	
Conditions and measures related to personal protection, hygiene and health evaluation	Wear suitable protective clothing.	
	Safety shoes Safety glasses In case of dust or aerosol formation: use respiratory protection with approved filter (P2) or Particle filter:P3	

3. Exposure estimation and reference to its source**Environment**

ERC3: Estimation based on workplace measurements

Contributing Scenario	Specific conditions	Compartment	Value	Level of Exposure	RCR
ERC3	---	Soil	PEC	5.2mg/kg dry weight (d.w.)	0.97
ERC3	---	Water	PEC	1206µg/L	0.597
ERC3	---	Fresh water sediment	PEC	1.67mg/kg dry weight (d.w.)	0.93

Workers

PROC8b: Advanced REACH Tool (ART model)

PROC2, PROC4, PROC8a, PROC9, PROC14, PROC15, PROC23: MEASE

PROC1, PROC2, PROC3, PROC4, PROC5, PROC8b, PROC22, PROC23: Workplace measurements

PROC1, PROC2, PROC3, PROC8a, PROC8b, PROC9, PROC14, PROC15, PROC22, PROC23: Advanced REACH Tool (ART model) (inhalative exposure)

Contributing Scenario	Specific conditions	Exposure routes	Level of Exposure	RCR
PROC4	Concentrations >= 0% - <= 25%	Dermal worker exposure	0.48mg/kg bw/day	---
PROC2	---	Dermal worker exposure	0.005mg/kg bw/day	---
PROC2	---	Inhalable dust.	0.002mg/kg/day	---

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PROC2	Concentrations $\geq 0\%$ - $\leq 25\%$	Inhalation worker exposure	0.001mg/kg bw/day	---
PROC4, PROC5	90th percentile value, small scale	Inhalation worker exposure	0.78mg/m ³	0.54
PROC4	Solid, high dustiness., during 15 mins - 1 hour, small scale	Dermal worker exposure	0.48mg/kg bw/day	< 0.001
PROC4, PROC5, PROC8b	90th percentile value, With respiratory protection, half mask	Inhalation worker exposure	0.2mg/m ³	0.14
PROC4	Solid, high dustiness., during 15 mins - 1 hour, large scale	Dermal worker exposure	4.8mg/kg bw/day	0.001
PROC8a, PROC8b	90th percentile value, no respiratory protection (RPE)	Inhalation worker exposure	1.33mg/m ³	0.92
PROC8a	Solid, high dustiness., during 1 - 4 hours	Dermal worker exposure	0.173mg/kg bw/day	< 0.001
PROC8b	---	Inhalation worker exposure	0.016mg/m ³	0.011
PROC8b	with local exhaust ventilation, Outdoor use., 90th percentile value	Inhalation worker exposure	0.03mg/m ³	0.021
PROC2	Solid, high dustiness., < 15 min/day	Dermal worker exposure	0.024mg/kg bw/day	---
PROC9	Solid, high dustiness., Concentration of substance in product: 5% - 25%	Dermal worker exposure	0.144mg/kg bw/day	---
PROC9	liquid, Concentration of substance in product: 5% - 25%	Dermal worker exposure	0.014mg/kg bw/day	---
PROC9	90th percentile value	Inhalation worker exposure	0.001 - 0.4mg/m ³	---
PROC9	90th percentile value, liquid	Inhalation worker exposure	0.01mg/m ³	---
PROC14	90th percentile value	Inhalable dust.	7mg/m ³	---
PROC14	> 4 h (half tour)	Dermal worker exposure	0.024mg/kg bw/day	---
PROC15	90th percentile value	Inhalation worker exposure	0.16mg/m ³	---
PROC15	Solid, high dustiness., during 15 mins - 1 hour, with local exhaust ventilation, without gloves	Dermal worker exposure	0.014mg/kg bw/day	---
PROC1, PROC2, PROC3, PROC22, PROC23	90th percentile value, without respiratory protection	Inhalation worker exposure	0.08mg/m ³	0.06
PROC23	Solid, low dustiness., Concentration of substance in product : 0% - 5%, during <15 mins	Inhalation worker exposure	0.01mg/m ³	0.0069
PROC2	Solid, high dustiness., during 15 mins - 1 hour	Dermal worker exposure	0.048mg/kg bw/day	< 0.001

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PROC23	With respiratory mask APF 40	Inhalation worker exposure	< 0.001mg/m ³	---
PROC1, PROC2, PROC3	90th percentile value, no respiratory protection (RPE)	Inhalation worker exposure	0.08mg/m ³	0.06
PROC2	cleaning, during 15 mins - 1 hour	Dermal worker exposure	0.048mg/kg bw/day	< 0.001

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

Guidance is based on assumed operating conditions which may not be applicable to all sites; thus, scaling may be necessary to define appropriate site-specific risk management measures.

Where other Risk Management Measures/Operational Conditions are adopted, then users should ensure that risks are managed to at least equivalent levels.

Only properly trained persons shall make use of scaling methods while checking whether the OC and RMM are within the boundaries set by the ES

Tonnage calculations have been based on boron such that no RCR exceeds 0.97, using back calculations with the relevant PNEC's when necessary. The equivalent tonnage of product handled on site should be calculated from the conversion factors detailed in the product table. For those operations that handle a combination of borate compounds, the boron equivalent of the combined tonnage cannot exceed the site tonnage value.

Substance	Formula	Conversion factor for the equivalent dose of B (multiply by)
Boric acid	H ₃ BO ₃	0,1748
Boric oxide	B ₂ O ₃	0,311
Disodium tetraborate anhydrous	Na ₂ B ₄ O ₇	0,2149
Disodium tetraborate pentahydrate	Na ₂ B ₄ O ₇ x 5H ₂ O	0,1484
Disodium tetraborate decahydrate	Na ₂ B ₄ O ₇ x 10H ₂ O	0,1134
Disodium octaborate tetrahydrate	Na ₂ B ₈ O ₁₃ x 4H ₂ O	0,2096
Sodium metaborate (anhydrous)	NaBO ₂	0,1643
Sodium metaborate (dihydrate)	NaBO ₂ x 2H ₂ O	0,1062
Sodium metaborate (tetrahydrate)	NaBO ₂ x 4H ₂ O	0,0784
Sodium pentaborate (anhydrous)	NaB ₅ O ₈	0,2636
Sodium pentaborate (pentahydrate)	NaB ₅ O ₈ x 5H ₂ O	0,1832

If measured data are not available, the DU may make use of an appropriate scaling tool such as MEASE (www.ebrc.de/mease.html) to estimate the associated exposure.

For further information on the assessment method, see: <http://www.advancedreachtool.com>

Additional good practice advice beyond the REACH Chemical Safety Assessment

Take care for general good hygiene and housekeeping.

BORIC ACID**1. Short title of Exposure Scenario 17: Use in building and construction work**

Main User Groups	SU 21: Consumer uses: Private households (= general public = consumers)
Chemical product category	PC0: Other (use UCN codes) PC1: Adhesives, sealants PC9b: Fillers, putties, plasters, modelling clay
Environmental Release Categories	ERC10a: Wide dispersive outdoor use of long-life articles and materials with low release ERC11a: Wide dispersive indoor use of long-life articles and materials with low release

2.1 Contributing scenario controlling environmental exposure for: ERC10a, ERC11a

Product characteristics	Concentration of the Substance in Mixture/Article	Covers percentage substance in the product up to 100 % (unless stated differently).
Amount used	Amounts used in the EU (tonnes/year)	1.1 Million tonnes/year
Frequency and duration of use	Continuous exposure	365 days/year, Dispersive use.
Environment factors not influenced by risk management	Other data.Other information	Local freshwater dilution factor:: 10
Other given operational conditions affecting environmental exposure	Emission or Release Factor: Water	32000 g/ton of product
Technical conditions and measures at process level (source) to prevent release Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil Organizational measures to prevent/limit release from the site	Air	Air emission controls are not applicable as there is no direct release to air.
Conditions and measures related to sewage treatment plant	Type of Sewage Treatment Plant	Municipal sewage treatment plant
	Flow rate of sewage treatment plant effluent	2,000 m3/d
	If sites discharge to a municipal STP the concentration of the substance should not exceed 10 mg/l in the municipal STP	
Conditions and measures related to external treatment of waste for disposal	Disposal methods	Dispose of waste in accordance with environmental legislation.

2.2 Contributing scenario controlling consumer exposure for: PC0, AC4**Use of substance containing construction materials**

Product characteristics	Concentration of the Substance in Mixture/Article	Covers concentrations up to 0,15%
	Physical Form (at time of use)	Solid substance
Frequency and duration of use	Exposure duration per day	480 min
	Frequency of use	5 days/year
Human factors not influenced by risk management	Breathing rate	34.7 m3/day(PC0)
	Body weight	60 kg(PC0)
	Breathing rate	20 m3/day(AC4)

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	Body weight	60 - 70 kg(AC4)
Other given operational conditions affecting consumers exposure	Indoor and outdoor use.	
Conditions and measures related to protection of consumer (e.g. behavioural advice, personal protection and hygiene)	Consumer Measures	Provide a good standard of general ventilation. Natural ventilation is from doors, windows etc. Controlled ventilation means air is supplied or removed by a powered fan.

2.3 Contributing scenario controlling consumer exposure for: PC0

Installation of substance containing cellulose insulation

Product characteristics	Concentration of the Substance in Mixture/Article	Covers concentrations up to 18%
Frequency and duration of use	Frequency of use	480 minutes/day
Human factors not influenced by risk management	Breathing rate	34.7 m3/day
	Body weight	60 kg

2.4 Contributing scenario controlling consumer exposure for: PC0

Use in mattresses as flame retardants

Human factors not influenced by risk management	Adults; bodyweight for adult consumers: 60 kg(PC0)	
	Body weight	20 kg(child PC0)

2.5 Contributing scenario controlling consumer exposure for: PC1, AC8

Mouthing of card board and oral contact with substance

Product characteristics	Concentration of the Substance in Mixture/Article	Covers concentrations up to 2%
	Physical Form (at time of use)	Massive objects
Amount used	Amount used per event (oral exposure)	2 g
Frequency and duration of use	Occasional exposure	
Human factors not influenced by risk management	Body weight	20 kg(child PC1)

2.6 Contributing scenario controlling consumer exposure for: PC9b: Modelling clay, AC10

Product characteristics	Concentration of the Substance in Mixture/Article	Covers concentrations up to 8%
Human factors not influenced by risk management	Body weight	20 kg
Conditions and measures related to protection of consumer (e.g. behavioural advice, personal protection and hygiene)	Consumer Measures	Limit the concentration of the substance to 5,75% Instructions addressed to the consumer via product labelling
	Consumer Measures	Instructions addressed to the consumer via product labelling

3. Exposure estimation and reference to its source

Environment

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ERC10a, ERC11a: METALS EUSES IT tool

Contributing Scenario	Specific conditions	Compartment	Value	Level of Exposure	RCR
ERC10a, ERC11a	---	Water	PEC	1021 µg/L	0.505
ERC10a, ERC11a	---	Sewage treatment plant (STP)	PEC	9644 µg/L	0.964

Consumers

PC1: Estimation based on measured data

PC9b: Other measured data

PC0: Estimation based on published data

AC4: Estimation based on workplace measurements

PC0, AC4: Workplace measurements

Contributing Scenario	Specific conditions	Exposure routes	Level of Exposure	RCR
PC0, AC4	---	Inhalable dust.	0.34mg/m ³	---
PC0	60kg body weight, worst-case	Consumer inhalation exposure	1.72 .10-5 mg/m ³	---
AC4	---	Consumer inhalation exposure	0.0000983mg/kg/day	---
PC0	---	Consumer inhalation exposure	0.0636mg/kg/day	---
PC0	adult	Consumer dermal exposure	1mg/kg/day	---
PC0	---	Consumer inhalation exposure	5.2 .10-6 mg/m ³	---
PC0	---	Consumer oral exposure	0.0028mg/kg/day	---
PC0	children	Consumer dermal exposure	1.76mg/kg/day	---
PC1	worst-case, child	Consumer oral exposure	0.1mg/kg/day	---
PC9b	worst-case, child	Consumer oral exposure	3.87mg/kg/day	---
PC9b	worst-case, child	Consumer dermal exposure	0.00438mg/kg/day	---

Estimated dermal exposure value is regarded to be negligible. Estimated inhalative exposure value is regarded to be negligible.

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

Guidance is based on assumed operating conditions which may not be applicable to all sites; thus, scaling may be necessary to define appropriate site-specific risk management measures.

Where other Risk Management Measures/Operational Conditions are adopted, then users should ensure that risks are managed to at least equivalent levels.

Only properly trained persons shall make use of scaling methods while checking whether the OC and RMM are within the boundaries set by the ES

Tonnage calculations have been based on boron such that no RCR exceeds 0.97, using back calculations with the relevant PNEC's when necessary. The equivalent tonnage of product handled on site should be calculated from the conversion factors detailed in the product table. For those operations that handle a combination of borate compounds, the boron equivalent of the combined tonnage cannot exceed the site tonnage value.

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Substance	Formula	Conversion factor for the equivalent dose of B (multiply by)
Boric acid	H_3BO_3	0,1748
Boric oxide	B_2O_3	0,311
Disodium tetraborate anhydrous	$\text{Na}_2\text{B}_4\text{O}_7$	0,2149
Disodium tetraborate pentahydrate	$\text{Na}_2\text{B}_4\text{O}_7 \times 5\text{H}_2\text{O}$	0,1484
Disodium tetraborate decahydrate	$\text{Na}_2\text{B}_4\text{O}_7 \times 10\text{H}_2\text{O}$	0,1134
Disodium octaborate tetrahydrate	$\text{Na}_2\text{B}_8\text{O}_{13} \times 4\text{H}_2\text{O}$	0,2096
Sodium metaborate (anhydrous)	NaBO_2	0,1643
Sodium metaborate (dihydrate)	$\text{NaBO}_2 \times 2\text{H}_2\text{O}$	0,1062
Sodium metaborate (tetrahydrate)	$\text{NaBO}_2 \times 4\text{H}_2\text{O}$	0,0784
Sodium pentaborate (anhydrous)	$\text{NaB}_5\text{O}_{10}$	0,2636
Sodium pentaborate (pentahydrate)	$\text{NaB}_5\text{O}_{10} \times 5\text{H}_2\text{O}$	0,1832

The ConsExpo model has been used to estimate consumer exposures unless otherwise indicated.
Only properly trained persons shall make use of scaling methods while checking whether the OC and RMM are within the boundaries set by the ES