



# Boric Oxide

## Section 1 Identification of the chemical and of the supplier

1.1	<b>Product Identifier</b>	Boric oxide	
1.2	<b>Other means of identification</b>	Boric oxide	
1.3	<b>Recommended use of the chemical and restrictions on use</b>	Industrial manufacturing	
1.4	<b>Supplier's details (including name, address, phone number, email)</b>	<b>Rio Tinto Minerals Asia Pte Ltd</b> 12 Marina Boulevard #20-01 Marina Bay Financial Centre Tower 3 Singapore 018982  +65 6679 9316  rtb.sds@riotinto.com	<b>Borax Europe Limited</b> 6 St. James's Square London, SW1Y 4AD, United Kingdom  +44 20 7781 2000
	<b>Manufacturer</b>	<b>U.S. Borax Inc.</b> 14486 Borax Road Boron, CA 93516-2000, USA  +1 (760) 762-7000	
1.5	<b>Emergency phone number</b>	<b>APAC</b> +65 3158 1074 (24-Hr Non toll-free number) (Rio Tinto Borates) <b>EIMEA</b> +44 (0) 1235 239 670 (Rio Tinto Borates)	

## Section 2 Hazards identification

- 2.1 **Classification of the substance or mixture**  
 Reproductive Toxicity Category 2  
 Acute Toxicity (Oral) Category 5
- 2.2 **GHS label elements, including pictogram or symbol, signal word, hazard and precautionary statements**

**Hazard pictograms**



**Signal word:** Warning

**Hazard statements:**

H361: Suspected of damaging fertility or the unborn child.  
 H303: May be harmful if swallowed.

**Precautionary statements:**

P202: Do not handle until all safety precautions have been read and understood.  
 P308+P313: IF exposed or concerned: Get medical advice/attention.  
 P501: Dispose of contents/container in accordance with local regulation.

Other hazards which do not result in classification (e.g. dust explosion hazard): None

## Section 3 Composition/information on ingredients

### 3.1 Substances

Chemical name	Common names and synonyms	CAS No.	% content
Boric oxide	Boron trioxide, diboron trioxide, anhydrous boric acid	1303-86-2	>97.5

## Section 4 First aid measures

### 4.1 Description of first aid measures

Protection of first-aiders: No special protective clothing is required.

**Inhalation:** If symptoms such as nose or throat irritation are observed, remove to fresh air.

**Eye contact:** Use eye wash fountain or fresh water to cleanse eye. If irritation persists for more than 30 minutes, seek medical attention.

**Skin contact:** No treatment necessary.

**Ingestion:** Swallowing small quantities (one teaspoon) will cause no harm to healthy adults. If larger amounts are swallowed, give two glasses of water to drink and seek medical attention.

**4.2 Most important symptoms and effects both acute and delayed:** Symptoms of accidental over-exposure to high doses of inorganic borate salts have been associated with ingestion or absorption through large areas of severely damaged skin. These may include nausea, vomiting, and diarrhoea, with delayed effects of skin redness and peeling (see Section 11).

**4.3 Indication of any immediate medical attention and special treatment needed:** Note to physicians: Supportive care only is required for adult ingestion of less than a few grams of the product. For ingestion of larger amounts, maintain fluid and electrolyte balance and maintain adequate kidney function. Gastric lavage is only recommended for heavily exposed, symptomatic patients in whom emesis has not emptied the stomach. Hemodialysis should be reserved for patients with massive acute absorption, especially for patients with compromised renal function. Boron analyses of urine or blood are only useful for verifying exposure and are not useful for evaluating severity of poisoning or as a guide in treatment<sup>1</sup>.

## Section 5 Fire-fighting measures

### 5.1 Suitable (and unsuitable) extinguishing media

**Suitable extinguishing media:** Use extinguishing media that are appropriate to local circumstances and the surrounding environment.

**Unsuitable extinguishing media:** None

### 5.2 Special hazards arising from the chemical

None. The product is not flammable, combustible or explosive.

### 5.3 Special protective equipment and precautions for fire-fighters:

Not applicable. The product is itself a flame retardant.

## Section 6 Accidental release measures

### 6.1 Personal precautions, protective equipment and emergency procedures

#### For non-emergency personnel:

Eye protection according to ANSI Z.87.1 or other national standards. Respirators according to EN149:2001 or other national standards should be considered if environment is excessively dusty.

#### For emergency responders:

Eye protection according to ANSI Z.87.1 or other national standards. Respirators according to EN149:2001 or other national standards should be considered if environment is excessively dusty.

**6.2 Environmental precautions:** The product is a water-soluble white powder that may cause damage to trees or vegetation by root absorption. Avoid contamination of water bodies during clean up and disposal. Advise local water

authority that none of the affected water should be used for irrigation or for the abstraction of potable water until natural dilution returns the boron value to its normal environmental background level or meets local water quality standards.

### 6.3 Methods and material for containment and cleaning up

**Appropriate containment:** Avoid spillage into water and cover drains.

**Land spill:** Vacuum, shovel or sweep up and place in containers for disposal in accordance with applicable local regulations.

**Spillage into water:** Where possible, remove any intact containers from the water.

### 6.4 Reference to other sections

Refer to sections 8, 12 and 13.

## Section 7 Handling and storage

### 7.1 Precautions for safe handling

Good housekeeping procedures should be followed to minimise dust generation and accumulation. Avoid spills. Do not eat, drink and smoke in work areas. Wash hands after use. Remove contaminated clothing and protective equipment before entering eating areas.

### 7.2 Conditions for safe storage, including any incompatibilities

No special handling precautions are required, but dry, indoor storage is recommended. To maintain package integrity and to minimise caking of the product, bags should be handled on a first-in first-out basis.

**Storage temperature:** Ambient  
**Storage pressure:** Atmospheric  
**Special sensitivity:** Moisture (Caking)

## Section 8 Exposure controls/personal protection

### 8.1 Control parameters

**Occupational exposure limit values:** In the absence of a national OEL, Rio Tinto Borates recommends and applies internally an Occupational Exposure Limit (OEL) of 1 mg B/m<sup>3</sup>. To convert product into equivalent boron (B) content, multiply by 0.311.

**8.2 Appropriate engineering controls:** Use local exhaust ventilation to keep airborne concentrations of dust below permissible exposure limits.

### 8.3 Personal protection equipment:

**Eye and face protection:** Eye protection according to ANSI Z.87.1 or other national standards may be warranted if environment is excessively dusty.

**Skin protection:** Standard work gloves (cotton, canvas or leather) may be warranted if environment is excessively dusty.

**Respiratory protection:** Where airborne concentrations are expected to exceed exposure limits, respirators should be used (EN149).

## Section 9 Physical and chemical properties

### 9.1 Information on basic physical and chemical properties

<b>Appearance:</b>	White, crystalline solid
<b>Odour</b>	Odourless
<b>Odour threshold:</b>	Not applicable: odourless
<b>pH @ 20°C:</b>	5.0 (1.0% solution)
<b>Melting point/ Freezing point:</b>	>633K
<b>Initial boiling point and boiling range:</b>	Not applicable: melting point >300°C
<b>Flash point:</b>	Not applicable: inorganic substance
<b>Evaporation rate:</b>	Not applicable: non-volatile
<b>Flammability (solid/gas):</b>	Non-flammable (used as a flame retardant)
<b>Upper/lower flammability or explosive limits:</b>	Not applicable: non-flammable
<b>Vapour pressure:</b>	Not applicable: melting point >300°C
<b>Vapour density:</b>	Not applicable: melting point >300°C
<b>Relative density:</b>	1.84 x 10 <sup>3</sup> kg/m <sup>3</sup> @ 21.5 °C
<b>Solubility(ies):</b>	Not applicable: reacts quickly with water to form boric acid
<b>Partition coefficient; n-octanol/water:</b>	Not applicable: Inorganic substance
<b>Auto-ignition temperature:</b>	Not applicable: not self-heating
<b>Decomposition temperature:</b>	Not applicable: melting point >300°C

<b>Viscosity:</b>	Not applicable: solid substance
<b>Explosive properties:</b>	Not explosive: does not contain chemical groups associated with explosive properties
<b>Oxidising properties:</b>	Not oxidising: does not contain chemical groups associated with oxidising properties

## 9.2 Other information

<b>Molecular weight:</b>	69.6
<b>Formula:</b>	B <sub>2</sub> O <sub>3</sub>

## Section 10 Stability and reactivity

- 10.1 Reactivity:** None known.
- 10.2 Chemical stability:** Under normal ambient temperatures (-40 °C to +40°C), the product is stable product. Reaction with water results in the liberation of heat (75.94 KJ/mol).
- 10.3 Possibility of hazardous reactions:** Reaction with strong reducing agents such as metal hydrides or alkali metals will generate hydrogen gas which could create an explosive hazard.
- 10.4 Conditions to avoid:** Avoid contact with strong reducing agents by storing according to good industrial practice.
- 10.5 Incompatible materials:** Strong reducing agents.
- 10.6 Hazardous decomposition products:** None.

## Section 11 Toxicological information

### 11.1 Information on the likely routes of exposure (inhalation, ingestion, skin and eye contact)

Inhalation is the most significant route of exposure in occupational and other settings. Dermal exposure is not usually a concern because product is poorly absorbed through intact skin. Product is not intended for ingestion.

#### (a) Acute toxicity

Method: Acute Oral Toxicity Study – OECD Guideline 401

Species: Rat

Dose: 1540; 2600 mg/kg body weight

Routes of Exposure: Oral

Results: Low acute oral toxicity. The oral LD50 value in male rats is >2600 mg/kg bw.

Classification: Acute Toxicity (Oral) Category 5 (Hazard statement: H303: May be harmful if swallowed)

Method: Acute Dermal Toxicity Study – U.S. EPA FIFRA Guidelines

Species: Rabbit

Dose: 2,000 mg/kg bw

Routes of Exposure: Dermal

Results: Low acute dermal toxicity; LD50 in rabbits is > 2,000 mg boric acid/kg bw. Poorly absorbed through intact skin. Based on the available data, the classification criteria are not met.

Method: Acute Inhalation Toxicity Study – OECD Guideline 403

Species: Rat

Dose: 2.12 mg/L

Routes of Exposure: Inhalation

Results: Low acute inhalation toxicity; LC50 in rats is > 2.0 mg boric acid/l (or g/m<sup>3</sup>). Based on the available data, the classification criteria are not met.

#### (b) Skin corrosion / irritation:

Method: Primary Dermal Irritation Study – U.S. EPA FIFRA Guidelines

Species: New Zealand White Rabbit

Dose: 0.5 g boric acid moistened with saline

Routes of Exposure: Dermal

Results: No skin irritation. Mean Primary Irritation Score boric acid: 0.1. Based on the available data, the classification criteria are not met.

#### (c) Serious eye damage / irritation:

Method: Eye Irritation Study – similar to OECD Guideline 405

Species: New Zealand White Rabbit

Dose: 0.1 g

Routes of Exposure: Eye

Results: Not irritating. Boric oxide induced slight to moderate conjunctivae redness and chemosis. The irritation was reversible after 24 hours with a return to near normal by 72 hours after exposure.

Classification: The classification criteria are not met. Many years of occupational exposure indicate no adverse effects

on human eye.

**(d) Respiratory or skin sensitization:**

Method: Buehler Test – OECD Guideline 406

Species: Guinea Pig

Dose: 0.4 g 95 % w/w/boric acid

Routes of Exposure: Dermal

Results: Not a skin sensitiser. No respiratory sensitisation studies have been conducted. There are no data to suggest that boric acid is a respiratory sensitiser. Based on the available data, the classification criteria are not met.

**(e) Germ cell mutagenicity:**

Method: Several in vitro mutagenicity studies have been carried out on boric acid including gene mutation in mammalian cells, unscheduled DNA synthesis, chromosomal aberration and sister chromatid exchange in mammalian cells.

Species: L5178Y mouse lymphoma, V79 Chinese hamster cells, C3H/10T1/2 cells, hepatocytes, Chinese hamster ovary (CHO cells).

Dose: 1.0 - 10.0 mg/ml (1000 -10000 ppm) boric acid

Routes of Exposure: in vitro

Results: Not mutagenic (based on boric acid). Based on the available data, the classification criteria are not met.

**(f) Carcinogenicity:**

Method: OECD 451 equivalent.

Species: B6C3F1 mice

Dose: 446 ; 1150 mg boric acid/kg bw/day

Routes of Exposure: Oral feeding study

Results: No evidence of carcinogenicity (based on boric acid). Based on the available data, the classification criteria are not met.

**(g) Reproductive toxicity:**

Method: Three-generation feeding study, similar to OECD 416 Two-Generation Study

Species: Rat

Dose: 0; 34 (5.9); 100 (17.5) and 336 (58.5) mg boric acid (mg B)/kg bw/day

Routes of Exposure: Oral feeding study

Results: NOAEL in rats for effects on fertility in males is 100 mg boric acid/kg bw equivalent to 17.5 mg B/kg bw.

Method: Prenatal Developmental Toxicity Study of Boric Acid – OECD Guideline 414

Species: Rat

Dose: 0; 19 (3.3); 36 (6.3); 55 (9.6); 76 (13.3) and 143 (25) mg boric acid (mg B)/kg bw.

Routes of Exposure: Oral feeding study

Results: NOAEL in rats for developmental effects on the foetus including foetal weight loss and minor skeletal variations is 55 mg boric acid/kg bw or 9.6 mg B/kg.

Classification: Reproductive Toxicity Category 2 (Hazard statement: H361: Suspected of damaging fertility or the unborn child.)

Method: Occupational studies of evaluating sensitive sperm parameters in highly exposed borate workers.

Epidemiological studies evaluating high environmental exposures to boron and developmental effects in humans have been conducted.

Species: Human

Dose: A subset of workers was exposed to 125 mg B/day.

Routes of Exposure: Combined oral ingestion and inhalation

Results: No adverse fertility effects in male workers. Epidemiological studies of human developmental effects have shown an absence of effects in exposed borate workers and populations living in areas with high environmental levels of boron.

**(h) STOT-single exposure:**

Method: Standard Test Method for Estimating Sensory Irritancy of Airborne Chemicals – ASTM E981-04 (2004)

Species: Mouse

Dose: 221 - 1096 mg boric acid/m<sup>3</sup>

Routes of Exposure: Inhalation

Results: The highest concentration of boric acid that was achievable with acceptable control of the aerosol concentration was 1096 mg/m<sup>3</sup> with a %RD of 19%. The lowest exposure tested of 221 mg/m<sup>3</sup> boric acid resulted in a reduced respiration rate of 9%, graded as no irritation. Based on the available data, the classification criteria are not met.

Method: Sensory irritation in human volunteers

Species: Human

Dose: 2.5, 5, 10 mg boric acid/m<sup>3</sup>

Routes of Exposure: Inhalation

Results: No irritation from boric acid was observed at exposures up to 10 mg/m<sup>3</sup> among male and female human volunteers under controlled laboratory conditions.

**(i) STOT-repeated exposure:**

Method: Chronic toxicity study of boric acid, similar to OECD 452

Species: Rat

Dose: 0; 33 (5.9); 100 (17.5); 334 (58.5) mg boric acid (B)/kg bw per day (nominal in diet)

Routes of Exposure: oral: feed

Results: A NOAEL of 17.5 mg B/kg bw/day equivalent to 100 mg boric acid/kg bw/day was determined in a chronic

feeding study (2 years) in rats and is based on testes effects. Other effects (kidney, haemopoietic system) are regarded only at even higher dose levels. Based on the available data, the classification criteria are not met.

**(j) Aspiration hazard:** Physical form of solid powder indicates no aspiration hazard potential.

#### Toxicokinetics

In the blood boric acid is the main species present and is not further metabolised. Boric acid is distributed rapidly and evenly through the body, with concentrations in bone 2 - 3 higher than in other tissues. Boric acid is excreted rapidly, with elimination half-lives of 1 h in the mouse, 3 h in the rat and < 27.8 h in humans, and has low potential for accumulation.

Boric acid is mainly excreted in the urine. Absorption of borates via the oral route is nearly 100 %. For the inhalation route also 100 % absorption is assumed as worst case scenario. Dermal absorption through intact skin is very low with a percent dose absorbed of < 0.5 %.

#### 11.2 Symptoms related to the physical, and chemical and toxicological characteristics:

Products are *not* intended for ingestion. Small amounts (e.g. a teaspoonful) swallowed accidentally are not likely to cause effects. Symptoms of accidental over-exposure to high doses of inorganic borate salts have been associated with ingestion or absorption through large areas of severely damaged skin. These may include nausea, vomiting, and diarrhoea, with delayed effects of skin redness and peeling.

#### 11.3 Delayed and immediate effects as well as chronic effects from short and long-term exposure:

Human epidemiological studies show no increase in pulmonary disease in occupational populations with chronic exposures to boric acid and sodium borate dust. Human epidemiological studies indicate no effect on fertility in occupational populations with chronic exposures to borate dust and indicate no effect to a general population with high exposures to borates in the environment.

#### 11.4 Numerical measures of toxicity (such as acute toxicity)

None. This product is a substance.

## Section 12 Ecological information

#### 12.1 Ecotoxicity (aquatic and terrestrial, where available)

Note that the data values are expressed as boron equivalents. To convert to this product divide the boron equivalent by 0.311. Studies judged to be unreliable or with insufficient information to evaluate are not included. All toxicity values are reported as added concentrations, i.e. with subtraction of the background concentration of Boron in the test media.

##### Freshwater

Chronic studies

Taxonomic Group	Number of Taxa Tested	Range of Endpoint Values (geometric NOEC/EC10)	References
Algal	1	17.5 mg B/L ( <i>Pseudokirchneriella subcapitata</i> )	2
Higher plants	1	6.0 mg B/L ( <i>Spirodella polyrhiza</i> )	3
Invertebrate	5	6.3 mg B/L ( <i>Hyaella azteca</i> ) to 30.0 mg B/L ( <i>Lampsilis siliquoidea</i> )	4, 5
Fish	6	6.3 mg B/L ( <i>Brachydanio rerio</i> ) to 36.8 mg B/L ( <i>Micropterus salmoides</i> )	6, 7
Amphibian	4	9.4 mg B/L ( <i>Xenopus laevis</i> ) to 69.9 mg B/L ( <i>Bufo fowleri</i> )	8, 9

Results<sup>2</sup>: Based on the complete data set of 17 species, the HC<sub>5-50</sub> value of the species sensitivity distribution is 5.7 mg B/L.

Acute studies

Taxonomic Group	Number of Taxa Tested	Range of Endpoint Values (geometric EC/LC50)	References
Algal	1	52.4 mg B/L ( <i>Pseudokirchneriella subcapitata</i> )	2
Invertebrate	7	112.9 mg B/L ( <i>Ceriodaphnia dubia</i> ) to >544 mg B/L ( <i>Megaloniaias nervosa</i> )	4
Fish	1	79.7 mg B/L ( <i>Pimephales promelas</i> )	4

Classification: Based on the acute data for freshwater species, this substance is not classified as hazardous to the environment.

**Marine and Estuarine Data**

## Chronic studies

Taxonomic Group	Number of Taxa Tested	Range of Endpoint Values (geometric NOEC/EC10)	References
Algal	1	27.9 mg B/L ( <i>Phaeodactylum tricornutum</i> )	10
Invertebrate	1	16.6 mg B/L ( <i>Americamysis bahia</i> )	11

Results: No data are available for vertebrate species. The results from the freshwater data set are recommended as applicable to marine and estuarine species.

## Acute studies

Taxonomic Group	Number of Taxa Tested	Range of Endpoint Values (geometric EC/LC50)	References
Alga	1	66.0 mg B/L ( <i>Phaeodactylum tricornutum</i> )	10
Invertebrate	1	130.0 mg B/L ( <i>Litopenaeus vannamei</i> )	12
Fish	1	74 mg B/L ( <i>Limanda limanda</i> ) (total)	13

**Sediment**

Taxonomic Group	Number of Taxa Tested	Range of Endpoint Values (geometric EC/LC50)	References
Invertebrate	1	37.7 mg B/kg sediment dw ( <i>Chironomus riparius</i> )	14

Results: The weight of evidence provided by the lack of partitioning of boron to the sediment and the results of the water only/whole sediment toxicity tests indicate that it is unlikely that boron will exert toxic effects via the sediment compartment and that the derivation of a sediment HC<sub>5-50</sub> value is not warranted for this product.

**Sewage Treatment Plants (STP)**

Taxonomic Group	Number of Taxa Tested	Range of Endpoint Values (geometric NOEC/EC10)	References
Activated sludge	NA	17.5 mg B/L to 10,000 mg B/L	15, 16
Microbes	3	10 mg B/L ( <i>Opercularia bimarginata</i> ) to 20 mg B/L ( <i>Paramecium caudatum</i> )	17

Results: The lowest NOEC for sewage treatment plant is 10 mg B/L.

**Terrestrial Data**

## Chronic studies

Taxonomic Group	Number of Taxa Tested	Range of Endpoint Values (geometric NOEC/EC10)	References
Plant	28	7.2 mg B/kg dw ( <i>Zea mays</i> ) to 56 mg B/kg dw ( <i>Allium cepa</i> )	18, 19
Invertebrates	9	15.4 mg B/kg dw ( <i>Folsomia candida</i> ) to 86.7 mg B/kg dw ( <i>Caenorhabditis elegans</i> )	20, 21
Soil micro	3	41.3 mg B/kg dw (substrate induced nitrification test) to 48.1 mg B/kg dw (soil nitrogen transformation test)	22, 23, 24

Results<sup>2</sup>: Based on the complete data set, the HC<sub>5-50</sub> value of the species sensitivity distribution is 11.3 mg B/kg dw.

**Phytotoxicity:** Boron is an essential micronutrient for healthy growth of plants. It can be harmful to boron sensitive plants in higher quantities. Care should be taken to minimise the amount of borate product released to the environment.

**12.2 Persistence and Degradability**

Biodegradation is not an applicable endpoint since the product is an inorganic substance.

**12.3 Bioaccumulative potential**

This product will undergo hydrolysis in water to form undissociated boric acid. Boric acid will not biomagnify through the foodchain. Octanol/Water partition coefficient: Log P<sub>ow</sub> = -0.7570 @ 25°C (based on boric acid).

- 12.4 Mobility in soil**  
The product is soluble in water and is leachable through normal soil. Adsorption to soils or sediments is insignificant.
- 12.5 Other adverse effects**  
None

## Section 13 Disposal considerations

- 13.1 Disposal methods**  
Product packaging should be recycled where possible.  
Local authorities should be consulted about any specific local requirements
- Such product should, if possible, be used for an appropriate application.

## Section 14 Transport information

Transport Classification for Road (ADR) / Rail (RID); Inland waterways (ADN); Sea (IMDG); Air (ICAO/IATA)

14.1 UN Number:	Not Regulated
14.2 UN Proper Shipping Name:	Not Regulated
14.3 Transport hazard class(es):	Not Regulated
14.4 Packing Group:	Not Regulated
14.5 Environmental Hazards (e.g. marine pollutant)	Not Regulated
14.6 Special precautions for user:	Not Regulated
14.7 Transport in bulk according to Annex II of MARPOL 73/78 and the IBC code:	Not Regulated

## Section 15 Regulatory information

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

**International regulations**

**Chemical Weapon Convention List Schedule I, II & III Chemicals:** Not listed.

**Clean Air Act (Montreal Protocol) - Substances that deplete the ozone layer:** Not manufactured with and does not contain any Class I or Class II ozone depleting substances.

**Stockholm Convention on Persistent Organic Pollutants:** Not listed

**Rotterdam Convention on Prior Informed Consent (PIC):** Not listed

**UNECE Aarhus Protocol on POPs and Heavy Metals:** Not listed

**Regulation (EC) No 689/2008 - Export and Import of Dangerous Chemicals:** Not listed.

**National Regulations:** Ensure all national/local regulations are observed.

**Chemical inventory listing:** The listing is sometimes under the Inventory number of the anhydrous form of this inorganic salt.

<b>United States (TSCA) Active:</b>	1303-86-2
<b>Canada (DSL):</b>	1303-86-2
<b>European Union (EINECS):</b>	215-125-8
<b>Australia (AICS):</b>	1303-86-2
<b>China (IECSC):</b>	1303-86-2
<b>Japan (METI &amp; ISHL):</b>	(1)-71
<b>New Zealand (NZIoC):</b>	1303-86-2
<b>Philippines (PICCS):</b>	1303-86-2
<b>South Korea (KECI):</b>	KE-09919
<b>Taiwan (NECI):</b>	Listed
<b>Thailand (TECI):</b>	Listed
<b>Vietnam:</b>	Listed



## Section 16 Other information

**16.1 Date of previous issue:** January 2015

**16.2 Date of latest revision date:** January 2020

### Revision Details:

Section 1: Updated manufacturer, suppliers' contact number and email.  
Section 11, 15 and 16: Additional information.  
Minor typographical corrections

### 16.3 References:

1. Litovitz T L, Norman S A, Veltri J C, Annual Report of the American Association of Poison Control Centers Data Collection System. Am. J. Emerg. Med. (1986), 4, 427-458
2. Hanstveit AO, H Oldersma (2000). Unpublished report. Report no.: V99.157. Borax Europe Limited.
3. Davis SM, KD Drake, KJ Maier (2002). Chemosphere 48, 615-620.
4. 4 Soucek D, A Dickinson, K Major (2010). Environ. Toxicol. Chem., 30(8):1906-1914
5. Lockwood R (2011). Unpublished report. Report no.: 20-26107A RT-3. Rio Tinto Minerals.
6. Hoofman RN, D van Drongelen-Sevenhuijsen, HPM de Haan (2000). Unpublished report. Report no.: IMW-99-9047-09. Borax Europe Limited.
7. Birge WJ, JA Black (1981). Unpublished report. No report number. Procter and Gamble.
8. Fort Douglas J (2011). Unpublished report. Report no.: RIOT01-00232. Rio Tinto Minerals.
9. Laposata MM, WA Dunson (1998). Arch. Environ. Contam. Toxicol. 35, 615-619.
10. Rebstock M (2011). Unpublished report. Report no.: 65484. REACH Consortium for Borates.
11. Hicks Stephen L (2011). Unpublished report. Report no.: 65481. REACH Consortium for Borates.
12. Bergfield A (2011). Unpublished report. Report no.: 65478. REACH Consortium for Borates.
13. Taylor D, BG Maddock, G Mance (1985). Aquatic Toxicology, 7 (1985) 135-144.
14. Gerke A (2011). Unpublished report. Report no.: Study No. 65474. REACH Consortium for Borates.
15. Hanstveit AO, JA Schoonmade (2000). Unpublished report. Report no.: V99.156. Borax Europe limited.
16. Muller, Bruns (2001). Unpublished report. Report no.: 1082 A/01 B. HC Starck.
17. Guhl W (2000). SÖFW-Journal, 126, Jahrgang 10-2000.
18. Hosseini SM, M Maftoun, N Karimian, A Ronaghi, Y Emam (2007). Journal of Plant Nutrition, 30 (5): 773-781.
19. Aquatarra Environmental (1998). Unpublished report. No report number. Environmental Technology Centre, Environment Canada.
20. Becker-van Slooten K, S Campiche, J Tarradellas (2003). Unpublished report. No report number. Environmental Technology Centre, Environment Canada.
21. Moser T, L Becker (2009). Unpublished report. No report number. Reach Consortium for Borates.
22. Van Laer L, P Salaets, E Smolders (2010). Unpublished report. No report number. Reach Consortium for Borates.
23. Förster B, L Becker (2009). Unpublished report. No report number. Reach Consortium for Borates.
24. Hanstveit R, JA Schoonmade, A Akdemir (2001). Unpublished report. Report no.: V99.1183. Borax Europe Limited.

For general information on the toxicology of borates see ECETOC Technical Report No. 63 (1995); Patty's Toxicology, 6th Edition Vol. I, (2012) Chap. 23, 'Boron'.

### 16.4 Abbreviations and acronyms:

bw: Body weight  
dw: Dry weight  
EC: Effect concentration  
GHS: Global Harmonised System for classification and labelling of chemicals  
HC: Hazard Concentration  
IATA: International Air Transport Association  
IBC: Intermediate Bulk Container  
IMDG: International Maritime Dangerous Goods  
LC: Lethal Concentration  
LD: Lethal Dose  
MARPOL: International Convention for the Prevention of Pollutant From Ships, 1973  
STOT: Specific Target Organ Toxicity  
LOEC: Lowest Observed Effect Concentration  
NA: Not applicable.  
NOAEL: No observed adverse effect level  
NOEC: No Observed Effect Concentration  
STP: Sewage Treatment Plant

### Precautionary Phrases:

Do not ingest.  
Keep out of reach of children.  
Refer to safety data sheet.  
Not for use in food, drugs or pesticides.

**Disclaimer:**

Rio Tinto Minerals Asia Pte. Ltd. provides the information contained herein in good faith but makes no representation as to its comprehensiveness or accuracy. This document is intended only as a guide to the appropriate precautionary handling of the material by a properly trained person using this product. Individuals receiving the information must exercise their independent judgement in determining its appropriateness for a particular purpose.

RIO TINTO MINERALS ASIA PTE. LTD. MAKES NO REPRESENTATIONS OR WARRANTIES, EITHER EXPRESSED OR IMPLIED, INCLUDING WITHOUT LIMITATION ANY WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE WITH RESPECT TO THE INFORMATION SET FORTH HEREIN OR THE PRODUCT TO WHICH THE INFORMATION REFERS. ACCORDINGLY RIO TINTO MINERALS ASIA PTE. LTD. WILL NOT BE RESPONSIBLE FOR DAMAGES RESULTING FROM USE OR RELIANCE UPON THIS INFORMATION.