Safety Data Sheet

Date of revision: January 2020
Supersedes: January 2015 version

Firebrake® 500

Section 1 Identification of the chemical and of the supplier

1.1 Product Identifier

Firebrake 500

1.2 Other means of identification

Hexaboron dizinc undecaoxide

1.3 Recommended use of the chemical and restrictions on use

Flame retardant

1.4 Supplier's details (including name, address, phone number, email)

Rio Tinto Minerals Asia Pte Ltd
12 Marina Boulevard
#20-01 Marina Bay Financial Centre
Tower 3
Singapore 018982

+65 6679 9316

rtb.sds@riotinto.com

Borax Europe Limited
6 St. James's Square
London, SW1Y 4AD,
United Kingdom

+44 20 7781 2000

Manufacturer

U.S. Borax Inc.
14486 Borax Road
Boron, CA 93516-2000, USA

+1 (760) 762-7000

1.5 Emergency phone number

APAC +65 3158 1074 (24-Hr Non toll-free number) (Rio Tinto Borates)
EIMEA +44 (0) 1235 239 670 (Rio Tinto Borates)

Section 2 Hazards identification

2.1 Classification of the substance or mixture

Reproductive Toxicity Category 2
Serious Eye Damage / Eye Irritation Category 2A
Acute Aquatic Toxicity Category 1
Chronic Aquatic Toxicity Category 2

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 the unborn child.
H319: Causes serious eye irritation.
H400: Very toxic to aquatic life.
H411: Toxic to aquatic life with long-lasting effects.

Precautionary statements:
P202: Do not handle until all safety precautions have been read and understood.

P273: Avoid release to the environment.
P280: Wear eye protection.
P305+P351+P338: IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
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
Hexaboron dizinc undecaoxide	Anhydrous zinc borate	12767-90-7	>98.8

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[1].

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/m3. To convert product into equivalent zinc (Zn) content, multiply by 0.352.To convert product into equivalent boron (B) content, multiply by 0.175.

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 are required.
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).

Environmental exposure controls:
Limiting releases from site: Where appropriate, material should be recovered and recycled through the process. Spillages of powder or granulated borates should be swept or vacuumed up immediately and placed in containers for disposal in order to prevent unintentional release to the environment. Waste containing borates should be handled as an hazardous waste and removed by licensed operator to an offsite location where it can be incinerated or disposed to a hazardous landfill.

Water Emissions: Storage should be sheltered from precipitation. Avoid spillage into water and cover drains. Removal from water can only be accomplished by very specific treatment technologies including ion exchange resins, reverse osmosis etc. Removal efficiency is dependent upon a number of factors and will vary from 40 to 90%. Much of the technology is currently not appropriate to high volume or mixed waste streams. Boron is not removed in considerable amounts in conventional STP. If sites discharge to a municipal STP the concentration of boron should not exceed the PNEC in the municipal STP.
Air Emissions: Emissions to air can be removed by one or more of the following dust-control measures: electrostatic precipitators, cyclones, fabric or bag filters, membrane filters, ceramic and metal mesh filters, and wet scrubbers.

Section 9 Physical and chemical properties

9.1 Information on basic physical and chemical properties

Appearance:	White, powder
Odour	Odourless
Odour threshold:	Not applicable: odourless
pH @ 20°C:	6.8 – 7.5 (aqueous solution)
Melting point/ Freezing point:	>300°C
Initial boiling point and boiling range:	Not applicable: melting point >300°C
Flash point:	Not applicable: inorganic substance
Evaporation rate:	Not applicable: non-volatile
Flammability (solid/ gas):	Non-flammable (used as a flame retardant)
Upper/lower flammability or explosive limits:	Not applicable: non-flammable
Vapour pressure:	Not applicable: melting point >300°C
Vapour density:	Not applicable: melting point >300°C
Relative density:	2.6@20°C
Solubility(ies):	Water**:** <0.28%@ 25°C
Partition coefficient; n-octanol/water:	Not applicable: inorganic substance
Auto-ignition temperature:	Not applicable: not self-heating
Decomposition temperature:	Not applicable: melting point >300°C
Viscosity:	Not applicable: solid substance
Explosive properties:	Not explosive: does not contain chemical groups associated with explosive properties
Oxidising properties:	Not oxidising: does not contain chemical groups associated with oxidising properties

9.2 Other information

Molecular weight:	371.62
Formula:	$2ZnO{\cdot}3B_2O_3$

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.

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 equivalent
Species: Rat
Dose: Limit test: 5.0 g/kg bw, 50% w/v formulation in corn oil.
Routes of Exposure: Oral
Results: Low acute oral toxicity. LD_{50} in rats is >5,000 mg/kg bw.
Based on available data, the classification criteria are not met.

Method: Acute Dermal Toxicity Study
Species: Rabbit
Dose: Limit test: 5.0 g/kg bw.
Routes of Exposure: Dermal
Results: Acute dermal LD50 is > 5,000 mg/kg (limit of tested dosages). Based on the available data, the classification criteria are not met.
Method: Acute Inhalation Toxicity Study – OECD Guideline 403
Species: Rat
Dose: 4.95 mg/L of Zinc Borate 415
Routes of Exposure: Inhalation
Results: No acute inhalation toxicity data is available for Zinc borate, hydrate. LC_{50} value in rats for acute inhalation toxicity > 4.95 mg /L based on an acute inhalation toxicity study on a similar zinc borate compound. 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, similar to OECD 404
Species: Rabbit
Dose: 500 mg
Routes of Exposure: Dermal
Results: No skin irritation. Primary Irritation Index of 0.2 based on erythema. No irritation persisted 72 hours following application. 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: Rabbit
Dose: 100 mg
Routes of Exposure: Eye
Results: Irritating, fully reversible in 14 days.
Classification: Eye irritation Category 2A (Hazard statement: H319: Causes serious eye irritation).

(d) Respiratory or skin sensitization:
Method: Buehler Test – OECD Guideline 406
Species: Guinea Pig
Dose: 0.4 g zinc borate (hydrate)
Routes of Exposure: Dermal
Results: Not a skin sensitiser. No respiratory sensitisation studies have been conducted. There are no data to suggest that zinc borates are respiratory sensitisers. Based on the available data, the classification criteria are not met.

(e) Germ cell mutagenicity:
Method: mammalian cell gene mutation assay (gene mutation) OECD Guideline 476.
Species: mouse lymphoma L5178Y cells
Dose: 0.001 - 0.075 mg/mL (1 - 75 ppm) zinc borate hydrate
Routes of Exposure: *in vitro*
Results: Not mutagenic. Based on the available data, the classification criteria are not met.

(f) Carcinogenicity:
No experimental test data on zinc borate.
Results: Zinc borate disassociates to zinc hydroxide and boric acid in the low pH environment of the stomach. No carcinogenic effects observed in chronic carcinogenicity studies of boric acid conducted in rats and mice, and no evidence of carcinogenic effects in zinc borate breakdown products. Based on the available data, the classification criteria are not met.

(g) Reproductive toxicity:
Method: 90-day Oral Toxicity Study – OECD 408
Species: Rat
Dose: 0, 50, 100, 200 and 375 mg zinc borate (hydrate)/kg/day
Routes of exposure: oral gavage
Results: NOAEL in rats for effects on fertility in males is 100 mg zinc borate (hydrate)/kg/bw.

Method: Prenatal Developmental Toxicity Study – OECD Guideline 414
Species: Rat
Dose: 0, 100, 125 and 150 mg zinc borate (hydrate)/kg bw
Routes of exposure: oral gavage
Results: NOAEL in rats for developmental effects on the foetus including foetal weight loss and minor skeletal variations is < 100 mg zinc borate hydrate/kg bw.
Classification: Reproductive Toxicity Category 2 (Hazard statement: H361d: Suspected of damaging 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:
No target organ has been identified in humans.

(i) STOT-repeated exposure:
Method: Repeated Dose 28-Day Oral Toxicity in Rodents - OECD Guideline 407
Species: Rat
Dose: 15; 150; 300; and 1000 mg zinc borate 415/kg/day
Routes of Exposure: Oral gavage
Results: NOAEL: 150 mg/kg bw/day. At doses above 150 mg/kg/day, haematological changes indicative of anaemia was observed. The changes observed at a dose level of 150 mg/kg/day were considered not to represent serious damage to the health of the animals. 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
Following a single oral dose (1000 mg/kg) of zinc borate (hydrate), zinc and boron appeared in rat plasma and tissue samples, indicating the hydrolysis of zinc borate in the gastrointestinal tract and subsequent systemic absorption of zinc and boron. In plasma, T_{max} occurred between 5 and 6 h after administration. Concentrations decreased to background levels by 72 h post-dose; T1/2 ranged from 5.0 to 7.7 h (zinc and boron, respectively). The gastrointestinal route was the primary elimination route for zinc, while urinary excretion via the kidneys was the primary elimination route for boron.

11.2 Symptoms related to the physical, and chemical and toxicological characteristics:
Not expected to be irritating to the eyes, nose, throat or skin in normal industrial use. Occasional mild irritation effects to the nose and throat may occur from inhalation of dust at levels greater than 10 mg/m^3. Products containing zinc borate are not intended for ingestion. Zinc borate has a low acute toxicity. Small amounts (e.g. a teaspoon) swallowed accidentally are not likely to cause effects; swallowing amounts larger than that may cause gastrointestinal symptoms.

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)
Data values are expressed as zinc ion or boron equivalents. To convert to this product, divide the zinc equivalent by 0.352 and divide the boron equivalent by 0.175. 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 zinc or boron in the test media.

Freshwater
Chronic studies

Zinc

Taxonomic Group	Number of Taxa Tested	Range of Endpoint Values (Geometric NOEC/EC10)	References
Algal	2	0.019 mg Zn/L (*Pseudokirchneriella subcapitata*) to 0.048 mg Zn/L (*Chlorella* sp.)	25
Higher plants	7	0.060 mg Zn/L (Cladophora glomerata) to >0.65 mg Zn/L (*Elodea nuttalli, Callitrische platycarpa, Spirodella polyrhiza, Lemna gibba, L. minor, L. pauciscostata)*	25
Invertebrate and protozoan	13	0.037 mg Zn/L (*Ceriodaphnia dubia*) to 0.137 mg Zn/L (*Chironomus tentans*)	25
Fish	7	0.044 mg Zn/L (*Jordanella floridae*) to 0.530 mg Zn/L (*Salvenius fontinalis*)	25

Results: Based on the complete data set of 23 species, the HC_5 value of the species sensitivity distribution is 0.021 mg Zn/L. For classification, two reference values are used: for low pH, the value of 0.082 mg Z/L is used, for neutral and high pH, the value of 0.019 mg Zn/L is used.

Boron

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

Results[2]: Based on the complete data set of 17 species, the $HC_{5\text{-}50}$ value of the species sensitivity distribution is 5.7 mg B/L.

Acute studies
Zinc

Taxonomic Group	Number of Taxa Tested	Range of Endpoint Values (Geometric EC/LC50)	References
Algal	1	0.142 mg Zn/L (*Pseudokirnkeriella subcapitata*)	25
Invertebrate and protozoan	5	0.147 mg Zn/L (*Ceriodaphnia dubia*) to 1.05 mg Zn/L (*Daphnia magna*)	25
Fish	5	0.169 mg Zn/L (*Oncorhynchus mykiss*) to 1.16 mg Zn/L (*Oncorhychus kisutch*)	25

Results: Based on the data set, two acute reference values are used. For low pH, the value of 0.413 mg Zn/L is used (based on the lowest value for *Ceriodaphnia dubia* at low pH. For neutral and high pH, the value of 0.136 mg Zn/L is used (based on the lowest value for *Pseudokirchneriella subcapitata*).

Boron

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

Classification: A study of the transformation/dissolution characteristics of zinc borate was conducted following the OECD 29 protocol[25]. The amount of zinc ion in solution after 24 hr exceeded the acute reference values, so zinc borate is classified as Aquatic Acute 1 (H400: Very toxic to aquatic life). The amount of zinc in solution after 28 days also exceeded the chronic reference values. Because over 70% of zinc ions were removed from the water column within 28 days (demonstrating "rapid partitioning") and zinc is not considered bioaccumulative, the Chronic 2 category applies (H411: Toxic to aquatic life with long-lasting effects).

Marine and Estuarine Data
Chronic studies

Zinc

Taxonomic Group	Number of Taxa Tested	Range of Endpoint Values (Geometric NOEC/EC10)	References
Micro-algae	4	0.011 mg Zn/L (*Chaetoceros compressum*) to 0.066 mg Zn/L (*Nitzschia closterium*)	25
Macro-algae	8	0.008 mg Zn/L (*Ceramium tenuicore*) to 0.671 mg Zn/L (*Pelvetia canaliculata*)	25
Invertebrate and protozoan	26	0.010 mg Zn/L (*Arbacia lixula, Sphaerechinus granularis*) to 0.900 mg Zn/L (*Mya arenia*)	25
Fish	1	0.025 mg Zn/L (*Clupea harengus*)	25

Results: Based on the complete data set of 39 species, the HC_5 value of the species sensitivity distribution is 0.0061 mg Zn/L.

Boron

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

Zinc
See freshwater acute data and marine chronic data.

Boron

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

Sediment
Zinc

Taxonomic Group	Number of Taxa Tested	Range of Endpoint Values (Geometric NOEC/EC10)	References
Crustaceans	2	0.146 mg Zn/kg dw (*Gammarus pulex)* to 0.529 mg Zn/kg dw (*Hyalella azteca*)	25
Insects	3	0.164 mg Zn/kg dw (*Ephoron virgo)* to 0.696 mg Zn/kg dw (*Chironomus tentans)*	25
Worms	2	0.878 mg Zn/kg dw (*Lumbriculus variegates)* to 1.101 mg Zn/kg dw (*Tubifex tubifex)*	25

Results: Based on the complete data set of 7 species, the HC_5 value of the species sensitivity distribution is 0.118 mg Zn/kg dw.

Boron

Taxonomic Group	Number of Taxa Tested	Range of Endpoint Values (geometric EC/LC50)	References
Invertebrate	1	37.7 mg B/kg sediment dw (*Chironomus riparius*)	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 $HC_{5\text{-}50}$ value is not warranted for this product.

Sewage Treatment Plants (STP)
Zinc

Taxonomic Group	Number of Taxa Tested	Range of Endpoint Values (Geometric NOEC/EC10)	References
Microbial process	1	>0.1 mg Zn/L (nitrification)	25

Boron

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 (*Opercularia bimarginata*) to 20 mg B/L (*Paramecium caudatum*)	17

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

Terrestrial Data
Chronic studies

Zinc

Taxonomic Group	Number of Taxa Tested	Range of Endpoint Values (Geometric NOEC/EC10)	References
Plant	18	32 mg Zn/kg dw (*Trifolium pratense, Vicia sativa)* to 5855 mg Zn/kg dw (*Triticum aestivum)*	25
Invertebrate	8	14.6 mg Zn/kg dw (*Folsomia candida)* to 1634 mg Zn/kg dw (*Lumbricus terrestris)*	25
Soil micro	17	17 mg Zn/kg dw (Soil respiration*)* to 2623 mg Zn/kg dw (Phosphatase*)*	25

Results: Based on the complete data set of 43 endpoints, the HC_5 value of the species sensitivity distribution is 35.6 mg Zn/kg dw.

Boron

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

Results[25]: Based on the complete data set, the $HC_{5\text{-}50}$ 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 Bioaccummulative potential
Zinc borate will hydrolyze under environmental conditions to boric acid and zinc hydroxide via zinc oxide. Boric acid will not biomagnify through the food chain. Zinc hydroxide solubility is low under neutral and basic conditions (pH). The rate of hydrolysis depends on the initial loading and pH. However, zinc is an essential element which is actively regulated by organisms, so bioaccumulation is not considered relevant.

12.4 Mobility in soil
Zinc borate will hydrolyze under environmental conditions to boric acid and zinc hydroxide. Adsorption of boric acid to soils or sediments is minimal. Adsorption of zinc ions is described by partition coefficients and may vary with site-specific conditions. For boric acid, the solids-water partitioning coefficients are 1.5 L/kg (soil) and 2.8 L/kg (sediment). For zinc, the solids-water partitioning coefficients are 159 L/kg (soil), 73,000 L/kg (freshwater/sediment), and 6010 L/kg (seawater/sediment).

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:**	3077
14.2	**UN Proper Shipping Name:**	Environmentally Hazardous Substance. Solid, N.O.S. (Zinc borate)
14.3	**Transport hazard class(es):**	9
14.4	**Packing Group:**	III
14.5	**Environmental Hazards (e.g. marine pollutant)**	Marine pollutant
14.6	**Special precautions for user:**	Refer to sections 6, 8 and 12

14.7 Transport in bulk according to Annex II of MARPOL 73/78 and the IBC code: Not applicable: not transported in bulk

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.

United States (TSCA) Active:	12767-90-7
Canada (DSL):	12767-90-7
European Union (EINECS):	235-804-2
Australia (AICS):	12767-90-7
China (IECSC):	12767-90-7
Japan (METI & ISHL):	(1)-73
New Zealand (NZIoC):	12767-90-7
Philippines (PICCS):	12767-90-7
South Korea (KECI):	KE-18394
Taiwan (NECI):	Listed
Thailand (TECI):	Not determined
Vietnam:	Listed

Section 16 Other information

16.1 Date of previous issue: January 2015

16.2 Date of latest revision: January 2020

Revision Details:
Section 1: Updated manufacturer, suppliers' information and email
Section 3, 6, 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.
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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 Shops, 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
PNEC: Predicted No 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.

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