



EXPOSURE SCENARIO FOR COMMUNICATION

Nuclear applications

Substance Information:

Substance	CAS Number	EC Number
Boric acid	10043-35-3	233-139-2
Boric oxide	1303-86-2	215-125-8
Disodium tetraborate	1330-43-4	215-540-4
Sodium pentaborate	12007-92-0	234-522-7
Dipotassium tetraborate	1332-77-0	215-575-5
Potassium pentaborate	11128-29-3	234-371-7

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0. General information

0.1 Qualitative assessment – Additional conditions and measures based on human health classification

The borates which are covered in this ES for communication are classified as follows:

Substance	CLP
Boric acid	Repro 1B (H360)
Boric oxide	Repro 1B (H360)
Disodium tetraborate	Repro 1B (H360) Eye Irrit 2 (H319)
Sodium pentaborate	Repro 2 (H361)
Dipotassium tetraborate	Repro 2 (H361)
Potassium pentaborate	Repro 2 (H361)

Hence, specific conditions of use (OCs and RMMs) should be implemented and PPE should be in place if the respective concentration is higher than the specific concentration limit (SCL) and exposure is expected.

The following measures are suggested to ensure that the risk attributed to the classification as toxic to reproduction (H360 and H361) is adequately controlled:

PPE

- Wear substance/task appropriate respirator;
- Wear substance/task appropriate gloves;
- Wear full skin coverage with appropriate barrier material;
- Wear chemical goggles.

General OCs and RMMs

- Ensure that any measure to eliminate exposure is considered;
- Ensure a very high level of containment, except for short term exposures e.g. taking samples;
- A closed system designed to allow for easy maintenance is assumed;
- (If possible) ensure equipment is kept under negative pressure;
- Assumes that staff is controlled upon entry to work area;
- Ensure all equipment well maintained;
- Assumes a permit to work for maintenance work;
- Assumes regular cleaning of equipment and work area;
- Ensure management/supervision in place to check that the RMMs in place are being used correctly and OCs followed;
- Ensure training for staff on good practice;
- Ensure procedures and training for emergency decontamination and disposal;
- Assumes a good standard of personal hygiene;
- Ensure that special instructions are obtained before use;
- Ensure that the substance is not handled until all safety precautions have been read and understood;
- Assumes medical advice/attention if exposed or concerned;
- Ensure that the substance is stored locked up.

Additionally, for **Disodium tetraborate** which is classified as Eye Irritant 2 (H319), the following measures are suggested to ensure that the risk is adequately controlled:

- Assumes thorough washing after handling.
- Ensure that eyes are rinsed cautiously with water for several minutes if substance is the eyes. Also, ensure to remove contact lenses, if present and easy to do and continue rinsing afterwards;
- Assumes medical advice/attention if eye irritation persists.



0.2 Information regarding exposure assessment and Boron equivalent

For comparative purposes, exposures to borates are expressed in terms of boron (B) equivalents based on the fraction of boron in the source substance on a molecular weight basis. The exposure assessment is conducted on the basis of elemental Boron, hence all values indicated in the ES for communication are boron equivalents.

Table 1 Conversion factors of Boron equivalents

Substance	Boron equivalent	
Boric acid (H_3BO_3)	0.1748	
Boric oxide (B_2O_3)	0.311	
Disodium tetraborate	anhydrous ($Na_2B_4O_7$)	0.2149
	pentahydrate ($Na_2B_4O_7 \cdot 5 H_2O$)	0.1484
	decahydrate ($Na_2B_4O_7 \cdot 10 H_2O$)	0.1134
Sodium pentaborate	anhydrous (NaB_5O_8)	0.2636
	pentahydrate ($NaB_5O_8 \cdot 5 H_2O$)	0.1832
Dipotassium tetraborate	anhydrous ($K_2B_4O_7$)	0.185
	tetrahydrate ($K_2B_4O_7 \cdot 4 H_2O$)	0.1415
Potassium pentaborate	anhydrous ($B_2K_2O_8$)	0.244
	tetrahydrate ($B_2K_2O_8 \cdot 4 H_2O$)	0.1843

Environmental exposure assessment

When using a borate or boric acid the amount of boron indicated in the environmental exposure assessment, i.e. the “daily use amount per site”, the “annual amount per site”, can be recalculated using the respective conversion factor as indicated in the table above (Table 1). Also, the release rates should be recalculated based on the respective conversion factor.

Human health assessment (workers and/or consumers)

When using a borate or boric acid the concentration covered in the human health exposure assessment can be adapted using the respective conversion factor as indicated in the table above (Table 1).



1. ES 1: Formulation or re-packing; Other (PC 0)

1.1. Use descriptors

ES name: *Formulation into mixture*

Product category: *Other (PC 0)*

Environment		SPERC
1: <i>Formulation into mixture</i>	ERC 2	<i>Eurometaux SPERC 2.2b.v2.1</i>
Worker		SWED
2: <i>Off-loading of borates from ships</i>	PROC 8a	
3: <i>Attach/detach loading chute to/from road tanker</i>	PROC 8b	
4: <i>Closed transfer of borate from road tankers to large vessels or containers (e.g. silos) at site</i>	PROC 1	
5: <i>Transfer to silos or via trucks to warehouses</i>	PROC 8a	
6: <i>Storage of borates - indoor</i>	PROC 2	
7: <i>Storage of borates - outdoor</i>	PROC 2	
8: <i>Transfer of borates to mixing vessel with no dedicated engineering controls in place for reducing the exposure</i>	PROC 8a	
9: <i>Weighing of borates prior to discharge into mixing vessel</i>	PROC 9	
10: <i>Mixing in closed or largely closed production processes at high temperature</i>	PROC 2	
11: <i>Mixing</i>	PROC 3	
12: <i>Packaging of substances into small containers (including packing and unpacking) - liquid</i>	PROC 9	
13: <i>Packaging of substances into small containers (including packing and unpacking) - paste</i>	PROC 9	
14: <i>Maintenance & routine cleaning - solid</i>	PROC 28	
15: <i>Maintenance & routine cleaning - liquid</i>	PROC 28	
16: <i>Taking samples (< 1kg/sample)</i>	PROC 9	
17: <i>Laboratory work including weighing and quality control processes</i>	PROC 15	

1.2. Conditions of use affecting exposure

1.2.1. Control of environmental exposure: *Formulation into mixture (ERC 2)*

Amount used, frequency and duration of use (or from service life)
<i>Daily amount per site ≤ 66.66 tonnes/day</i>
<i>Annual amount per site ≤ 10000 tonnes/year</i>
Technical and organisational conditions and measures
<i>Electrostatic precipitators or wet electrostatic precipitators or cyclones or fabric/bag filter or ceramic/metal mesh filter</i>
<i>Chemical precipitation or sedimentation or filtration or electrolysis or reverse osmosis or ion exchange</i>
Conditions and measures related to biological sewage treatment plant
<i>Municipal sewage treatment plant is assumed.</i>
<i>Assumed domestic sewage treatment plant flow ≥ 2000 m³/day</i>
Conditions and measures related to external treatment of waste (including article waste)
<i>Dispose of waste product or used containers according to local regulations.</i>



1.2.2. Control of worker exposure: *Off-loading of borates from ships (PROC 8a)*

Product (article) characteristics
<i>Covers the use of solid material such as powders and dust consisting of relatively coarse particles with a moderate potential to become (and stay) airborne.</i>
<i>Powders, granules or pelletised material</i>
<i>Covers the use of coarse dust materials.</i>
<i>Covers dry product with <5 % moisture content.</i>
<i>Covers the use of a material containing up to 90 % of the substance.</i>
Amount used (or contained in articles), frequency and duration of use/exposure
<i>Assumes that open trucks, waggons or ships are handled.</i>
<i>Covers use up to 8 h/day</i>
Technical and organisational conditions and measures
<i>Assumes that the process is mostly enclosed during standard operation.</i>
<i>Assumes that the process is highly automated. Very limited manual intervention is required to run. Contact with the substance may be possible for a very limited duration of time.</i>
<i>Assumes that there are no adjacent workplaces contributing to exposure of the substance.</i>
<i>Covers a far field emission source where the emission source is not located in the breathing zone of the worker (i.e. the emission source is further than 1 meter away in any direction of the workers head).</i>
<i>Covers the falling transfer of powders, granules or pelletised material.</i>
<i>Covers the transfer of >1000 kg/min.</i>
<i>Cover a drop height of > 0.5 m.</i>
<i>Assumes a partial personal enclosure which is ventilated. Also a positive pressure is assumed to be maintained inside the personal enclosure.</i>
Conditions and measures related to personal protection, hygiene and health evaluation
<i>Assumes occasional general cleaning operations at the workplace.</i>
<i>Effective housekeeping practices (e.g. daily cleaning using appropriate methods, preventive maintenance of machinery, use of protective clothing that will repel spills and reduce personal cloud) in place.</i>
<i>Wear standard safety clothing.</i>
Other conditions affecting workers exposure
<i>Outdoor use</i>
<i>Covers the outdoor application in completely open areas.</i>
<i>Covers the outdoor application where the worker is located further than 4 meters from the emission source</i>

1.2.3. Control of worker exposure: *Attach/detach loading chute to/from road tanker (PROC 8b)*

Product (article) characteristics
<i>Covers the use of solid material such as powders and dust consisting of relatively coarse particles with a moderate potential to become (and stay) airborne.</i>
<i>Covers concentrations up to 100 %</i>
<i>Powders, granules or pelletised material</i>
<i>Covers the use of coarse dust materials.</i>
<i>Covers dry product with <5 % moisture content.</i>



Amount used (or contained in articles), frequency and duration of use/exposure
<i>Assumes that open trucks, waggons or ships are handled.</i>
<i>Covers the use of up to 100 containers.</i>
<i>Covers use up to 2 h/day</i>
Technical and organisational conditions and measures
<i>Assumes that the process is completely enclosed for the vast majority of its duration. Very infrequent and controlled opening during operation may occur.</i>
<i>Assumes that the process is highly automated. Very limited manual intervention is required to run. Contact with the substance may be possible for a very limited duration of time.</i>
<i>Assumes that there are no adjacent workplaces contributing to exposure of the substance.</i>
<i>Covers the handling of contaminated solid objects or paste.</i>
<i>Covers the handling of objects with limited residual dust (thin layer visible).</i>
<i>Covers the normal handling, involves regular work procedures.</i>
<i>Covers handling that reduces contact between product and adjacent air.</i>
Conditions and measures related to personal protection, hygiene and health evaluation
<i>Assumes occasional general cleaning operations at the workplace.</i>
<i>Effective housekeeping practices (e.g. daily cleaning using appropriate methods, preventive maintenance of machinery, use of protective clothing that will repel spills and reduce personal cloud) in place.</i>
<i>Wear standard safety clothing.</i>
Other conditions affecting workers exposure
<i>Outdoor use</i>
<i>Covers the outdoor application close to buildings or in completely open areas.</i>

1.2.4. Control of worker exposure: Closed transfer of borate from road tankers to large vessels or containers (e.g. silos) at site (PROC 1)

Product (article) characteristics
<i>Covers the use of solid material such as powders and dust consisting of relatively coarse particles with a moderate potential to become (and stay) airborne.</i>
<i>Covers concentrations > 25 %.</i>
Amount used (or contained in articles), frequency and duration of use/exposure
<i>Covers use of > 4 h/day.</i>
Technical and organisational conditions and measures
<i>Assumes that the process is completely closed during standard operation.</i>
<i>Assumes that the process is fully automated. Workers are only involved in supervision and control walks. Direct contact with the substance is not possible.</i>
<i>Assumes that there are no adjacent workplaces contributing to exposure of the substance.</i>
<i>Covers an indoor use where a basic mechanical ventilation of at least 1 ACH is provided as well as an outdoor use.</i>
Conditions and measures related to personal protection, hygiene and health evaluation
<i>Assumes occasional general cleaning operations at the workplace.</i>
<i>Wear standard safety clothing.</i>
Other conditions affecting workers exposure
<i>Outdoor use</i>



1.2.5. Control of worker exposure: *Transfer to silos or via trucks to warehouses (PROC 8a)*

Product (article) characteristics
<i>Covers the use of solid material such as powders and dust consisting of relatively coarse particles with a moderate potential to become (and stay) airborne.</i>
<i>Powders, granules or pelletised material</i>
<i>Covers the use of coarse dust materials.</i>
<i>Covers dry product with <5 % moisture content.</i>
<i>Covers the use of a material containing up to 90 % of the substance.</i>
Amount used (or contained in articles), frequency and duration of use/exposure
<i>Assumes that open trucks, waggons or ships are handled.</i>
<i>Covers use up to 8 h/day</i>
Technical and organisational conditions and measures
<i>Assumes that the process is mostly enclosed during standard operation.</i>
<i>Assumes that the process is highly automated. Very limited manual intervention is required to run. Contact with the substance may be possible for a very limited duration of time.</i>
<i>Assumes that there are no adjacent workplaces contributing to exposure of the substance.</i>
<i>Covers a far field emission source where the emission source is not located in the breathing zone of the worker (i.e. the emission source is further than 1 meter away in any direction of the workers head).</i>
<i>Covers the falling transfer of powders, granules or pelletised material.</i>
<i>Covers the transfer of 100 to 1000 kg/min.</i>
<i>Cover a drop height of > 0.5 m.</i>
<i>Assumes a partial personal enclosure which is ventilated. Also a positive pressure is assumed to be maintained inside the personal enclosure.</i>
Conditions and measures related to personal protection, hygiene and health evaluation
<i>Assumes occasional general cleaning operations at the workplace.</i>
<i>Effective housekeeping practices (e.g. daily cleaning using appropriate methods, preventive maintenance of machinery, use of protective clothing that will repel spills and reduce personal cloud) in place.</i>
<i>Wear standard safety clothing.</i>
Other conditions affecting workers exposure
<i>Outdoor use</i>
<i>Covers the outdoor application close to buildings or in completely open areas.</i>
<i>Covers the outdoor application where the worker is located further than 4 meters from the emission source</i>

1.2.6. Control of worker exposure: *Storage of borates - indoor (PROC 2)*

Product (article) characteristics
<i>Covers the use of solid material such as powders and dust consisting of relatively coarse particles with a moderate potential to become (and stay) airborne.</i>
<i>Covers concentrations > 25 %.</i>
Amount used (or contained in articles), frequency and duration of use/exposure
<i>Covers use of > 4 h/day.</i>



Technical and organisational conditions and measures
<i>Assumes that the process is completely enclosed for the vast majority of its duration. Very infrequent and controlled opening during operation may occur.</i>
<i>Assumes that the process is highly automated. Very limited manual intervention is required to run. Contact with the substance may be possible for a very limited duration of time.</i>
<i>Assumes that there are no adjacent workplaces contributing to exposure of the substance.</i>
<i>Covers an indoor use where a basic mechanical ventilation of at least 1 ACH is provided as well as an outdoor use.</i>
Conditions and measures related to personal protection, hygiene and health evaluation
<i>Assumes occasional general cleaning operations at the workplace.</i>
<i>Wear standard safety clothing.</i>
Other conditions affecting workers exposure
<i>Assumes process temperature up to 40 °C</i>

1.2.7. Control of worker exposure: *Storage of borates - outdoor (PROC 2)*

Product (article) characteristics
<i>Covers the use of solid material such as powders and dust consisting of relatively coarse particles with a moderate potential to become (and stay) airborne.</i>
<i>Covers concentrations > 25 %.</i>
Amount used (or contained in articles), frequency and duration of use/exposure
<i>Covers use of > 4 h/day.</i>
Technical and organisational conditions and measures
<i>Assumes that the process is completely enclosed for the vast majority of its duration. Very infrequent and controlled opening during operation may occur.</i>
<i>Assumes that the process is highly automated. Very limited manual intervention is required to run. Contact with the substance may be possible for a very limited duration of time.</i>
<i>Assumes that there are no adjacent workplaces contributing to exposure of the substance.</i>
<i>Covers an indoor use where a basic mechanical ventilation of at least 1 ACH is provided as well as an outdoor use.</i>
Conditions and measures related to personal protection, hygiene and health evaluation
<i>Assumes occasional general cleaning operations at the workplace.</i>
<i>Wear standard safety clothing.</i>
Other conditions affecting workers exposure
<i>Outdoor use</i>
<i>Assumes process temperature up to 40 °C</i>

1.2.8. Control of worker exposure: *Transfer of borates to mixing vessel with no dedicated engineering controls in place for reducing the exposure (PROC 8a)*

Product (article) characteristics
<i>Covers the use of solid material such as powders and dust consisting of relatively coarse particles with a moderate potential to become (and stay) airborne.</i>
<i>Powders, granules or pelletised material</i>
<i>Covers the use of coarse dust materials.</i>
<i>Covers dry product with <5 % moisture content.</i>
<i>Covers the use of a material containing up to 90 % of the substance.</i>



Amount used (or contained in articles), frequency and duration of use/exposure
<i>Assumes that a system such as a conveyer belt is installed for transfer/handling operation.</i>
<i>Covers use up to 4 h/day</i>
Technical and organisational conditions and measures
<i>Assumes that the process is mostly enclosed during standard operation.</i>
<i>Assumes that the process is semi-automated. Manual intervention is repeatedly required although large parts of the process are machinery assisted.</i>
<i>Assumes that there are no adjacent workplaces contributing to exposure of the substance.</i>
<i>Local exhaust ventilation - efficiency of at least 90 % (e.g. fixed capturing hoods, on-tool extraction, horizontal/downward laminar flow booth, other enclosing hoods).</i>
<i>Provide a ventilation of at least 3 ACH.</i>
<i>Covers the falling transfer of powders, granules or pelletised material.</i>
<i>Covers the transfer of 10 to 100 kg/min.</i>
<i>Covers a drop height of < 0.5 m.</i>
Conditions and measures related to personal protection, hygiene and health evaluation
<i>Assumes regular cleaning operations at the workplace.</i>
<i>Effective housekeeping practices (e.g. daily cleaning using appropriate methods, preventive maintenance of machinery, use of protective clothing that will repel spills and reduce personal cloud) in place.</i>
<i>Wear appropriate selected gloves. For further specification, refer to section 8 of the SDS. Assumes that gloves are used by trained workers.</i>
<i>Wear standard safety clothing.</i>
Other conditions affecting workers exposure
<i>Indoor use</i>
<i>Indoor use (workrooms >1000 m³).</i>

1.2.9. Control of worker exposure: Weighing of borates prior to discharge into mixing vessel (PROC 9)

Product (article) characteristics
<i>Covers the use of solid material such as powders and dust consisting of relatively coarse particles with a moderate potential to become (and stay) airborne.</i>
<i>Covers concentrations > 25 %.</i>
Amount used (or contained in articles), frequency and duration of use/exposure
<i>Covers use of > 4 h/day.</i>
<i>Assumes that bottles and cans with an approximate volume of 1L are used.</i>
Technical and organisational conditions and measures
<i>Assumes that the process is mostly enclosed during standard operation.</i>
<i>Assumes that there are no adjacent workplaces contributing to exposure of the substance.</i>
<i>Covers an indoor use where a basic mechanical ventilation of at least 1 ACH is provided as well as an outdoor use.</i>
Conditions and measures related to personal protection, hygiene and health evaluation
<i>Assumes occasional general cleaning operations at the workplace.</i>
<i>Wear standard safety clothing.</i>



1.2.10. Control of worker exposure: *Mixing in closed or largely closed production processes at high temperature (PROC 2)*

Product (article) characteristics
<i>Covers the use of solid material such as powders and dust consisting of relatively coarse particles with a moderate potential to become (and stay) airborne.</i>
<i>Covers concentrations > 25 %.</i>
Amount used (or contained in articles), frequency and duration of use/exposure
<i>Covers use of > 4 h/day.</i>
Technical and organisational conditions and measures
<i>Assumes that the process is completely enclosed for the vast majority of its duration. Very infrequent and controlled opening during operation may occur.</i>
<i>Assumes that the process is highly automated. Very limited manual intervention is required to run. Contact with the substance may be possible for a very limited duration of time.</i>
<i>Assumes that there are no adjacent workplaces contributing to exposure of the substance.</i>
<i>Covers an indoor use where a basic mechanical ventilation of at least 1 ACH is provided as well as an outdoor use.</i>
Conditions and measures related to personal protection, hygiene and health evaluation
<i>Assumes occasional general cleaning operations at the workplace.</i>
<i>Wear standard safety clothing.</i>
Other conditions affecting workers exposure
<i>Assumes process temperature up to 1000 °C</i>

1.2.11. Control of worker exposure: *Mixing (PROC 3)*

Product (article) characteristics
<i>Covers the use of a substance handled in solution.</i>
<i>Covers concentrations \leq 5 %.</i>
Amount used (or contained in articles), frequency and duration of use/exposure
<i>Covers use of > 4 h/day.</i>
Technical and organisational conditions and measures
<i>Assumes that the process is completely enclosed for the vast majority of its duration. Very infrequent and controlled opening during operation may occur.</i>
<i>Assumes that the process is highly automated. Very limited manual intervention is required to run. Contact with the substance may be possible for a very limited duration of time.</i>
<i>Assumes that there are no adjacent workplaces contributing to exposure of the substance.</i>
<i>Covers an indoor use where a basic mechanical ventilation of at least 1 ACH is provided as well as an outdoor use.</i>
Conditions and measures related to personal protection, hygiene and health evaluation
<i>Wear standard safety clothing.</i>
<i>Assumes occasional general cleaning operations at the workplace.</i>
Other conditions affecting workers exposure
<i>Assumes process temperature up to 1000 °C</i>



1.2.12. Control of worker exposure: *Packaging of substances into small containers (including packing and unpacking) - liquid (PROC 9)*

Product (article) characteristics
<i>Covers the use of a liquid.</i>
<i>Covers concentrations ≤ 25 %.</i>
Amount used (or contained in articles), frequency and duration of use/exposure
<i>Assumes that bottles and cans with an approximate volume of 1L are used.</i>
<i>Covers use of > 4 h/day.</i>
Technical and organisational conditions and measures
<i>Assumes that the process is completely enclosed for the vast majority of its duration. Very infrequent and controlled opening during operation may occur.</i>
<i>Assumes that the process is highly automated. Very limited manual intervention is required to run. Contact with the substance may be possible for a very limited duration of time.</i>
<i>Assumes that there are no adjacent workplaces contributing to exposure of the substance.</i>
<i>Covers an indoor use where a basic mechanical ventilation of at least 1 ACH is provided as well as an outdoor use.</i>
Conditions and measures related to personal protection, hygiene and health evaluation
<i>Assumes occasional general cleaning operations at the workplace.</i>
<i>Wear standard safety clothing.</i>

1.2.13. Control of worker exposure: *Packaging of substances into small containers (including packing and unpacking) - paste (PROC 9)*

Product (article) characteristics
<i>Covers the use of a paste.</i>
<i>Covers concentrations ≤ 25 %.</i>
Amount used (or contained in articles), frequency and duration of use/exposure
<i>Assumes that bottles and cans with an approximate volume of 1L are used.</i>
<i>Covers use of > 4 h/day.</i>
Technical and organisational conditions and measures
<i>Assumes that the process is completely enclosed for the vast majority of its duration. Very infrequent and controlled opening during operation may occur.</i>
<i>Assumes that the process is highly automated. Very limited manual intervention is required to run. Contact with the substance may be possible for a very limited duration of time.</i>
<i>Assumes that there are no adjacent workplaces contributing to exposure of the substance.</i>
<i>Covers an indoor use where a basic mechanical ventilation of at least 1 ACH is provided as well as an outdoor use.</i>
Conditions and measures related to personal protection, hygiene and health evaluation
<i>Assumes occasional general cleaning operations at the workplace.</i>
<i>Wear standard safety clothing.</i>



1.2.14. Control of worker exposure: *Maintenance & routine cleaning - solid (PROC 28)*

Product (article) characteristics
<i>Covers the use of solid material such as fine powders having a high potential to become and stay airborne.</i>
<i>Covers concentrations > 25 %.</i>
Amount used (or contained in articles), frequency and duration of use/exposure
<i>Covers use of up to 1 h/day.</i>
<i>Assumes a contamination level of the workplace of up to 5 mg/m³.</i>
Technical and organisational conditions and measures
<i>Assumes that the main cleaning device is a wet cleaning car.</i>
<i>Provide a mechanical ventilation of at least 3 ACH.</i>
Conditions and measures related to personal protection, hygiene and health evaluation
<i>Wear standard safety clothing.</i>

1.2.15. Control of worker exposure: *Maintenance & routine cleaning - liquid (PROC 28)*

Product (article) characteristics
<i>Covers the use of a liquid.</i>
<i>Covers concentrations > 25 %.</i>
Amount used (or contained in articles), frequency and duration of use/exposure
<i>Covers use of up to 1 h/day.</i>
<i>Assumes a contamination level of the workplace of up to 5 mg/m³.</i>
Technical and organisational conditions and measures
<i>Covers an indoor use where a basic mechanical ventilation of at least 1 ACH is provided as well as an outdoor use.</i>
<i>Assumes that the main cleaning device is a mop.</i>
Conditions and measures related to personal protection, hygiene and health evaluation
<i>Wear standard safety clothing.</i>

1.2.16. Control of worker exposure: *Taking samples (< 1kg/sample) (PROC 9)*

Product (article) characteristics
<i>Covers the use of solid material such as powders and dust consisting of relatively coarse particles with a moderate potential to become (and stay) airborne.</i>
<i>Covers concentrations > 25 %.</i>
Amount used (or contained in articles), frequency and duration of use/exposure
<i>Assumes that bottles and cans with an approximate volume of 1L are used.</i>
<i>Covers the use of up to 10 containers.</i>
<i>Covers use of up to 1 h/day.</i>
Technical and organisational conditions and measures
<i>Assumes that there are no adjacent workplaces contributing to exposure of the substance.</i>
<i>Covers an indoor use where a basic mechanical ventilation of at least 1 ACH is provided as well as an outdoor use.</i>
<i>Assumes that the main cleaning device is a mop.</i>
Conditions and measures related to personal protection, hygiene and health evaluation
<i>Assumes occasional general cleaning operations at the workplace.</i>
<i>Wear standard safety clothing.</i>



1.2.17. Control of worker exposure: *Laboratory work including weighing and quality control processes (PROC 15)*

Product (article) characteristics
<i>Covers the use of solid material such as powders and dust consisting of relatively coarse particles with a moderate potential to become (and stay) airborne.</i>
<i>Covers concentrations > 25 %.</i>
Amount used (or contained in articles), frequency and duration of use/exposure
<i>Assumes that bottles and cans with an approximate volume of 1L are used.</i>
<i>Covers the use of up to 10 containers.</i>
<i>Covers use of up to 1 h/day.</i>
Technical and organisational conditions and measures
<i>Assumes that there are no adjacent workplaces contributing to exposure of the substance.</i>
<i>Covers an indoor use where a basic mechanical ventilation of at least 1 ACH is provided as well as an outdoor use.</i>
Conditions and measures related to personal protection, hygiene and health evaluation
<i>Assumes occasional general cleaning operations at the workplace.</i>
<i>Wear standard safety clothing.</i>

1.3. Exposure estimation and reference to its source

1.3.1. Environmental release and exposure: *Formulation into mixture (ERC 2)*

Release route	Release rate	Release estimation method
Water	6.667 kg/day	SPERC
Air	3.333 kg/day	SPERC
Soil	6.667 kg/day	SPERC

Protection target	Exposure estimate	RCR
Fresh water	0.385 mg/L (EUSES 2.1.2)	0.133
Marine water	0.038 mg/L (EUSES 2.1.2)	0.013
Sewage Treatment Plant	3.332 mg/L (EUSES 2.1.2)	0.333
Agricultural soil	0.165 mg/kg dw (EUSES 2.1.2)	0.029
Man via environment - Inhalation (systemic effects)	0.000381 mg/m ³ (EUSES 2.1.2)	< 0.01
Man via environment - Oral	0.064 mg/kg bw/day (EUSES 2.1.2)	0.376
Man via environment - combined routes		0.376

1.3.2. Worker exposure: *Off-loading of borates from ships (PROC 8a)*

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.8 mg/m ³ (ART)	0.552
Dermal, systemic, long term	6.825 mg/kg bw/day (MEASE)	0.099
Combined, systemic, long term		0.651



1.3.3. Worker exposure: *Attach/detach loading chute to/from road tanker (PROC 8b)*

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.43 mg/m ³ (ART)	0.297
Dermal, systemic, long term	2.457 mg/kg bw/day (MEASE)	0.036
Combined, systemic, long term		0.332

1.3.4. Worker exposure: *Closed transfer of borate from road tankers to large vessels or containers (e.g. silos) at site (PROC 1)*

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.001 mg/m ³ (MEASE)	< 0.01
Dermal, systemic, long term	0.003 mg/kg bw/day (MEASE)	< 0.01
Combined, systemic, long term		< 0.01

1.3.5. Worker exposure: *Transfer to silos or via trucks to warehouses (PROC 8a)*

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.82 mg/m ³ (ART)	0.566
Dermal, systemic, long term	6.825 mg/kg bw/day (MEASE)	0.099
Combined, systemic, long term		0.665

1.3.6. Worker exposure: *Storage of borates - indoor (PROC 2)*

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.013 mg/m ³ (MEASE)	< 0.01
Dermal, systemic, long term	0.035 mg/kg bw/day (MEASE)	< 0.01
Combined, systemic, long term		< 0.01

1.3.7. Worker exposure: *Storage of borates - outdoor (PROC 2)*

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.011 mg/m ³ (MEASE)	< 0.01
Dermal, systemic, long term	0.035 mg/kg bw/day (MEASE)	< 0.01
Combined, systemic, long term		< 0.01

1.3.8. Worker exposure: *Transfer of borates to mixing vessel with no dedicated engineering controls in place for reducing the exposure (PROC 8a)*

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.67 mg/m ³ (ART)	0.462
Dermal, systemic, long term	20.37 mg/kg bw/day (MEASE)	0.297
Combined, systemic, long term		0.759

1.3.9. Worker exposure: *Weighing of borates prior to discharge into mixing vessel (PROC 9)*

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.316 mg/m ³ (MEASE)	0.218
Dermal, systemic, long term	0.518 mg/kg bw/day (MEASE)	< 0.01
Combined, systemic, long term		0.225



1.3.10. Worker exposure: *Mixing in closed or largely closed production processes at high temperature (PROC 2)*

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.013 mg/m ³ (MEASE)	< 0.01
Dermal, systemic, long term	0.035 mg/kg bw/day (MEASE)	< 0.01
Combined, systemic, long term		< 0.01

1.3.11. Worker exposure: *Mixing (PROC 3)*

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.253 mg/m ³ (MEASE)	0.174
Dermal, systemic, long term	0.007 mg/kg bw/day (MEASE)	< 0.01
Combined, systemic, long term		0.175

1.3.12. Worker exposure: *Packaging of substances into small containers (including packing and unpacking) - liquid (PROC 9)*

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.008 mg/m ³ (MEASE)	< 0.01
Dermal, systemic, long term	0.031 mg/kg bw/day (MEASE)	< 0.01
Combined, systemic, long term		< 0.01

1.3.13. Worker exposure: *Packaging of substances into small containers (including packing and unpacking) - paste (PROC 9)*

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.008 mg/m ³ (MEASE)	< 0.01
Dermal, systemic, long term	0.031 mg/kg bw/day (MEASE)	< 0.01
Combined, systemic, long term		< 0.01

1.3.14. Worker exposure: *Maintenance & routine cleaning - solid (PROC 28)*

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	1.063 mg/m ³ (MEASE)	0.733
Dermal, systemic, long term	2.492 mg/kg bw/day (MEASE)	0.036
Combined, systemic, long term		0.769

1.3.15. Worker exposure: *Maintenance & routine cleaning - liquid (PROC 28)*

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.116 mg/m ³ (MEASE)	0.08
Dermal, systemic, long term	2.492 mg/kg bw/day (MEASE)	0.036
Combined, systemic, long term		0.116

1.3.16. Worker exposure: *Taking samples (< 1kg/sample) (PROC 9)*

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.013 mg/m ³ (MEASE)	< 0.01
Dermal, systemic, long term	0.104 mg/kg bw/day (MEASE)	< 0.01
Combined, systemic, long term		0.01



1.3.17. Worker exposure: *Laboratory work including weighing and quality control processes (PROC 15)*

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.013 mg/m ³ (MEASE)	< 0.01
Dermal, systemic, long term	0.069 mg/kg bw/day (MEASE)	< 0.01
Combined, systemic, long term		< 0.01

1.4. Guidance to DU to evaluate whether he works inside the boundaries set by the ES

Guidance:

The conditions of use at downstream users' sites may differ in some way from those described in the exposure scenario. In case of differences between the description of conditions of use in the exposure scenario and your own practice it does not mean that the use is not covered. The risk may still be adequately controlled. The way in which you determine if your conditions are equivalent or lower is termed "scaling". Scaling instructions are given below.

Human health: The workers' exposure is addressed using MEASE 2.0. However, for some PROCs ART v1.5 is used instead of MEASE 2.0 to estimate the inhalation exposure.

Environment: Emissions to the environment are estimated using EUSES v.2.1.2 as implemented in CHESAR v3.5. The releases have been estimated on the basis of SPERC Eurometaux SPERC 2.2b.v2.1.

Scaling tool:

Please use the above indicated publicly available modelling tools for scaling.

Scaling instructions:

Scaling can be used to check whether your conditions are "equivalent" to the conditions defined in the exposure scenario. If your conditions of use differ slightly from those indicated in the respective exposure scenario you might be able to demonstrate that, under your conditions of use, the exposure levels are equivalent or lower than under the described conditions. It may be possible to demonstrate this by compensating a variation in one particular condition with a variation in other conditions.

Scalable parameters:

In the following, the key determinants which are likely to vary in the actual use situation are given to be used for scaling.

- Workers:

ART 1.5: Powder weight fraction, Concentration of the substance, Handling of contaminated solid object or paste, Duration of activity, Emission source, Transfer rate, Drop height, LEV, PPE.

MEASE 2.0: Concentration of the substance, Duration of exposure, Level of automation, Dust suppression techniques, Extraction device, ACH, Process temperature, Room size, Container capacity, Number of containers used, Contamination level of workplace, PPE.

Remark regarding RMMs: Effectiveness is the key information related to risk management measures. You can be sure that your risk management measures are covered if their effectiveness is equal to, or higher than, what is specified in the exposure scenario.

- Environment:

Daily use amount, Annual use amount, Number of emission days, Release factors, Discharge rate of STP, Receiving surface water flow rate.

Further details on scaling are provided in ECHA's Guidance for downstream users v2.1 (October 2014) as well as in ECHA's Practical Guide 13 (June 2012).

Boundaries of scaling:

RCRs not to be exceeded are described in Section 1.3.



2. ES 2: Formulation or re-packing; Other (PC 0)

2.1. Use descriptors

ES name: *Formulation into solid matrix*

Product category: *Other (PC 0)*

Environment	
1: <i>Formulation into solid matrix</i>	ERC 3
Worker	
2: <i>Attach/detach loading chute to/from road tanker</i>	PROC 8b
3: <i>Closed transfer of borate from road tankers to large vessels or containers (e.g. silos) at site</i>	PROC 1
4: <i>Storage of borates - indoor</i>	PROC 2
5: <i>Storage of borates - outdoor</i>	PROC 2
6: <i>Transfer of borates to mixing vessel with no dedicated engineering controls in place for reducing the exposure</i>	PROC 8a
7: <i>Weighing of borates prior to discharge into mixing vessel</i>	PROC 9
8: <i>Mixing in closed or largely closed production processes at high temperature</i>	PROC 2
9: <i>Mixing in closed continuous process at elevated temperature with occasional controlled exposure during opening</i>	PROC 2
10: <i>Hot gunning repair including spraying</i>	PROC 7
11: <i>Casting into shape for use</i>	PROC 23
12: <i>Grinding of solids to a powder in enclosed grinding mill</i>	PROC 24
13: <i>Compaction and tableting of borates and borate mixtures</i>	PROC 14
14: <i>Packaging of substances into small containers (including packing and unpacking) - powder</i>	PROC 9
15: <i>Packaging of substances into small containers (including packing and unpacking) - pellet</i>	PROC 9
16: <i>Maintenance & routine cleaning - indoor</i>	PROC 28
17: <i>Taking samples (< 1kg/sample)</i>	PROC 9
18: <i>Laboratory work including weighing and quality control processes</i>	PROC 15

2.2. Conditions of use affecting exposure

2.2.1. Control of environmental exposure: *Formulation into solid matrix (ERC 3)*

Amount used, frequency and duration of use (or from service life)
<i>Daily amount per site ≤ 27.5 tonnes/day</i>
<i>Annual amount per site ≤ 10000 tonnes/year</i>
Conditions and measures related to biological sewage treatment plant
<i>Municipal sewage treatment plant is assumed.</i>
<i>Assumed domestic sewage treatment plant flow ≥ 2000 m³/day</i>
Conditions and measures related to external treatment of waste (including article waste)
<i>Dispose of waste product or used containers according to local regulations.</i>
Other conditions affecting environmental exposure
<i>Receiving surface water flow ≥ 18000 m³/day</i>



2.2.2. Control of worker exposure: *Attach/detach loading chute to/from road tanker (PROC 8b)*

Product (article) characteristics
<i>Covers the use of solid material such as powders and dust consisting of relatively coarse particles with a moderate potential to become (and stay) airborne.</i>
<i>Covers concentrations up to 100 %</i>
<i>Powders, granules or pelletised material</i>
<i>Covers the use of coarse dust materials.</i>
<i>Covers dry product with <5 % moisture content.</i>
Amount used (or contained in articles), frequency and duration of use/exposure
<i>Assumes that open trucks, waggons or ships are handled.</i>
<i>Covers the use of up to 100 containers.</i>
<i>Covers use up to 2 h/day</i>
Technical and organisational conditions and measures
<i>Assumes that the process is completely enclosed for the vast majority of its duration. Very infrequent and controlled opening during operation may occur.</i>
<i>Assumes that the process is highly automated. Very limited manual intervention is required to run. Contact with the substance may be possible for a very limited duration of time.</i>
<i>Assumes that there are no adjacent workplaces contributing to exposure of the substance.</i>
<i>Covers the handling of contaminated solid objects or paste.</i>
<i>Covers the handling of objects with limited residual dust (thin layer visible).</i>
<i>Covers the normal handling, involves regular work procedures.</i>
<i>Covers handling that reduces contact between product and adjacent air.</i>
Conditions and measures related to personal protection, hygiene and health evaluation
<i>Assumes occasional general cleaning operations at the workplace.</i>
<i>Effective housekeeping practices (e.g. daily cleaning using appropriate methods, preventive maintenance of machinery, use of protective clothing that will repel spills and reduce personal cloud) in place.</i>
<i>Wear standard safety clothing.</i>
Other conditions affecting workers exposure
<i>Outdoor use</i>
<i>Covers the outdoor application close to buildings or in completely open areas.</i>

2.2.3. Control of worker exposure: *Closed transfer of borate from road tankers to large vessels or containers (e.g. silos) at site (PROC 1)*

Product (article) characteristics
<i>Covers the use of solid material such as powders and dust consisting of relatively coarse particles with a moderate potential to become (and stay) airborne.</i>
<i>Covers concentrations > 25 %.</i>
Amount used (or contained in articles), frequency and duration of use/exposure
<i>Covers use of > 4 h/day.</i>



Technical and organisational conditions and measures
<i>Assumes that the process is completely closed during standard operation.</i>
<i>Assumes that the process is fully automated. Workers are only involved in supervision and control walks. Direct contact with the substance is not possible.</i>
<i>Assumes that there are no adjacent workplaces contributing to exposure of the substance.</i>
<i>Covers an indoor use where a basic mechanical ventilation of at least 1 ACH is provided as well as an outdoor use.</i>
Conditions and measures related to personal protection, hygiene and health evaluation
<i>Assumes occasional general cleaning operations at the workplace.</i>
<i>Wear standard safety clothing.</i>
Other conditions affecting workers exposure
<i>Outdoor use</i>

2.2.4. Control of worker exposure: Storage of borates - indoor (PROC 2)

Product (article) characteristics
<i>Covers the use of solid material such as powders and dust consisting of relatively coarse particles with a moderate potential to become (and stay) airborne.</i>
<i>Covers concentrations > 25 %.</i>
Amount used (or contained in articles), frequency and duration of use/exposure
<i>Covers use of > 4 h/day.</i>
Technical and organisational conditions and measures
<i>Assumes that the process is completely enclosed for the vast majority of its duration. Very infrequent and controlled opening during operation may occur.</i>
<i>Assumes that the process is highly automated. Very limited manual intervention is required to run. Contact with the substance may be possible for a very limited duration of time.</i>
<i>Assumes that there are no adjacent workplaces contributing to exposure of the substance.</i>
<i>Covers an indoor use where a basic mechanical ventilation of at least 1 ACH is provided as well as an outdoor use.</i>
Conditions and measures related to personal protection, hygiene and health evaluation
<i>Assumes occasional general cleaning operations at the workplace.</i>
<i>Wear standard safety clothing.</i>
Other conditions affecting workers exposure
<i>Assumes process temperature up to 40 °C</i>

2.2.5. Control of worker exposure: Storage of borates - outdoor (PROC 2)

Product (article) characteristics
<i>Covers the use of solid material such as powders and dust consisting of relatively coarse particles with a moderate potential to become (and stay) airborne.</i>
<i>Covers concentrations > 25 %.</i>
Amount used (or contained in articles), frequency and duration of use/exposure
<i>Covers use of > 4 h/day.</i>



Technical and organisational conditions and measures
<i>Assumes that the process is completely enclosed for the vast majority of its duration. Very infrequent and controlled opening during operation may occur.</i>
<i>Assumes that the process is highly automated. Very limited manual intervention is required to run. Contact with the substance may be possible for a very limited duration of time.</i>
<i>Assumes that there are no adjacent workplaces contributing to exposure of the substance.</i>
<i>Covers an indoor use where a basic mechanical ventilation of at least 1 ACH is provided as well as an outdoor use.</i>
Conditions and measures related to personal protection, hygiene and health evaluation
<i>Assumes occasional general cleaning operations at the workplace.</i>
<i>Wear standard safety clothing.</i>
Other conditions affecting workers exposure
<i>Outdoor use</i>
<i>Assumes process temperature up to 40 °C</i>

2.2.6. Control of worker exposure: Transfer of borates to mixing vessel with no dedicated engineering controls in place for reducing the exposure (PROC 8a)

Product (article) characteristics
<i>Covers the use of solid material such as powders and dust consisting of relatively coarse particles with a moderate potential to become (and stay) airborne.</i>
<i>Powders, granules or pelletised material</i>
<i>Covers the use of coarse dust materials.</i>
<i>Covers dry product with <5 % moisture content.</i>
<i>Covers the use of a material containing up to 90 % of the substance.</i>
Amount used (or contained in articles), frequency and duration of use/exposure
<i>Assumes that a system such as a conveyer belt is installed for transfer/handling operation.</i>
<i>Covers use up to 4 h/day</i>
Technical and organisational conditions and measures
<i>Assumes that the process is mostly enclosed during standard operation.</i>
<i>Assumes that the process is semi-automated. Manual intervention is repeatedly required although large parts of the process are machinery assisted.</i>
<i>Assumes that there are no adjacent workplaces contributing to exposure of the substance.</i>
<i>Local exhaust ventilation - efficiency of at least 90 % (e.g. fixed capturing hoods, on-tool extraction, horizontal/downward laminar flow booth, other enclosing hoods).</i>
<i>Provide a ventilation of at least 3 ACH.</i>
<i>Covers the falling transfer of powders, granules or pelletised material.</i>
<i>Covers the transfer of 10 to 100 kg/min.</i>
<i>Covers a drop height of < 0.5 m.</i>
Conditions and measures related to personal protection, hygiene and health evaluation
<i>Assumes regular cleaning operations at the workplace.</i>
<i>Effective housekeeping practices (e.g. daily cleaning using appropriate methods, preventive maintenance of machinery, use of protective clothing that will repel spills and reduce personal cloud) in place.</i>
<i>Wear appropriate selected gloves. For further specification, refer to section 8 of the SDS. Assumes that gloves are used by trained workers.</i>
<i>Wear standard safety clothing.</i>



Other conditions affecting workers exposure
<i>Indoor use</i>
<i>Indoor use (workrooms >1000 m³).</i>

2.2.7. Control of worker exposure: Weighing of borates prior to discharge into mixing vessel (PROC 9)

Product (article) characteristics
<i>Covers the use of solid material such as powders and dust consisting of relatively coarse particles with a moderate potential to become (and stay) airborne.</i>
<i>Covers concentrations > 25 %.</i>
Amount used (or contained in articles), frequency and duration of use/exposure
<i>Covers use of > 4 h/day.</i>
<i>Assumes that bottles and cans with an approximate volume of 1L are used.</i>
Technical and organisational conditions and measures
<i>Assumes that the process is mostly enclosed during standard operation.</i>
<i>Assumes that there are no adjacent workplaces contributing to exposure of the substance.</i>
<i>Covers an indoor use where a basic mechanical ventilation of at least 1 ACH is provided as well as an outdoor use.</i>
Conditions and measures related to personal protection, hygiene and health evaluation
<i>Assumes occasional general cleaning operations at the workplace.</i>
<i>Wear standard safety clothing.</i>

2.2.8. Control of worker exposure: Mixing in closed or largely closed production processes at high temperature (PROC 2)

Product (article) characteristics
<i>Covers the use of solid material such as powders and dust consisting of relatively coarse particles with a moderate potential to become (and stay) airborne.</i>
<i>Covers concentrations > 25 %.</i>
Amount used (or contained in articles), frequency and duration of use/exposure
<i>Covers use of > 4 h/day.</i>
Technical and organisational conditions and measures
<i>Assumes that the process is completely enclosed for the vast majority of its duration. Very infrequent and controlled opening during operation may occur.</i>
<i>Assumes that the process is highly automated. Very limited manual intervention is required to run. Contact with the substance may be possible for a very limited duration of time.</i>
<i>Assumes that there are no adjacent workplaces contributing to exposure of the substance.</i>
<i>Covers an indoor use where a basic mechanical ventilation of at least 1 ACH is provided as well as an outdoor use.</i>
Conditions and measures related to personal protection, hygiene and health evaluation
<i>Assumes occasional general cleaning operations at the workplace.</i>
<i>Wear standard safety clothing.</i>
Other conditions affecting workers exposure
<i>Assumes process temperature up to 1000 °C</i>



2.2.9. Control of worker exposure: *Mixing in closed continuous process at elevated temperature with occasional controlled exposure during opening (PROC 2)*

Product (article) characteristics
<i>Covers concentrations > 25 %.</i>
<i>Covers the use of a substance handled in solution.</i>
Amount used (or contained in articles), frequency and duration of use/exposure
<i>Covers use of > 4 h/day.</i>
Technical and organisational conditions and measures
<i>Assumes that the process is completely enclosed for the vast majority of its duration. Very infrequent and controlled opening during operation may occur.</i>
<i>Assumes that the process is highly automated. Very limited manual intervention is required to run. Contact with the substance may be possible for a very limited duration of time.</i>
<i>Assumes that there are no adjacent workplaces contributing to exposure of the substance.</i>
<i>Covers an indoor use where a basic mechanical ventilation of at least 1 ACH is provided as well as an outdoor use.</i>
Conditions and measures related to personal protection, hygiene and health evaluation
<i>Wear standard safety clothing.</i>
<i>Assumes occasional general cleaning operations at the workplace.</i>
Other conditions affecting workers exposure
<i>Assumes process temperature up to 500 °C</i>

2.2.10. Control of worker exposure: *Hot gunning repair including spraying (PROC 7)*

Product (article) characteristics
<i>Covers concentrations < 1 %.</i>
<i>Covers the use of a substance handled in solution.</i>
<i>Powders dissolved in a liquid or incorporated in a liquid matrix</i>
<i>Covers liquids with low to medium viscosity.</i>
Amount used (or contained in articles), frequency and duration of use/exposure
<i>Covers use up to 8 h/day</i>
Technical and organisational conditions and measures
<i>Assumes that the process is semi-automated. Manual intervention is repeatedly required although large parts of the process are machinery assisted.</i>
<i>Assumes that there are no adjacent workplaces contributing to exposure of the substance.</i>
<i>Covers the spray application of liquids (surface spraying).</i>
<i>Covers a low application rate (0.03 - 0.3 l/min).</i>
<i>Covers the spraying with no or low compressed air use.</i>
<i>Covers horizontal or downward spraying.</i>
<i>Provide good natural ventilation.</i>
Conditions and measures related to personal protection, hygiene and health evaluation
<i>Wear standard safety clothing.</i>
<i>Assumes occasional general cleaning operations at the workplace.</i>
<i>Effective housekeeping practices (e.g. daily cleaning using appropriate methods, preventive maintenance of machinery, use of protective clothing that will repel spills and reduce personal cloud) in place.</i>



Other conditions affecting workers exposure
<i>Indoor use</i>
<i>Indoor use (workrooms >30 m³).</i>

2.2.11. Control of worker exposure: *Casting into shape for use (PROC 23)*

Product (article) characteristics
<i>Covers concentrations < 1 %.</i>
<i>Covers the use of a molten substance/material.</i>
Amount used (or contained in articles), frequency and duration of use/exposure
<i>Covers use of > 4 h/day.</i>
Technical and organisational conditions and measures
<i>Assumes that the process is mostly enclosed during standard operation.</i>
<i>Assumes that the process is semi-automated. Manual intervention is repeatedly required although large parts of the process are machinery assisted.</i>
<i>Assumes that there are no adjacent workplaces contributing to exposure of the substance.</i>
<i>Covers an indoor use where a basic mechanical ventilation of at least 1 ACH is provided as well as an outdoor use.</i>
Conditions and measures related to personal protection, hygiene and health evaluation
<i>Wear standard safety clothing.</i>
<i>Assumes occasional general cleaning operations at the workplace.</i>
Other conditions affecting workers exposure
<i>Assumes process temperature up to 1000 °C</i>

2.2.12. Control of worker exposure: *Grinding of solids to a powder in enclosed grinding mill (PROC 24)*

Product (article) characteristics
<i>Covers the use of massive objects with a very low intrinsic emission potential.</i>
<i>Covers a concentration > 25% of the substance in the layer to which mechanical treatment is applied to.</i>
<i>The substance is not present the part of the tool or machinery used for the mechanical treatment.</i>
Amount used (or contained in articles), frequency and duration of use/exposure
<i>Covers use of > 4 h/day.</i>
Technical and organisational conditions and measures
<i>Covers grinding.</i>
<i>Assumes that the process is completely closed during standard operation.</i>
<i>Assumes that the process is fully automated. Workers are only involved in supervision and control walks. Direct contact with the substance is not possible.</i>
<i>Assumes that there are no adjacent workplaces contributing to exposure of the substance.</i>
<i>Covers an indoor use where a basic mechanical ventilation of at least 1 ACH is provided as well as an outdoor use.</i>
Conditions and measures related to personal protection, hygiene and health evaluation
<i>Wear standard safety clothing.</i>
<i>Assumes occasional general cleaning operations at the workplace.</i>



2.2.13. Control of worker exposure: *Compaction and tableting of borates and borate mixtures (PROC 14)*

Product (article) characteristics
<i>Covers concentrations > 25 %.</i>
<i>Covers the use of solid material such as powders and dust consisting of relatively coarse particles with a moderate potential to become (and stay) airborne.</i>
Amount used (or contained in articles), frequency and duration of use/exposure
<i>Covers use of > 4 h/day.</i>
Technical and organisational conditions and measures
<i>Assumes that the process is completely enclosed for the vast majority of its duration. Very infrequent and controlled opening during operation may occur.</i>
<i>Assumes that the process is highly automated. Very limited manual intervention is required to run. Contact with the substance may be possible for a very limited duration of time.</i>
<i>Assumes that there are no adjacent workplaces contributing to exposure of the substance.</i>
<i>Covers an indoor use where a basic mechanical ventilation of at least 1 ACH is provided as well as an outdoor use.</i>
Conditions and measures related to personal protection, hygiene and health evaluation
<i>Wear standard safety clothing.</i>
<i>Assumes occasional general cleaning operations at the workplace.</i>

2.2.14. Control of worker exposure: *Packaging of substances into small containers (including packing and unpacking) - powder (PROC 9)*

Product (article) characteristics
<i>Covers concentrations \leq 25 %.</i>
<i>Covers the use of solid material such as fine powders having a high potential to become and stay airborne.</i>
Amount used (or contained in articles), frequency and duration of use/exposure
<i>Assumes that bottles and cans with an approximate volume of 1L are used.</i>
<i>Covers use of > 4 h/day.</i>
Technical and organisational conditions and measures
<i>Assumes that the process is completely enclosed for the vast majority of its duration. Very infrequent and controlled opening during operation may occur.</i>
<i>Assumes that the process is highly automated. Very limited manual intervention is required to run. Contact with the substance may be possible for a very limited duration of time.</i>
<i>Covers an indoor use where a basic mechanical ventilation of at least 1 ACH is provided as well as an outdoor use.</i>
<i>Assumes that there are no adjacent workplaces contributing to exposure of the substance.</i>
Conditions and measures related to personal protection, hygiene and health evaluation
<i>Wear standard safety clothing.</i>
<i>Assumes occasional general cleaning operations at the workplace.</i>

2.2.15. Control of worker exposure: *Packaging of substances into small containers (including packing and unpacking) - pellet (PROC 9)*

Product (article) characteristics
<i>Covers concentrations \leq 25 %.</i>
<i>Covers the use of solid material with a low dustiness such as granules, pellets, wetted/moistened powders, etc. with a low potential for dust emissions.</i>



Amount used (or contained in articles), frequency and duration of use/exposure
<i>Covers use of > 4 h/day.</i>
<i>Assumes that bottles and cans with an approximate volume of 1L are used.</i>
Technical and organisational conditions and measures
<i>Assumes that the process is completely enclosed for the vast majority of its duration. Very infrequent and controlled opening during operation may occur.</i>
<i>Assumes that the process is highly automated. Very limited manual intervention is required to run. Contact with the substance may be possible for a very limited duration of time.</i>
<i>Assumes that there are no adjacent workplaces contributing to exposure of the substance.</i>
<i>Covers an indoor use where a basic mechanical ventilation of at least 1 ACH is provided as well as an outdoor use.</i>
Conditions and measures related to personal protection, hygiene and health evaluation
<i>Wear appropriate selected gloves. For further specification, refer to section 8 of the SDS.</i>
<i>Wear standard safety clothing.</i>
<i>Assumes occasional general cleaning operations at the workplace.</i>

2.2.16. Control of worker exposure: Maintenance & routine cleaning - indoor (PROC 28)

Product (article) characteristics
<i>Covers concentrations > 25 %.</i>
<i>Covers the use of solid material such as powders and dust consisting of relatively coarse particles with a moderate potential to become (and stay) airborne.</i>
Amount used (or contained in articles), frequency and duration of use/exposure
<i>Covers use of up to 1 h/day.</i>
<i>Assumes a contamination level of the workplace of up to 5 mg/m³.</i>
Technical and organisational conditions and measures
<i>Assumes that the main cleaning device is a Hoover.</i>
<i>Provide a mechanical ventilation of at least 3 ACH.</i>
Conditions and measures related to personal protection, hygiene and health evaluation
<i>Wear standard safety clothing.</i>

2.2.17. Control of worker exposure: Taking samples (< 1kg/sample) (PROC 9)

Product (article) characteristics
<i>Covers the use of solid material such as powders and dust consisting of relatively coarse particles with a moderate potential to become (and stay) airborne.</i>
<i>Covers concentrations > 25 %.</i>
Amount used (or contained in articles), frequency and duration of use/exposure
<i>Assumes that bottles and cans with an approximate volume of 1L are used.</i>
<i>Covers the use of up to 10 containers.</i>
<i>Covers use of up to 1 h/day.</i>
Technical and organisational conditions and measures
<i>Assumes that there are no adjacent workplaces contributing to exposure of the substance.</i>
<i>Covers an indoor use where a basic mechanical ventilation of at least 1 ACH is provided as well as an outdoor use.</i>
<i>Assumes that the main cleaning device is a mop.</i>



Conditions and measures related to personal protection, hygiene and health evaluation
<i>Assumes occasional general cleaning operations at the workplace.</i>
<i>Wear standard safety clothing.</i>

2.2.18. Control of worker exposure: *Laboratory work including weighing and quality control processes (PROC 15)*

Product (article) characteristics
<i>Covers the use of solid material such as powders and dust consisting of relatively coarse particles with a moderate potential to become (and stay) airborne.</i>
<i>Covers concentrations > 25 %.</i>
Amount used (or contained in articles), frequency and duration of use/exposure
<i>Assumes that bottles and cans with an approximate volume of 1L are used.</i>
<i>Covers the use of up to 10 containers.</i>
<i>Covers use of up to 1 h/day.</i>
Technical and organisational conditions and measures
<i>Assumes that there are no adjacent workplaces contributing to exposure of the substance.</i>
<i>Covers an indoor use where a basic mechanical ventilation of at least 1 ACH is provided as well as an outdoor use.</i>
Conditions and measures related to personal protection, hygiene and health evaluation
<i>Assumes occasional general cleaning operations at the workplace.</i>
<i>Wear standard safety clothing.</i>

2.3. Exposure estimation and reference to its source

2.3.1. Environmental release and exposure: *Formulation into solid matrix (ERC 3)*

Release route	Release rate	Release estimation method
Water	0 kg/day	Estimated release factor
Air	2.75 kg/day	Estimated release factor
Soil	27.5 kg/day	ERC

Protection target	Exposure estimate	RCR
Fresh water	0.051 mg/L (EUSES 2.1.2)	0.018
Marine water	0.00508 mg/L (EUSES 2.1.2)	< 0.01
Sewage Treatment Plant	0 mg/L (EUSES 2.1.2)	< 0.01
Agricultural soil	0.147 mg/kg dw (EUSES 2.1.2)	0.026
Man via environment - Inhalation (systemic effects)	0.000762 mg/m ³ (EUSES 2.1.2)	< 0.01
Man via environment - Oral	0.117 mg/kg bw/day (EUSES 2.1.2)	0.687
Man via environment - combined routes		0.688

2.3.2. Worker exposure: *Attach/detach loading chute to/from road tanker (PROC 8b)*

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.43 mg/m ³ (ART)	0.297
Dermal, systemic, long term	2.457 mg/kg bw/day (MEASE)	0.036
Combined, systemic, long term		0.332



2.3.3. Worker exposure: Closed transfer of borate from road tankers to large vessels or containers (e.g. silos) at site (PROC 1)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.001 mg/m ³ (MEASE)	< 0.01
Dermal, systemic, long term	0.003 mg/kg bw/day (MEASE)	< 0.01
Combined, systemic, long term		< 0.01

2.3.4. Worker exposure: Storage of borates - indoor (PROC 2)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.013 mg/m ³ (MEASE)	< 0.01
Dermal, systemic, long term	0.035 mg/kg bw/day (MEASE)	< 0.01
Combined, systemic, long term		< 0.01

2.3.5. Worker exposure: Storage of borates - outdoor (PROC 2)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.011 mg/m ³ (MEASE)	< 0.01
Dermal, systemic, long term	0.035 mg/kg bw/day (MEASE)	< 0.01
Combined, systemic, long term		< 0.01

2.3.6. Worker exposure: Transfer of borates to mixing vessel with no dedicated engineering controls in place for reducing the exposure (PROC 8a)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.67 mg/m ³ (ART)	0.462
Dermal, systemic, long term	20.38 mg/kg bw/day (MEASE)	0.297
Combined, systemic, long term		0.759

2.3.7. Worker exposure: Weighing of borates prior to discharge into mixing vessel (PROC 9)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.316 mg/m ³ (MEASE)	0.218
Dermal, systemic, long term	0.518 mg/kg bw/day (MEASE)	< 0.01
Combined, systemic, long term		0.225

2.3.8. Worker exposure: Mixing in closed or largely closed production processes at high temperature (PROC 2)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.013 mg/m ³ (MEASE)	< 0.01
Dermal, systemic, long term	0.035 mg/kg bw/day (MEASE)	< 0.01
Combined, systemic, long term		< 0.01

2.3.9. Worker exposure: Mixing in closed continuous process at elevated temperature with occasional controlled exposure during opening (PROC 2)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.379 mg/m ³ (MEASE)	0.261
Dermal, systemic, long term	0.035 mg/kg bw/day (MEASE)	< 0.01
Combined, systemic, long term		0.262



2.3.10. Worker exposure: *Hot gunning repair including spraying (PROC 7)*

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.42 mg/m ³ (ART)	0.29
Dermal, systemic, long term	7.501 mg/kg bw/day (MEASE)	0.109
Combined, systemic, long term		0.399

2.3.11. Worker exposure: *Casting into shape for use (PROC 23)*

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.19 mg/m ³ (MEASE)	0.131
Dermal, systemic, long term	0.102 mg/kg bw/day (MEASE)	< 0.01
Combined, systemic, long term		0.133

2.3.12. Worker exposure: *Grinding of solids to a powder in enclosed grinding mill (PROC 24)*

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.127 mg/m ³ (MEASE)	0.088
Dermal, systemic, long term	0.014 mg/kg bw/day (MEASE)	< 0.01
Combined, systemic, long term		0.088

2.3.13. Worker exposure: *Compaction and tableting of borates and borate mixtures (PROC 14)*

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.127 mg/m ³ (MEASE)	0.088
Dermal, systemic, long term	0.069 mg/kg bw/day (MEASE)	< 0.01
Combined, systemic, long term		0.089

2.3.14. Worker exposure: *Packaging of substances into small containers (including packing and unpacking) - powder (PROC 9)*

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.19 mg/m ³ (MEASE)	0.131
Dermal, systemic, long term	0.031 mg/kg bw/day (MEASE)	< 0.01
Combined, systemic, long term		0.131

2.3.15. Worker exposure: *Packaging of substances into small containers (including packing and unpacking) - pellet (PROC 9)*

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.038 mg/m ³ (MEASE)	0.026
Dermal, systemic, long term	0.031 mg/kg bw/day (MEASE)	< 0.01
Combined, systemic, long term		0.027

2.3.16. Worker exposure: *Maintenance & routine cleaning - indoor (PROC 28)*

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	1.063 mg/m ³ (MEASE)	0.733
Dermal, systemic, long term	2.493 mg/kg bw/day (MEASE)	0.036
Combined, systemic, long term		0.769



2.3.17. Worker exposure: *Taking samples (< 1kg/sample)* (PROC 9)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.013 mg/m ³ (MEASE)	< 0.01
Dermal, systemic, long term	0.104 mg/kg bw/day (MEASE)	< 0.01
Combined, systemic, long term		0.01

2.3.18. Worker exposure: *Laboratory work including weighing and quality control processes* (PROC 15)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.013 mg/m ³ (MEASE)	< 0.01
Dermal, systemic, long term	0.069 mg/kg bw/day (MEASE)	< 0.01
Combined, systemic, long term		< 0.01

2.4. Guidance to DU to evaluate whether he works inside the boundaries set by the ES

Guidance:

The conditions of use at downstream users' sites may differ in some way from those described in the exposure scenario. In case of differences between the description of conditions of use in the exposure scenario and your own practice it does not mean that the use is not covered. The risk may still be adequately controlled. The way in which you determine if your conditions are equivalent or lower is termed "scaling". Scaling instructions are given below.

Human health: The workers' exposure is addressed using MEASE 2.0. However, for some PROCs ART v1.5 is used instead of MEASE 2.0 to estimate the inhalation exposure.

Environment: Emissions to the environment are estimated using EUSES v.2.1.2 as implemented in CHESAR v3.5.

Scaling tool:

Please use the above indicated publicly available modelling tools for scaling.

Scaling instructions:

Scaling can be used to check whether your conditions are "equivalent" to the conditions defined in the exposure scenario. If your conditions of use differ slightly from those indicated in the respective exposure scenario you might be able to demonstrate that, under your conditions of use, the exposure levels are equivalent or lower than under the described conditions. It may be possible to demonstrate this by compensating a variation in one particular condition with a variation in other conditions.

Scalable parameters:

In the following, the key determinants which are likely to vary in the actual use situation are given to be used for scaling.

- Workers:

ART 1.5: Powder weight fraction, Concentration of the substance, Handling of contaminated solid object or paste, Duration of activity, Emission source, Transfer rate, Drop height, LEV, Ventilation rate, Spray direction/technique, Application rate, workroom size, PPE.

MEASE 2.0: Concentration of the substance, Duration of exposure, Level of automation, Dust suppression techniques, Extraction device, ACH, Process temperature, Room size, Container capacity, Number of containers used, Contamination level of workplace, PPE.

Remark regarding RMMs: Effectiveness is the key information related to risk management measures. You can be sure that your risk management measures are covered if their effectiveness is equal to, or higher than, what is specified in the exposure scenario.



- **Environment:**

Daily use amount, Annual use amount, Number of emission days, Release factors, Discharge rate of STP, Receiving surface water flow rate.

Further details on scaling are provided in ECHA's Guidance for downstream users v2.1 (October 2014) as well as in ECHA's Practical Guide 13 (June 2012).

Boundaries of scaling:

RCRs not to be exceeded are described in Section 2.3.



3. ES 3: Use at industrial sites; Water treatment chemicals (PC 37); Electricity, steam, gas water supply and sewage treatment (SU 23)

3.1. Use descriptors

ES name: *Industrial use of borates in closed nuclear system*

Product category: *Water treatment chemicals (PC 37)*

Sector of use: *Electricity, steam, gas water supply and sewage treatment (SU 23)*

Environment	
1: <i>Use of non-reactive processing aid at industrial site (no inclusion into or onto article)</i>	ERC 4
2: <i>Use of reactive processing aid at industrial site (no inclusion into or onto article)</i>	ERC 6b
Worker	
3: <i>Attach/detach loading chute to/from road tanker</i>	PROC 8b
4: <i>Closed transfer of borate from road tankers to large vessels or containers (e.g. silos) at site</i>	PROC 1
5: <i>Storage of borates</i>	PROC 2
6: <i>Transfer of borates to mixing vessel with no dedicated engineering controls in place for reducing the exposure</i>	PROC 8a
7: <i>Weighing of borates prior to discharge into mixing vessel</i>	PROC 9
8: <i>Discharge of borates into mixing vessel</i>	PROC 8a
9: <i>Mixing in closed continuous process at ambient temperature with occasional controlled exposure during opening and addition of borates from 25kg bags</i>	PROC 2
10: <i>Mixing in closed continuous process at elevated temperature with occasional controlled exposure during opening</i>	PROC 2
11: <i>Maintenance & routine cleaning</i>	PROC 28
12: <i>Taking samples (< 1kg/sample)</i>	PROC 9
13: <i>Laboratory work including weighing and quality control processes</i>	PROC 15

3.2. Conditions of use affecting exposure

3.2.1. Control of environmental exposure: *Use of non-reactive processing aid at industrial site (no inclusion into or onto article) (ERC 4)*

Amount used, frequency and duration of use (or from service life)
<i>Daily amount per site ≤ 15 tonnes/day</i>
<i>Annual amount per site ≤ 300 tonnes/year</i>
Conditions and measures related to biological sewage treatment plant
<i>Municipal sewage treatment plant is assumed.</i>
<i>Assumed domestic sewage treatment plant flow ≥ 2000 m³/day</i>
Conditions and measures related to external treatment of waste (including article waste)
<i>Dispose of waste product or used containers according to local regulations.</i>
Other conditions affecting environmental exposure
<i>Receiving surface water flow ≥ 18000 m³/day</i>



3.2.2. Control of environmental exposure: *Use of reactive processing aid at industrial site (no inclusion into or onto article)* (ERC 6b)

Amount used, frequency and duration of use (or from service life)
<i>Daily amount per site ≤ 15 tonnes/day</i>
<i>Annual amount per site ≤ 300 tonnes/year</i>
Conditions and measures related to biological sewage treatment plant
<i>Municipal sewage treatment plant is assumed.</i>
<i>Assumed domestic sewage treatment plant flow ≥ 2000 m³/day</i>
Conditions and measures related to external treatment of waste (including article waste)
<i>Dispose of waste product or used containers according to local regulations.</i>
Other conditions affecting environmental exposure
<i>Receiving surface water flow ≥ 18000 m³/day</i>

3.2.3. Control of worker exposure: *Attach/detach loading chute to/from road tanker* (PROC 8b)

Product (article) characteristics
<i>Covers the use of solid material such as powders and dust consisting of relatively coarse particles with a moderate potential to become (and stay) airborne.</i>
<i>Covers concentrations up to 100 %</i>
<i>Powders, granules or pelletised material</i>
<i>Covers the use of coarse dust materials.</i>
<i>Covers dry product with <5 % moisture content.</i>
Amount used (or contained in articles), frequency and duration of use/exposure
<i>Assumes that open trucks, waggons or ships are handled.</i>
<i>Covers the use of up to 100 containers.</i>
<i>Covers use up to 2 h/day</i>
Technical and organisational conditions and measures
<i>Assumes that the process is completely enclosed for the vast majority of its duration. Very infrequent and controlled opening during operation may occur.</i>
<i>Assumes that the process is highly automated. Very limited manual intervention is required to run. Contact with the substance may be possible for a very limited duration of time.</i>
<i>Assumes that there are no adjacent workplaces contributing to exposure of the substance.</i>
<i>Covers the handling of contaminated solid objects or paste.</i>
<i>Covers the handling of objects with limited residual dust (thin layer visible).</i>
<i>Covers the normal handling, involves regular work procedures.</i>
<i>Covers handling that reduces contact between product and adjacent air.</i>
Conditions and measures related to personal protection, hygiene and health evaluation
<i>Assumes occasional general cleaning operations at the workplace.</i>
<i>Effective housekeeping practices (e.g. daily cleaning using appropriate methods, preventive maintenance of machinery, use of protective clothing that will repel spills and reduce personal cloud) in place.</i>
<i>Wear standard safety clothing.</i>
Other conditions affecting workers exposure
<i>Outdoor use</i>
<i>Covers the outdoor application close to buildings or in completely open areas.</i>



3.2.4. Control of worker exposure: *Closed transfer of borate from road tankers to large vessels or containers (e.g. silos) at site (PROC 1)*

Product (article) characteristics
<i>Covers the use of solid material such as powders and dust consisting of relatively coarse particles with a moderate potential to become (and stay) airborne.</i>
<i>Covers concentrations > 25 %.</i>
Amount used (or contained in articles), frequency and duration of use/exposure
<i>Covers use of > 4 h/day.</i>
Technical and organisational conditions and measures
<i>Assumes that the process is completely closed during standard operation.</i>
<i>Assumes that the process is fully automated. Workers are only involved in supervision and control walks. Direct contact with the substance is not possible.</i>
<i>Assumes that there are no adjacent workplaces contributing to exposure of the substance.</i>
<i>Covers an indoor use where a basic mechanical ventilation of at least 1 ACH is provided as well as an outdoor use.</i>
Conditions and measures related to personal protection, hygiene and health evaluation
<i>Assumes occasional general cleaning operations at the workplace.</i>
<i>Wear standard safety clothing.</i>
Other conditions affecting workers exposure
<i>Outdoor use</i>

3.2.5. Control of worker exposure: *Storage of borates (PROC 2)*

Product (article) characteristics
<i>Covers concentrations > 25 %.</i>
<i>Covers the use of solid material such as powders and dust consisting of relatively coarse particles with a moderate potential to become (and stay) airborne.</i>
Amount used (or contained in articles), frequency and duration of use/exposure
<i>Covers use of > 4 h/day.</i>
Technical and organisational conditions and measures
<i>Assumes that there are no adjacent workplaces contributing to exposure of the substance.</i>
<i>Covers an indoor use where a basic mechanical ventilation of at least 1 ACH is provided as well as an outdoor use.</i>
<i>Assumes that the process is highly automated. Very limited manual intervention is required to run. Contact with the substance may be possible for a very limited duration of time.</i>
<i>Assumes that the process is completely enclosed for the vast majority of its duration. Very infrequent and controlled opening during operation may occur.</i>
Conditions and measures related to personal protection, hygiene and health evaluation
<i>Wear standard safety clothing.</i>
<i>Assumes occasional general cleaning operations at the workplace.</i>
Other conditions affecting workers exposure
<i>Assumes process temperature up to 40 °C</i>



3.2.6. Control of worker exposure: *Transfer of borates to mixing vessel with no dedicated engineering controls in place for reducing the exposure (PROC 8a)*

Product (article) characteristics
<i>Covers the use of solid material such as powders and dust consisting of relatively coarse particles with a moderate potential to become (and stay) airborne.</i>
<i>Powders, granules or pelletised material</i>
<i>Covers the use of coarse dust materials.</i>
<i>Covers dry product with <5 % moisture content.</i>
<i>Covers the use of a material containing up to 90 % of the substance.</i>
Amount used (or contained in articles), frequency and duration of use/exposure
<i>Assumes that a system such as a conveyer belt is installed for transfer/handling operation.</i>
<i>Covers use up to 4 h/day</i>
Technical and organisational conditions and measures
<i>Assumes that the process is mostly enclosed during standard operation.</i>
<i>Assumes that the process is semi-automated. Manual intervention is repeatedly required although large parts of the process are machinery assisted.</i>
<i>Assumes that there are no adjacent workplaces contributing to exposure of the substance.</i>
<i>Local exhaust ventilation - efficiency of at least 90 % (e.g. fixed capturing hoods, on-tool extraction, horizontal/downward laminar flow booth, other enclosing hoods).</i>
<i>Provide a ventilation of at least 3 ACH.</i>
<i>Covers the falling transfer of powders, granules or pelletised material.</i>
<i>Covers the transfer of 10 to 100 kg/min.</i>
<i>Covers a drop height of < 0.5 m.</i>
Conditions and measures related to personal protection, hygiene and health evaluation
<i>Assumes regular cleaning operations at the workplace.</i>
<i>Effective housekeeping practices (e.g. daily cleaning using appropriate methods, preventive maintenance of machinery, use of protective clothing that will repel spills and reduce personal cloud) in place.</i>
<i>Wear appropriate selected gloves. For further specification, refer to section 8 of the SDS. Assumes that gloves are used by trained workers.</i>
<i>Wear standard safety clothing.</i>
Other conditions affecting workers exposure
<i>Indoor use</i>
<i>Indoor use (workrooms >1000 m³).</i>

3.2.7. Control of worker exposure: *Weighing of borates prior to discharge into mixing vessel (PROC 9)*

Product (article) characteristics
<i>Covers the use of solid material such as powders and dust consisting of relatively coarse particles with a moderate potential to become (and stay) airborne.</i>
<i>Covers concentrations > 25 %.</i>
Amount used (or contained in articles), frequency and duration of use/exposure
<i>Covers use of > 4 h/day.</i>
<i>Assumes that bottles and cans with an approximate volume of 1L are used.</i>



Technical and organisational conditions and measures
<i>Assumes that the process is mostly enclosed during standard operation.</i>
<i>Assumes that there are no adjacent workplaces contributing to exposure of the substance.</i>
<i>Covers an indoor use where a basic mechanical ventilation of at least 1 ACH is provided as well as an outdoor use.</i>
Conditions and measures related to personal protection, hygiene and health evaluation
<i>Assumes occasional general cleaning operations at the workplace.</i>
<i>Wear standard safety clothing.</i>

3.2.8. Control of worker exposure: *Discharge of borates into mixing vessel (PROC 8a)*

Product (article) characteristics
<i>Covers concentrations > 25 %.</i>
<i>Covers the use of solid material such as powders and dust consisting of relatively coarse particles with a moderate potential to become (and stay) airborne.</i>
Amount used (or contained in articles), frequency and duration of use/exposure
<i>Assumes that containers such as big bags with a capacity of > 500 kg are used.</i>
<i>Covers the use of up to 100 containers.</i>
<i>Covers use of up to 1 h/day.</i>
Technical and organisational conditions and measures
<i>Assumes that there are no adjacent workplaces contributing to exposure of the substance.</i>
<i>Covers an indoor use where a basic mechanical ventilation of at least 1 ACH is provided as well as an outdoor use.</i>
<i>Assumes that the process is semi-automated. Manual intervention is repeatedly required although large parts of the process are machinery assisted.</i>
<i>Assumes that the process is mostly enclosed during standard operation.</i>
Conditions and measures related to personal protection, hygiene and health evaluation
<i>Wear standard safety clothing.</i>
<i>Assumes occasional general cleaning operations at the workplace.</i>
<i>Wear suitable respiratory protection. Inhalation - minimum efficiency of 90 %. For further specification, refer to section 8 of the SDS.</i>

3.2.9. Control of worker exposure: *Mixing in closed continuous process at ambient temperature with occasional controlled exposure during opening and addition of borates from 25kg bags (PROC 2)*

Product (article) characteristics
<i>Covers concentrations > 25 %.</i>
<i>Covers the use of a substance handled in solution.</i>
Amount used (or contained in articles), frequency and duration of use/exposure
<i>Covers use of > 4 h/day.</i>
Technical and organisational conditions and measures
<i>Assumes that the process is completely enclosed for the vast majority of its duration. Very infrequent and controlled opening during operation may occur.</i>
<i>Assumes that the process is highly automated. Very limited manual intervention is required to run. Contact with the substance may be possible for a very limited duration of time.</i>
<i>Assumes that there are no adjacent workplaces contributing to exposure of the substance.</i>
<i>Covers an indoor use where a basic mechanical ventilation of at least 1 ACH is provided as well as an outdoor use.</i>



Conditions and measures related to personal protection, hygiene and health evaluation
<i>Wear standard safety clothing.</i>
<i>Assumes occasional general cleaning operations at the workplace.</i>
Other conditions affecting workers exposure
<i>Assumes process temperature up to 40 °C</i>

3.2.10. Control of worker exposure: *Mixing in closed continuous process at elevated temperature with occasional controlled exposure during opening (PROC 2)*

Product (article) characteristics
<i>Covers concentrations > 25 %.</i>
<i>Covers the use of a substance handled in solution.</i>
Amount used (or contained in articles), frequency and duration of use/exposure
<i>Covers use of > 4 h/day.</i>
Technical and organisational conditions and measures
<i>Assumes that the process is completely enclosed for the vast majority of its duration. Very infrequent and controlled opening during operation may occur.</i>
<i>Assumes that the process is highly automated. Very limited manual intervention is required to run. Contact with the substance may be possible for a very limited duration of time.</i>
<i>Assumes that there are no adjacent workplaces contributing to exposure of the substance.</i>
<i>Covers an indoor use where a basic mechanical ventilation of at least 1 ACH is provided as well as an outdoor use.</i>
Conditions and measures related to personal protection, hygiene and health evaluation
<i>Wear standard safety clothing.</i>
<i>Assumes occasional general cleaning operations at the workplace.</i>
Other conditions affecting workers exposure
<i>Assumes process temperature up to 500 °C</i>

3.2.11. Control of worker exposure: *Maintenance & routine cleaning (PROC 28)*

Product (article) characteristics
<i>Covers concentrations > 25 %.</i>
<i>Covers the use of solid material such as fine powders having a high potential to become and stay airborne.</i>
Amount used (or contained in articles), frequency and duration of use/exposure
<i>Assumes a contamination level of the workplace of up to 3 mg/m³.</i>
<i>Covers use of up to 1 h/day.</i>
Technical and organisational conditions and measures
<i>Assumes that the process is semi-automated. Manual intervention is repeatedly required although large parts of the process are machinery assisted.</i>
<i>Provide a mechanical ventilation of at least 3 ACH.</i>
<i>Assumes that the main cleaning device is a mop.</i>
Conditions and measures related to personal protection, hygiene and health evaluation
<i>Assumes occasional general cleaning operations at the workplace.</i>



3.2.12. Control of worker exposure: *Taking samples (< 1kg/sample) (PROC 9)*

Product (article) characteristics
<i>Covers the use of solid material such as powders and dust consisting of relatively coarse particles with a moderate potential to become (and stay) airborne.</i>
<i>Covers concentrations > 25 %.</i>
Amount used (or contained in articles), frequency and duration of use/exposure
<i>Assumes that bottles and cans with an approximate volume of 1L are used.</i>
<i>Covers the use of up to 10 containers.</i>
<i>Covers use of up to 1 h/day.</i>
Technical and organisational conditions and measures
<i>Assumes that there are no adjacent workplaces contributing to exposure of the substance.</i>
<i>Covers an indoor use where a basic mechanical ventilation of at least 1 ACH is provided as well as an outdoor use.</i>
<i>Assumes that the main cleaning device is a mop.</i>
Conditions and measures related to personal protection, hygiene and health evaluation
<i>Assumes occasional general cleaning operations at the workplace.</i>
<i>Wear standard safety clothing.</i>

3.2.13. Control of worker exposure: *Laboratory work including weighing and quality control processes (PROC 15)*

Product (article) characteristics
<i>Covers the use of solid material such as powders and dust consisting of relatively coarse particles with a moderate potential to become (and stay) airborne.</i>
<i>Covers concentrations > 25 %.</i>
Amount used (or contained in articles), frequency and duration of use/exposure
<i>Assumes that bottles and cans with an approximate volume of 1L are used.</i>
<i>Covers the use of up to 10 containers.</i>
<i>Covers use of up to 1 h/day.</i>
Technical and organisational conditions and measures
<i>Assumes that there are no adjacent workplaces contributing to exposure of the substance.</i>
<i>Covers an indoor use where a basic mechanical ventilation of at least 1 ACH is provided as well as an outdoor use.</i>
Conditions and measures related to personal protection, hygiene and health evaluation
<i>Assumes occasional general cleaning operations at the workplace.</i>
<i>Wear standard safety clothing.</i>

3.3. Exposure estimation and reference to its source

3.3.1. Environmental release and exposure: *Use of non-reactive processing aid at industrial site (no inclusion into or onto article) (ERC 4)*

Release route	Release rate	Release estimation method
Water	0 kg/day	Estimated release factor
Air	6 kg/day	Estimated release factor
Soil	750 kg/day	ERC



Protection target	Exposure estimate	RCR
Fresh water	0.051 mg/L (EUSES 2.1.2)	0.018
Marine water	0.00508 mg/L (EUSES 2.1.2)	< 0.01
Sewage Treatment Plant	0 mg/L (EUSES 2.1.2)	< 0.01
Agricultural soil	0.142 mg/kg dw (EUSES 2.1.2)	0.025
Man via environment - Inhalation (systemic effects)	0.0000914 mg/m ³ (EUSES 2.1.2)	< 0.01
Man via environment - Oral	0.016 mg/kg bw/day (EUSES 2.1.2)	0.097
Man via environment - combined routes		0.097

3.3.2. Environmental release and exposure: Use of reactive processing aid at industrial site (no inclusion into or onto article) (ERC 6b)

Release route	Release rate	Release estimation method
Water	0 kg/day	Estimated release factor
Air	6 kg/day	Estimated release factor
Soil	3.75 kg/day	ERC

Protection target	Exposure estimate	RCR
Fresh water	0.051 mg/L (EUSES 2.1.2)	0.018
Marine water	0.00508 mg/L (EUSES 2.1.2)	< 0.01
Sewage Treatment Plant	0 mg/L (EUSES 2.1.2)	< 0.01
Agricultural soil	0.142 mg/kg dw (EUSES 2.1.2)	0.025
Man via environment - Inhalation (systemic effects)	0.0000914 mg/m ³ (EUSES 2.1.2)	< 0.01
Man via environment - Oral	0.016 mg/kg bw/day (EUSES 2.1.2)	0.097
Man via environment - combined routes		0.097

3.3.3. Worker exposure: Attach/detach loading chute to/from road tanker (PROC 8b)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.43 mg/m ³ (ART)	0.297
Dermal, systemic, long term	2.457 mg/kg bw/day (MEASE)	0.036
Combined, systemic, long term		0.332

3.3.4. Worker exposure: Closed transfer of borate from road tankers to large vessels or containers (e.g. silos) at site (PROC 1)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.001 mg/m ³ (MEASE)	< 0.01
Dermal, systemic, long term	0.003 mg/kg bw/day (MEASE)	< 0.01
Combined, systemic, long term		< 0.01

3.3.5. Worker exposure: Storage of borates (PROC 2)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.013 mg/m ³ (MEASE)	< 0.01
Dermal, systemic, long term	0.35 mg/kg bw/day (MEASE)	< 0.01
Combined, systemic, long term		0.014



3.3.6. Worker exposure: Transfer of borates to mixing vessel with no dedicated engineering controls in place for reducing the exposure (PROC 8a)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.67 mg/m ³ (ART)	0.462
Dermal, systemic, long term	20.38 mg/kg bw/day (MEASE)	0.297
Combined, systemic, long term		0.759

3.3.7. Worker exposure: Weighing of borates prior to discharge into mixing vessel (PROC 9)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.316 mg/m ³ (MEASE)	0.218
Dermal, systemic, long term	0.518 mg/kg bw/day (MEASE)	< 0.01
Combined, systemic, long term		0.225

3.3.8. Worker exposure: Discharge of borates into mixing vessel (PROC 8a)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.633 mg/m ³ (MEASE)	0.437
Dermal, systemic, long term	8.19 mg/kg bw/day (MEASE)	0.119
Combined, systemic, long term		0.556

3.3.9. Worker exposure: Mixing in closed continuous process at ambient temperature with occasional controlled exposure during opening and addition of borates from 25kg bags (PROC 2)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.013 mg/m ³ (MEASE)	< 0.01
Dermal, systemic, long term	0.035 mg/kg bw/day (MEASE)	< 0.01
Combined, systemic, long term		< 0.01

3.3.10. Worker exposure: Mixing in closed continuous process at elevated temperature with occasional controlled exposure during opening (PROC 2)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.379 mg/m ³ (MEASE)	0.261
Dermal, systemic, long term	0.035 mg/kg bw/day (MEASE)	< 0.01
Combined, systemic, long term		0.262

3.3.11. Worker exposure: Maintenance & routine cleaning (PROC 28)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	1.063 mg/m ³ (MEASE)	0.733
Dermal, systemic, long term	2.493 mg/kg bw/day (MEASE)	0.036
Combined, systemic, long term		0.769

3.3.12. Worker exposure: Taking samples (< 1kg/sample) (PROC 9)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.013 mg/m ³ (MEASE)	< 0.01
Dermal, systemic, long term	0.104 mg/kg bw/day (MEASE)	< 0.01
Combined, systemic, long term		0.01



3.3.13. Worker exposure: *Laboratory work including weighing and quality control processes (PROC 15)*

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.013 mg/m ³ (MEASE)	< 0.01
Dermal, systemic, long term	0.069 mg/kg bw/day (MEASE)	< 0.01
Combined, systemic, long term		< 0.01

3.4. Guidance to DU to evaluate whether he works inside the boundaries set by the ES

Guidance:

The conditions of use at downstream users' sites may differ in some way from those described in the exposure scenario. In case of differences between the description of conditions of use in the exposure scenario and your own practice it does not mean that the use is not covered. The risk may still be adequately controlled. The way in which you determine if your conditions are equivalent or lower is termed "scaling". Scaling instructions are given below.

Human health: The workers' exposure is addressed using MEASE 2.0. However, for "Attach/detach loading chute to/from road tanker" (PROC 8b) and "Transfer of borates to mixing vessel with no dedicated engineering controls in place for reducing the exposure" (PROC 8a) ART v1.5 is used instead of MEASE 2.0 to estimate the inhalation exposure.

Environment: Emissions to the environment are estimated using EUSES v.2.1.2 as implemented in CHESAR v3.5.

Scaling tool:

Please use the above indicated publicly available modelling tools for scaling.

Scaling instructions:

Scaling can be used to check whether your conditions are "equivalent" to the conditions defined in the exposure scenario. If your conditions of use differ slightly from those indicated in the respective exposure scenario you might be able to demonstrate that, under your conditions of use, the exposure levels are equivalent or lower than under the described conditions. It may be possible to demonstrate this by compensating a variation in one particular condition with a variation in other conditions.

Scalable parameters:

In the following, the key determinants which are likely to vary in the actual use situation are given to be used for scaling.

- **Workers:**

ART 1.5: Concentration of the substance, Handling of contaminated solid object or paste, Duration of activity, Emission source, Transfer rate, Drop height, LEV, Room size, PPE.

MEASE 2.0: Concentration of the substance, Duration of exposure, Level of automation, Dust suppression techniques, Extraction device, ACH, Process temperature, Room size, Container capacity, Number of containers used, Contamination level of workplace, PPE.

Remark regarding RMMs: Effectiveness is the key information related to risk management measures. You can be sure that your risk management measures are covered if their effectiveness is equal to, or higher than, what is specified in the exposure scenario.

- **Environment:**

Daily use amount, Annual use amount, Number of emission days, Release factors, Discharge rate of STP, Receiving surface water flow rate.

Further details on scaling are provided in ECHA's Guidance for downstream users v2.1 (October 2014) as well as in ECHA's Practical Guide 13 (June 2012).



Boundaries of scaling:

RCRs not to be exceeded are described in Section 3.3.