

SAFETY DATA SHEET



CROWN ALLOYS COMPANY

Section 1 – PRODUCT AND COMPANY IDENTIFICATION

PRODUCT NAME: Powder Flux
PRODUCT IDENTIFICATION: ROYAL TIGER FLUX #4
SPECIFICATION: N/A
RECOMMENDED USE: For use in TB (Torch Brazing) applications
SUPPLIER: Crown Alloys Company
 30105 Stephenson Hwy.
 Madison Heights, MI. 48071
TELEPHONE NUMBER: (248) 588-3790
EMERGENCY NUMBER: (866) 928-0789 or call **CHEMTREC Day or Night 1-800-424-9300 / +1 703-527-3887**
WEBSITE: www.crownalloys.com

Section 2 – HAZARDS IDENTIFICATION

2.1 Classification of the mixture

This product is placed on the market in solid (powder) form

2.1.1 Classification in accordance with GHS-US

Acute Tox. 4 (Oral)	H302	STOT SE 3	H335
Eye Irrit. 2	H319	STOT SE 3	H336
Acute Tox. 4 (Inhalation)	H332	Repr. 2	H361

2.2 Label elements

GHS-US labelling

Hazard Pictograms (GHS-US):



GHS07



GHS08

Signal word (GHS-US):

Warning

Hazard statements (GHS-US):

H302 – Harmful if swallowed
 H319 – Causes serious eye irritation
 H332 – Harmful if inhaled

H335 – May cause respiratory irritation
 H361 – Suspected of damaging fertility or the unborn child
 H336 – May cause drowsiness or dizziness

Precautionary statements (GHS-US):

P202 – Do not handle until all safety precautions have been read and understood
 P260 – Do not breathe dust/fume/gas/mist/vapors/spray
 P261 – Avoid breathing dust/fume/gas/mist/vapors/spray
 P264 – Wash thoroughly after handling
 P270 – Do not eat, drink or smoke when using this product
 P271 – Use only outdoors or in a well-ventilated area
 P272 – Contaminated work clothing should not be allowed out of the workplace
 P280 – Wear protective gloves/protective clothing/eye protection/face protection
 P301+P312+P330 – IF SWALLOWED: Call a POISON CENTER or doctor/physician if you feel unwell. Rinse mouth.
 P302+P352 – IF ON SKIN: Wash with plenty of soap and water
 P308+P313 – IF EXPOSED OR CONCERNED: Get medical advice/attention

P305+P351+P338: IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
 P304+P340 – IF INHALED: Remove person to fresh air and keep comfortable for breathing
 P312 – Call a POISON CENTER or physician if you feel unwell
 P314 – Get medical advice and attention if you feel unwell
 P321 – Specific treatment (see label)
 P333+P313 – If skin irritation or rash occurs: Get medical advice/attention
 P362+P364 – Take off contaminated clothing and wash it before reuse
 P403+P233 – Store in a well-ventilated place. Keep container tightly closed
 P405 – Store locked up

P501- Dispose of contents/container in accordance with local / regional / national / international regulations

2.3 Other hazards

No additional information available

2.4 Unknown acute toxicity (GHS-US)

No data available

Other hazards which do not result in GHS classification:

Heat rays (infrared radiation) from flame or hot metal can injure eyes. Overexposure to brazing fumes and gases can be hazardous. Read and understand the manufacturer's instructions, Safety Data Sheets and the precautionary labels before using these alloys. Refer to Section 8.

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Substance(s) formed under the conditions of use:

The welding/brazing fumes produced from these welding alloys may contain the following constituent(s) and/or their complex metallic oxides as well as solid particles or other constituents from the consumables, base metal, or base metal coating not listed below:

Chemical Identity	CAS-No.	Chemical Identity	CAS-No.	Chemical Identity	CAS-No.
Carbon Dioxide	124-38-9	Ozone	10028-15-6	Nitrogen Dioxide	10102-44-0
Carbon Monoxide	630-08-0				

Section 3 – COMPOSITION / INFORMATION ON INGREDIENTS

3.1 Substances

Not applicable

Full text of H-phrases: See section 16

3.2 Mixture

Reportable Hazardous Ingredients

Chemical Identity	CAS-No.	Weight Percent (%)	GHS-US Classification
Boric acid	10043-35-3	70.0 – 75.0	Repr. 2, H361
Manganese dioxide	1313-13-9	2.00 max.	Accute Tox. 4, H302 + H332
Sodium tetraborate decahydrate	1303-96-4	25.0 – 30.0	Eye Irrit. 2, H319 Repr. 2, H361

Composition Comments: The term “Hazardous Ingredients” should be interpreted as a term defined in Hazard Communication standards and does not necessarily imply the existence of a welding hazard. These alloys may contain additional non-hazardous ingredients or may form additional compounds under the condition of use. Refer to Sections 2 & 8 for more information.

Section 4 – FIRST AID MEASURES

4.1 Description of first aid measures

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

Ingestion: Very low ingestion hazard during normal use. Rinse mouth with water. Never give anything by mouth to an unconscious person. Consult a physician.

Inhalation: If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

Skin Contact: Wash with soap and water. Get medical attention if irritation develops. For thermal burns, obtain medical assistance.

Eye Contact: Dust or fume from this product should be flushed from the eyes with clean, tepid water. If irritation persists for more than 30 minutes, seek medical attention. Do not rub eyes or keep eyes tightly closed.
 Arc rays can injure eyes. If exposed, move victim to a dark room, remove contact lenses and cover eyes with a padded dressing and rest. Obtain medical assistance if symptoms persist.

4.2 Most important symptoms/effects, acute and delayed

Symptoms/injuries after inhalation: May cause respiratory irritation.

Symptoms/injuries after skin contact/ingestion: 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 diarrhea, with delayed effects of skin redness and peeling (see Section 11).

Symptoms/injuries after eye contact: Causes eye irritation.

4.3 Indication of 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.

Section 5 – FIRE-FIGHTING MEASURES

General Fire Hazards: As shipped, this product is nonflammable, combustible or explosive. The product is itself a flame retardant. However, the Tiger Flux #4 is used during welding and brazing. Welding/brazing arcs and sparks can ignite combustibles and flammable products. Read and understand American National Standard Z49.1, "Safety In Welding, Cutting and Allied Processes" and National Fire Protection Association NFPA 51B, "Standard for Fire Prevention During Welding, Cutting and Other Hot Work" before using this product.

5.1 Extinguishing media

Suitable extinguishing media: Use extinguishing media appropriate for surrounding fire. Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

Unsuitable extinguishing media: None known.



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5.2 Special hazards arising from the substance

Fire hazard: Not flammable, however, manganese/manganese oxides will be released at elevated temperatures.
Explosion hazard: Not combustible.

5.3 Special protective equipment and precautions for firefighters

Special firefighting procedures: Use standard firefighting procedures and consider the hazards of other involved materials.
Special protective equipment for firefighters: The product itself is a flame retardant. However, firefighters should wear full protective gear that is appropriate to the local circumstances and the surrounding environment.

Section 6 – ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures

Eye goggles and gloves are not required for normal industrial exposures, but eye protection according to ANSI Z.87.1 or other national standard. Respirators should be considered if environment is excessively dusty. If airborne dust and/or fume is present, use adequate engineering controls and, if needed, personal protection to prevent overexposure. Refer to recommendations in Section 8.

6.2 Environmental precautions

Avoid release to the environment. The product is a water-soluble 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

Clean up spills immediately, observing precautions in the personal protective equipment in Section 8. Avoid generating dust. Prevent product from entering any drains, sewers or water sources. Refer to Section 13 for proper disposal. Attempt to reclaim the product if possible.

Section 7 – HANDLING AND STORAGE

7.1 Precautions for safe handling

Avoid inhaling welding/brazing fumes. Keep formation of airborne dusts to a minimum. Provide appropriate exhaust ventilation at places where dust is formed. Read and understand the manufacturer's instruction and the precautionary label on the product. See American National Standard Z49.1, "Safety In Welding, Cutting and Allied Processes" published by the American Welding Society, <http://pubs.aws.org> and OSHA Publication 2206 (29CFR1910), U.S. Government Printing Office, www.gpo.gov.

Do not eat, drink or smoke when using the product. Always observe good personal hygiene measures, such as washing after handling the material and before eating, drinking, and/or smoking. Cosmetics should not be applied in areas where exposures exist! Routinely wash work clothing and protective equipment to remove contaminants.

7.2 Conditions for safe storage, including any incompatibilities

Store in closed original container in a dry place. Store away from incompatible materials. No special handling precautions are required, but dry, indoor storage is recommended. To maintain package integrity and to minimize caking of the product, cans should be handled on a first-in first-out basis.

Storage temperature: Ambient

Storage pressure: Atmospheric

Special sensitivity: Moisture (Caking)

Store in accordance with local/regional/national regulations.

7.3 Specific end use(s)

For welding/brazing consumables and related products

Section 8 – EXPOSURE CONTROLS / PERSONAL PROTECTION

8.1 Control parameters

Chemical Identity (CAS-No.)	ACGIH TLV (TWA)	OSHA PEL (TWA)	NIOSH REL	Cal OSHA/PEL
Boric acid (10043-35-3)	2.0 mg/m ³ (inhalable fraction) [Borate Compounds, inorganic] 6.0 mg/m ³ (inhalable fraction) [Borate Compounds, inorganic] 15 min STEL	5.0 mg/m ³ (respirable dust) 15.0 mg/m ³ (total dust)	N/A	5.0 mg/m ³
Manganese dioxide (1313-13-9)	0.02 mg/m ³ (inhalable particles)	0.20 mg/m ³ (total dust)	1.0 mg/m ³ (TWA) 3.0 mg/m ³ (ST)	N/A
Sodium tetraborate decahydrate (1303-96-4)	2.0 mg/m ³ (inhalable fraction) 6.0 mg/m ³ (inhalable fraction) STEL	5.0 mg/m ³ (respirable dust) 15.0 mg/m ³ (total dust)	N/A	5.0 mg/m ³

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8.2 Exposure controls

Appropriate Engineering Controls:

Use enough ventilation, local exhaust at the arc/flame, or both to keep the fumes and gases from the worker's breathing zone & the general area. Maintain exposures below acceptable exposure levels (see Section 8.1). Use industrial hygiene air monitoring to ensure that your use of these products does not create exposures that exceed the recommended exposure limits. Always use exhaust ventilation in user operations such as high temperature cutting, grinding, welding and brazing. Train the welder to keep his head out of the fume plume. Confined spaces require adequate ventilation and/or air supplied respirators. Read and understand the manufacturer's instructions and the precautionary label on the product. See American National Standard Z49.1, Safety in Welding, Cutting, and Allied Processes, published by the American Welding Society, 8669 Doral Blvd. Suite 130, Doral, FL 33166 and OSHA Publication 2206 (29CFR1910), US Government Printing Office, Washington, D.C. 20402 for more details on many of the following.

General information:

Exposure Guidelines: Threshold Limit Values (TLVs) and Biological Exposure Indices (BEIs) are values published by the American Conference of Government Industrial Hygienists (ACGIH). ACGIH Statement of Positions Regarding the TLVs® and BEIs® states that the TLV-TWA should be used as a guide in the control of health hazards and should not be used to indicate a fine line between safe and dangerous exposures. See Section 10 for information on potential fume constituents of health interest. Threshold Limit Values are figures published by the American Conference of Government Industrial Hygienists.

Eye/face protection:

Wear helmet or use face shield with filter lens of the appropriate shade number. No specific lens shade recommendation for submerged arc processes. Shield others by providing screens and flash goggles.

Skin/Hand Protection:

Wear protective gloves. Suitable gloves can be recommended by the glove supplier.

Protective Clothing:

Wear hand, head, and body protection which help to prevent injury from radiation, sparks and electrical shock. See Z49.1. At a minimum this includes welder's gloves and a protective face shield, and may include arm protectors, aprons, hats, shoulder protection, as well as dark substantial clothing. Wear dry gloves free of holes or split seams. Train the welder not to permit electrically live parts or electrodes to contact skin . . . or clothing or gloves if they are wet. Insulate yourself from the work piece and ground using dry plywood, rubber mats or other dry insulation.

Respiratory Protection:

Keep your head out of fumes. Use enough ventilation and local exhaust to keep fumes and gases from your breathing zone and the general area. An approved respirator should be used unless exposure assessments are below applicable exposure limits. Use respirable fume respirator or air supplied respirator when welding in confined space or where local exhaust or ventilation does not keep exposure below TLV's (see Section 8.1). Use only NIOSH approved respirators in accordance with 29 CFR 1910.134 – Respiratory Protection. Oxygen levels below 19.5% are considered IDLH by OSHA. In such atmospheres, use of a full face-piece pressure/demand SCBA or a full face-piece, supplied air respirator with auxiliary self-contained air supply is required under OSHA's Respiratory Protection Standard (1910.134-1998).

Hygiene measures:

Do not eat, drink or smoke when using the product. Always observe good personal hygiene measures, such as washing after handling the material and before eating, drinking, and/or smoking. Cosmetics should not be applied in areas where exposures exist! Routinely wash work clothing and protective equipment to remove contaminants.

Determine the composition and quantity of fumes and gases to which workers are exposed by taking an air sample from inside the welder's helmet if worn or in the worker's breathing zone. Improve ventilation if exposures are not below limits. See ANSI/AWS F1.1, F1.2, F1.3 and F1.5, available from the American Welding Society, www.aws.org.

Section 9 – PHYSICAL AND CHEMICAL PROPERTIES

Appearance:

Physical state	Solid
Form	Crystalline (powder)
Color	Dark Gray
Odor	None
Odor threshold	Not applicable: odorless
pH	Not applicable
Melting point/freezing point	116°C
Flammability	Non-flammable
Flash Point	Not applicable: inorganic substance
Evaporation rate	Not applicable: non-volatile
Initial boiling point/range	Not applicable

Flammability limit - upper (%)	Not applicable: non-flammable
Flammability limit - lower (%)	Not applicable: non- flammable
Explosive limit - upper (%)	No data available
Explosive limit - lower (%)	No data available
Vapor pressure	Not applicable
Vapor density	Not applicable
Relative density	1.60 @ 23°C
Solubility in water	49.2 g/L @ 20°C
Solubility (other)	No data available
Partition coefficient	No data available
Auto-ignition temperature	Not applicable: not self-heating
Decomposition temperature	No data available
Viscosity	Not applicable

Section 10 – STABILITY AND REACTIVITY

10.1 Reactivity

This product is non-reactive under normal conditions of use, storage and transport.

10.2 Chemical stability

Under normal ambient temperatures (-40°C to +40°C), the product is stable. When heated it loses water, first forming metaboric acid (HBO₂), and on further heating it is converted into boric oxide (B₂O₃) and eventually forming anhydrous borax (Na₂B₄O₇).

10.3 Possibility of hazardous reactions

Reaction with strong acids or strong reducing agents such as metal hydrides or alkali metals will generate hydrogen gas which could create an explosive hazard.

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10.4 Conditions to avoid

Avoid contact with strong acids or strong reducing agents by storing according to good industrial practice.

10.5 Incompatible materials

Strong acids or strong reducing agents.

10.6 Hazardous decomposition products

Welding/brazing fumes and gases can't be classified simply. The composition and quantity of both are dependent upon the metal being welded/brazed and the rods used. Coatings on the metal being welded/brazed (such as paint, plating, or galvanizing), the number of welders, the volume of the work area, the quality and the amount of ventilation, the position of the welder's head with respect to the gas plume, the presence of contaminants in the atmosphere (such as chlorinated hydrocarbon vapors from cleaning and degreasing activities), the process and procedures, as well as the welding/brazing consumables.

When the Tiger Flux #4 is heated, the fume and gas decomposition products generated are different in percent and form from the ingredients listed in Section 3. Decomposition products of normal operation include those originating from the volatilization, reaction, or oxidation of the materials shown in Section 3, plus those from the base metal, coatings, etc., as noted above. Gaseous reaction products may include carbon monoxide and carbon dioxide. Ozone and nitrogen oxides may be formed by the radiation from an arc, in addition to the shielding gases like argon and helium, whenever they are employed. One recommended way to determine the composition and quantity of fumes and gases to which workers are exposed is to take an air sample inside the welder's helmet if worn or in the worker's breathing zone. See ANSI/AWS F1.1 "Method for Sampling Airborne Particles Generated by Welding and Allied Processes" and "Characterization of Arc Welding Fume" available from the American Welding Society, 8669 Doral Blvd. Suite 130, Doral, FL 33166.

Section 11 – TOXICOLOGICAL INFORMATION

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

- Ingestion:** This product is *not* intended for ingestion.
- Inhalation:** Potential chronic health hazards related to the use of this product is most applicable to the inhalation route of exposure. Refer to Inhalation statements in this section.
- Skin Contact:** Arc rays can burn skin. Skin cancer has been reported. Dermal exposure is not usually a concern because this product is poorly absorbed through intact skin.
- Eye contact:** Arc rays can injure eyes.

Information on toxicological effects

Acute toxicity (list all possible routes of exposure): Harmful if swallowed

Specified substance: MANGANESE DIOXIDE

Men exposed to manganese dusts showed a decrease in fertility. Chronic manganese poisoning primarily involves the central nervous system. Early symptoms include languor, sleepiness and weakness in the legs. A stolid mask-like appearance of the face, emotional disturbances such as uncontrollable laughter and a spastic gait with tendency to fall during walking are findings in more advanced cases. High incidence of pneumonia has been found in workers exposed to the dust or fume of some manganese compounds.

To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.

Liver – Irregularities – Based on Human Evidence.

Carcinogenicity: No component of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC, ACGIH, NTP or OSHA.

Germ Cell Mutagenicity: No data available

Reproductive Toxicity: No data available

Specific Target Organ Toxicity – Single Exposure: No data available

Specific Target Organ Toxicity – Repeated Exposure: No data available

	Specified substance: BORIC ACID	Specified substance: SODIUM TETRABORATE DECAHYDRATE
(a) Acute toxicity	Method: Acute Oral Toxicity Study – OECD Guideline 401 Species: Rat Dose: 2000 – 5000 mg/kg body weight Routes of Exposure: Oral Results: Low acute oral toxicity. The oral LD50 value in male rats is 3,450 mg/kg bw, and in female rats is 4080 mg/kg bw. Classification: Acute Toxicity (Oral) Category 5 (Hazard statement: H303: May be harmful if swallowed)	Method: Acute Oral Toxicity Study – U.S. EPA FIFRA Guidelines Species: Rat Dose: 5,150 – 6,000 mg/kg of body weight Routes of Exposure: Oral Results: Low acute oral toxicity. LD50 in rats is 5,560 mg/kg of body weight. 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/kg of body weight. Poorly absorbed through intact skin. Based on the available data, the classification criteria are not met.	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/kg of body weight. 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/l (or g/m3). Based on the available data, the classification criteria are not met.	Method: Acute Inhalation Toxicity Study – OECD Guideline 403 Species: Rat Dose: 2.03 mg/L Routes of Exposure: Inhalation Results: Low acute inhalation toxicity. LC50 in rats is > 2.0 mg/l (or g/m3). Based on the available data, the classification criteria are not met.

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	Specified substance: BORIC ACID	Specified substance: SODIUM TETRABORATE DECAHYDRATE
(b) Skin corrosion/irritation	Method: Primary Dermal Irritation Study – U.S. EPA FIFRA Guidelines Species: New Zealand White Rabbit Dose: 0.5 g moistened with saline Routes of Exposure: Dermal Results: No skin irritation. Mean Primary Irritation Score: 0.1. Based on the available data, the classification criteria are not met.	Method: Primary Dermal Irritation Study – U.S. EPA FIFRA Guidelines Species: New Zealand White Rabbit Dose: 0.5 g moistened with saline Routes of Exposure: Dermal Results: No skin irritation. Mean Primary Irritation Score: 0. 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, corneal involvement or irritation clearing in 7 days. Classification: Based on mean scores < 1, and the effects were fully reversible within 7 days, the classification criteria are not met. Many years of occupational exposure indicate no adverse effects on human eye.	Method: Eye Irritation Study – similar to OECD Guideline 405 Species: New Zealand White Rabbit Dose: 0.077g Routes of Exposure: Eye Results: Irritating, fully reversible in 14 days. Classification: Eye Irritation Category 2A (Hazard statement: H319: Causes serious eye irritation.) 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 sensitizer. No respiratory sensitization studies have been conducted. There are no data to suggest that boric acid is a respiratory sensitizer. Based on the available data, the classification criteria are not met.	Method: Buehler Test – OECD Guideline 406 Species: Guinea Pig Dose: 0.4 g Routes of Exposure: Dermal Results: Not a skin sensitizer. No respiratory sensitization studies have been conducted. There are no data to suggest that disodium tetraborates are respiratory sensitizers. 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: <i>in vitro</i> Results: Not mutagenic (based on boric acid). Based on the available data, the classification criteria are not met.	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: <i>in vitro</i> 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 the available data, the classification criteria are not met.	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: 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; and 0; 50 (5.9); 155 (17.5); and 518 (58.5) mg borax (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 and 155 mg sodium tetraborate decahydrate/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 fetus including fetal 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: Prenatal Developmental Toxicity Study - 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 fetus including fetal weight loss and minor skeletal variations is 55 mg boric acid/kg bw or 9.6 mg B/kg; equivalent to 85 mg disodium tetraborate pentahydrate/kg bw. 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.	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.

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	Specified substance: BORIC ACID	Specified substance: SODIUM TETRABORATE DECAHYDRATE
(h) STOT – single exposure	<p>Method: Standard Test Method for Estimating Sensory Irritancy of Airborne Chemicals – ASTM E981-04 (2004) Species: Mouse Dose: 221 - 1096 mg boric acid/m3 Routes of Exposure: Inhalation Results: The highest concentration of boric acid that was achievable with acceptable control of the aerosol concentration was 1096 mg/m3 with a %RD of 19%. The lowest exposure tested of 221 mg/m3 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.</p> <p>Method: Sensory irritation in human volunteers Species: Human Dose: 2.5, 5, 10 mg boric acid/m3 Routes of Exposure: Inhalation Results: No irritation from boric acid was observed at exposures up to 10 mg/m3 among male and female human volunteers under controlled laboratory conditions.</p>	<p>Method: Standard Test Method for Estimating Sensory Irritancy of Airborne Chemicals - ASTM E981-04 (2004) Species: Mouse Dose: 186 – 1704 mg/m3 Routes of Exposure: Inhalation Results: The maximum exposure of 1704 mg/m3 resulted in a reduced respiratory rate of 33%, graded as moderate irritation. The lowest exposure tested of 186 mg/m3 sodium tetraborate pentahydrate resulted in a reduced respiration rate of 11%, graded as no irritation. Based on the available data, the classification criteria are not met.</p> <p>Method: Sensory irritation in human volunteers Species: Human Dose: 5 - 40 mg/m3 Routes of Exposure: Inhalation Results: A NOAEL for irritation from sodium tetraborate pentahydrate of 10 mg/m3 among male and female human volunteers under controlled laboratory conditions. At 10 mg/m3 increased nasal secretion was observed, but occurred in the absence of other irritating effects at a concentration below that considered irritating by volunteers and was not seen in a subsequent study.</p>
(i) STOT – repeated exposure	<p>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.</p>	<p>Method: Chronic toxicity study of boric acid and disodium tetraborate decahydrate, 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); and 0; 52 (5.9); 155 (17.5); 516 (58.5) mg borax (B)/kg/day (nominal in diet) Routes of Exposure: Oral feeding study Results: A NOAEL of 17.5 mg B/kg bw/day equivalent to 118 mg sodium tetraborate pentahydrate/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.</p>
(j) Aspiration hazard	Physical form of solid powder indicates no aspiration hazard potential.	

11.2 Symptoms related to the physical, chemical and toxicological characteristics

Inhalation: Short-term (acute) overexposure to welding fumes may result in discomfort such as metal fume fever, dizziness, nausea, or dryness or irritation of nose, throat, or eyes. May aggravate pre-existing respiratory problems (e.g. asthma, emphysema). Long-term (chronic) overexposure to welding fumes can lead to siderosis (iron deposits in lung), central nervous system effects, bronchitis and other pulmonary effects.

At high concentrations irritation of nose, throat and eye may be observed. 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 diarrhea, 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.

Additional toxicological information under the conditions of use:

Acute toxicity

Specified substance: CARBON MONOXIDE LC50 (inhalation, rat) = 1300 mg/l /4h	Specified substance: CARBON DIOXIDE LCLo (inhalation, human) = 90000 ppm/5 min.	Specified substance: NITROGEN DIOXIDE LC50 (inhalation, rat) = 88 ppm/4h Specified substance: OZONE LCLo (inhalation, human) = 50 ppm/30 min.
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Section 12 – ECOLOGICAL INFORMATION

12.1 Eco-toxicity

Note that the data values are expressed as boron equivalents. To convert to this product divide the boron equivalent by 0.143. Studies judged to be unreliable or with insufficient information to evaluate are not included.

There is no data available as to the toxicity of manganese dioxide.

SAFETY DATA SHEET



Freshwater

Chronic studies

Taxonomic Group	Number of Taxa Tested	Range of Endpoint Values (geometric NOEC/EC10)
Algal	4	10 mg B/L (<i>Chlorella pyrenoidosa</i>) to 50 mg B/L (<i>Anacystis nidulans</i>)
Higher plants	3	4.0 mg B/L (<i>Phragmites australis</i>) to 60 mg B/L (<i>Lemna minor</i>)
Invertebrate and protozoan	7	5.7 mg B/L (<i>Daphnia magna</i>) to 32 mg B/L (<i>Chironomus riparius</i>)
Fish	6	2.9 mg B/L (<i>Micropterus salmoides</i>) to 17 mg B/L (<i>Carassius auratus</i>)
Amphibian	2	29 mg B/L (<i>Rana pipiens</i>) to 41 mg B/L (<i>Bufo fowleri</i>)

Results: Based on the complete data set of 22 species, the HC5 value of the species sensitivity distribution is 4.05 mg B/L.

Acute studies

Taxonomic Group	Number of Taxa Tested	Range of Endpoint Values (geometric EC/LC50)
Algal	2	10 mg B/L (<i>Chlorella pyrenoidosa</i>) to 28 mg B/L (<i>Selenastrum capricornutum</i>)
Invertebrate and protozoan	9	113 mg B/L (<i>Ceriodaphnia dubia</i>) to 1376 mg B/L (<i>Chironomus decorus</i>)
Fish	7	80 mg B/L (<i>Pimephales promelas</i>) to 627 mg B/L (<i>Onchorhynchus tschawytscha</i>)
Amphibian	2	86 mg B/L (<i>Rana pipiens</i>) to 104 mg B/L (<i>Bufo fowleri</i>)

Results: Based on the complete data set from 46 studies with 20 species, the HC5 value of the species sensitivity distribution is 27.3 mg B/L

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)
Algal	19	5 mg B/L (<i>Emiliana huxleyi</i>) to >100 mg B/L (<i>Agmenellum quadruplicatum</i> , <i>Anacystis marina</i> , <i>Thalassiosira pseudonana</i>)

Results: No data are available for invertebrate or 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)
Invertebrate	3	45 mg B/L (<i>Litopenaeus vannamei</i>) to 83 mg B/L (<i>Americamysis bahia</i>)
Fish	2	74 mg B/L (<i>Limanda limanda</i>) to 600 mg B/L (<i>Oncorhynchus tschawytscha</i>)

No data are available for algal species.

Sediment

Taxonomic Group	Number of Taxa Tested	Range of Endpoint Values (geometric EC/LC50)
Invertebrate	1	82.4 mg B/kg sediment dw (<i>Chironomus riparius</i>)

Results: Although limited, the data suggest that sediment organisms are within range of toxicity of aquatic organisms. In addition, the substance will not partition to the sediment, so a sediment/water partitioning approach is justified.

Sewage Treatment Plants (STP)

Taxonomic Group	Number of Taxa Tested	Range of Endpoint Values (geometric NOEC/EC10)
Activated sludge	N/A	>17.5 mg B/L to 100 mg B/L
Microbes	3	10 mg B/L (<i>Opercularia bimarginata</i>) to 20 mg B/L (<i>Paramecium caudatum</i>)

Terrestrial Data

Chronic studies

Taxonomic Group	Number of Taxa Tested	Range of Endpoint Values (geometric NOEC/EC10)
Plant	28	7.2 mg B/kg dw (<i>Zea mays</i>) to 56 mg B/kg dw (<i>Allium cepa</i>)
Invertebrates	9	15.4 mg B/kg dw (<i>Folsomia candida</i>) to 87 mg B/kg dw (<i>Caenorhabditis elegans</i>)
Soil micro	3	12 mg B/kg dw (nitrogen mineralization and nitrification test) to 420 mg B/kg dw (soil nitrogen transformation test)

Results: Based on the complete data set, the HC5 value of the species sensitivity distribution is 10.8 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 minimize 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.

SAFETY DATA SHEET



CROWN ALLOYS COMPANY

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 Pow = -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

Waste disposal recommendations: Prevent waste from contaminating surrounding environment. Discard any product, residue, disposable container or liner in an environmentally acceptable manner, in full compliance with international/federal/state/local regulations. Product packaging should be recycled where possible.

Section 14 – TRANSPORT INFORMATION

In accordance with DOT / ADR / RID / ADNR / IMDG / ICAO / IATA

14.1 UN number

Not a dangerous good in sense of transport regulations

14.2 UN proper shipping name

Not applicable

14.3 Additional information

Other information: No supplementary information available

Overland transport:

No additional information available

Transport by sea:

No additional information available

Air transport:

No additional information available

Section 15 – REGULATORY INFORMATION

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

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.

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

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

U.S. EPA RCRA: This product is not listed as a hazardous waste under any sections of the Resource Conservation and Recovery Act (RCRA) or regulations (40 CFR 261 *et seq.*).

Superfund: CERCLA/SARA. This product is not listed under CERCLA (Comprehensive Environmental Response Compensation and Liability Act) or its 1986 amendments, SARA (Superfund Amendments and Reauthorization Act), including substances listed under Section 313 of SARA, Toxic Chemicals, 42 USC 11023, 40 CFR 372.65, Section 302 of SARA, Extremely Hazardous Substances, 42 USC 11002, 40 CFR 355, or the CERCLA Hazardous Substances list, 42 USC 9604, 40 CFR 302.

SARA 313 Components

The following components are subject to reporting levels established by SARA Title III, Section 313:

Manganese dioxide CAS-No. 1313-13-9

Safe Drinking Water Act (SDWA): This product is not regulated under the SDWA, 42 USC 300g-1, 40 CFR 141 *et seq.* Consult state and local regulations for possible water quality advisories regarding boron compounds.

Clean Water Act (CWA) (Federal Water Pollution Control Act): 33 USC 1251 *et seq.*

a) This product is not itself a discharge covered by any water quality criteria of Section 304 of the CWA, 33 USC 1314.

b) It is not on the Section 307 List of Priority Pollutants, 33 USC 1317, 40 CFR 129.

c) It is not on the Section 311 List of Hazardous Substances, 33 USC 1321, 40 CFR 116.

IARC: International Agency for Research on Cancer (IARC) (a unit of the World Health Organization) does not list or categorize this product as a carcinogen.

NTP Biennial Report on Carcinogens: This product is not listed.

OSHA carcinogen: This product is not listed.

Pennsylvania Right To Know Components

Manganese dioxide CAS-No. 1313-13-9

New Jersey Right To Know Components

Manganese dioxide CAS-No. 1313-13-9

California Proposition 65: This product is not listed on the Proposition 65 list of carcinogens or reproductive toxicants.

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

SAFETY DATA SHEET



Section 16 – OTHER INFORMATION

SUPERSEDES LAST REVISION: 06/15/2021 (SDS)

HMIS RATING (Hazardous Materials Information System)			
Health (blue) - 2	Flammability (red) - 0	Reactivity (yellow) - 0	Protective Equipment - X (See Sections 4, 8 & 10)

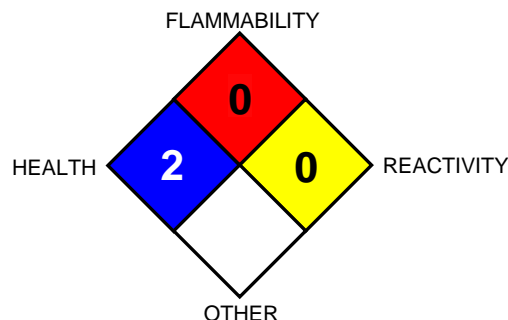
Health Hazard: 0 (minimal acute or chronic exposure hazard); 1 (slight acute or chronic exposure hazard); 2 (moderate acute or significant chronic exposure hazard); 3 (severe acute exposure hazard; one time overexposure can result in permanent injury and may be fatal); 4 (extreme acute exposure hazard; onetime overexposure can be fatal).

Flammability Hazard: 0 (minimal hazard); 1 (materials that require substantial pre-heating before burning); 2 (combustible liquid or solids; liquids with a flash point of 38-93°C [100-200°F]); 3 (Class IB and IC flammable liquids with flash points below 38°C [100°F]); 4 (Class IA flammable liquids with flash points below 23°C [73°F] and boiling points below 38°C [100°F]).

Reactivity Hazard: 0 (normally stable); 1 (material that can become unstable at elevated temperatures or which can react slightly with water); 2 (materials that are unstable but do not detonate or which can react violently with water); 3 (materials that can detonate when initiated or which can react explosively with water); 4 (materials that can detonate at normal temperatures or pressures).

Caution: HMIS® ratings are based on a 0-4 rating scale, with 0 representing minimal hazards or risks, and 4 representing significant hazards or risks. Although HMIS® ratings are not required on SDS's under 29 CFR 1910.1200, the preparer may choose to provide them. HMIS® ratings are to be used only in conjunction with a fully implemented HMIS® program by workers who have received appropriate HMIS® training. HMIS® is a registered trade and service mark of the NPCA.

NFPA RATING



NATIONAL FIRE PROTECTION ASSOCIATION:

Health Hazard: 0 (material that on exposure under fire conditions would offer no hazard beyond that of ordinary combustible materials);

1 (materials that on exposure under fire conditions could cause irritation or minor residual injury); 2 (materials that on intense or continued exposure under fire conditions could cause temporary incapacitation or possible residual injury); 3 (materials that can on short exposure cause serious temporary or residual injury); 4 (materials that under very short exposure causes death or major residual injury).

Flammability Hazard: Refer to definitions for "HMIS RATING (Hazardous Materials Information System)"

Reactivity Hazard: Refer to definitions for "HMIS RATING (Hazardous Materials Information System)"

DEFINITIONS OF TERMS

ACGIH - American Conference of Governmental Industrial Hygienists

CAS No. - Chemical Abstracts Service Number

EPA - Environmental Protection Agency

GHS - Globally Harmonized System

IARC - International Agency for Research on Cancer

LC50 - Lethal Concentration (50 percent kill)

LCLO - Lowest published lethal concentration

LD50 - Lethal dose (50 percent kill)

LDLO - Lowest published lethal dose

NIOSH - National Institute of Occupational Safety and Health

NTP - National Toxicology Program

OSHA - U.S. Occupational Safety and Health Administration

PEL - Permissible Exposure Limit

SARA - Superfund Amendments and Reauthorization Act

STEL - Short Term Exposure Limit

TCLo - the lowest concentration to cause a symptom

TDLo - the lowest dose to cause a symptom

TLV - Threshold Limit Value

TSCA - Toxic Substances Control Act

TWA - Time Weighted Average

Full text of H-phrases (from Section 2)

Eye Irrit. 2	Eye Irrit. Category 2
STOT SE 3	Specific target organ toxicity – Single exposure, Category 3
STOT SE 3	Specific target organ toxicity – Single exposure, Category 3
Repr. 2	Reproductive toxicity, Category 2
H302	Harmful if swallowed
H319	Causes serious eye irritation
H332	Harmful if inhaled
H335	May cause respiratory irritation
H336	May cause drowsiness or dizziness
H361	Suspected of damaging fertility or the unborn child

DISCLAIMER OF EXPRESSED AND IMPLIED WARRANTIES: Crown Alloys Company urges each end user and recipient of this SDS to study it carefully. If necessary, consult an industrial hygienist or other expert to understand this information and safeguard the environment and protect workers from the potential hazards associated with the handling or use of this product. The information in this document is believed to be correct as of the date issued. However, this information is provided without any representation or warranty, expressed or implied, regarding accuracy or correctness. The conditions or methods of handling, storage, use and disposal of the product are beyond our control and may be beyond our knowledge. For this and other reasons we do not assume responsibility and expressly disclaim liability of loss, damage, or expense arising from it or any way connected with the handling, storage, use, or disposal of this product. Data may be changed from time to time. Be sure to consult the latest edition of the SDS. Compliance with all applicable Federal, State, Provincial and local laws and regulations remain the responsibility of the user.