NOSB NATIONAL LIST
FILE CHECKLIST

CROPS

MATERIAL NAME: **Boric Acid**

CATEGORY: Synthetic **Complete?:** _____

✓ **NOSB Database Form**

_____ **References**

✓ **MSDS (or equivalent)**

✓ **Date file mailed out:** 1/17/95, 2/20/95

~~2/20/95~~

✓ **TAP Reviews from:** _____

Jerald Feitelson

James Johnson

Brian Baker

✓ **Supplemental Information:**

Epa R.E.D.

MISSING INFORMATION: _____

NOSB/NATIONAL LIST COMMENT FORM/BALLOT

Use this page to write down comments and questions regarding the data presented in the file of this National List material. Also record your planned opinion/vote to save time at the meeting on the National List.

Name of Material Boric Acid

Type of Use: ✓ **Crops;** ____ **Livestock;** ____ **Processing**

TAP Review by:

1. Jerald Fertdson
2. James Johnson
3. Brian Baker

Comments/Questions:

My Opinion/Vote is:

Signature _____ **Date** _____

USDA/TAP REVIEWER COMMENT FORM

Use this page or an equivalent to write down comments and summarize your evaluation regarding the data presented in the file of this potential National List material. Attach additional sheets if you wish.

This file is due back to us within 30 days of: Due: MAR 01 1995

Name of Material: Boric Acid

Reviewer Name: Jerald Feilelson

Is this substance Natural or Synthetic? Explain (if appropriate)

Synthetic.

Please comment on the accuracy of the information in the file:

Please refer to attached comments.

This material should be added to the National List as:

__X__ **Synthetic Allowed** ____ **Prohibited Natural**

or, ____ **This material does not belong on the National List because:**

Are there any restrictions or limitations that should be placed on this material by use or application on the National List?

No restrictions.

Any additional comments or references?

Please refer to attached comments.

Signature Jerald Feilelson **Date** 1 March 1995

ORGANIC FOOD PRODUCTION ACT/NATIONAL LIST SECTIONS

USDA/TAP REVIEWER COMMENT FORM

Use this page or an equivalent to write down comments and summarize your evaluation regarding the data presented in the file of this potential National List material. Attach additional sheets if you wish.

This file is due back to us within 30 days of: Due: MAR 0 1 1995

Name of Material: Boric Acid

Reviewer Name: James Johnson

Is this substance Natural or Synthetic? Explain (if appropriate)

Synthetic

Please comment on the accuracy of the information in the file:

under OFPA Criteria "interaction", Van Waters & Rogers Inc use the word "hydride" instead of hydroxide. Complete except for "manufacture" & status sec.

This material should be added to the National List as:

✓ **Synthetic Allowed** ____ **Prohibited Natural**

or, ____ **This material does not belong on the National List because:**

Are there any restrictions or limitations that should be placed on this material by use or application on the National List?

Restricted use for ant control on crops, fungicide, and when plants exhibit signs of B deficiency such as transplants (celery & crucifers). Also, not used on edible plant parts.

Any additional comments or references?

Signature James R. Johnson **Date** 3/8/95

ORGANIC FOOD PRODUCTION ACT/NATIONAL LIST SECTIONS

MAR - 2 1995

USDA/TAP REVIEWER COMMENT FORM

Use this page or an equivalent to write down comments and summarize your evaluation regarding the data presented in the file of this potential National List material. Attach additional sheets if you wish.

This file is due back to us within 30 days of: due: March 20

Name of Material: Boric Acid

Reviewer Name: Brian Baker

Is this substance Natural or Synthetic? Explain (if appropriate)

Please comment on the accuracy of the information in the file:
Toxicology data incomplete

This material should be added to the National List as:

✓ **Synthetic Allowed** ____ **Prohibited Natural**

or, ____ **This material does not belong on the National List because:**

Are there any restrictions or limitations that should be placed on this material by use or application on the National List?
Can be used only in traps and crack-and-crevice. No direct contact with food, crop or soil.

Any additional comments or references? Attached

Signature _____ **Date** 3/24/95

ORGANIC FOOD PRODUCTION ACT/NATIONAL LIST SECTIONS

USDA/TAP REVIEWER COMMENT FORM

Use this page or an equivalent to write down comments and summarize your evaluation regarding the data presented in the file of this potential National List material. Attach additional sheets if you wish.

This file is due back to us within 30 days of: due: March 20[illegible]

Name of Material: Boric Acid

Reviewer Name: Paul Sachs

Is this substance Natural or Synthetic? Explain (if appropriate)

Synthetic. It is manufactured from borax which is purified from tincal.

Please comment on the accuracy of the information in the file:

I am unqualified to either confirm or deny the accuracy of the enclosed information.

This material should be added to the National List as:

_x_ Synthetic Allowed **____ Prohibited Natural**

or, ____ This material does not belong on the National List because:

Are there any restrictions or limitations that should be placed on this material by use or application on the National List?

As per label

Any additional comments or references?

See enclosed article.

Signature Paul O. Sachs **Date** 17 March 1995

ORGANIC FOOD PRODUCTION ACT/NATIONAL LIST SECTIONS

TAP review by Brian Baker

BORIC ACID

Boric acid, H_3BO_3, also known as boracic acid, is a weak acid that is used primarily for structural pest control of roaches and ants. While the predominant use in organic food production would be in handling, it may also have some plant crop production and livestock applications as well. Bait stations might be used for outdoor ant control, and it is also registered as an external parasiticide for animals, although at present all labels are for companion, not food animals. While boric acid is found naturally in some volcanic springs, there is no known commercially available natural source. Technical grade boric acid is manufacturered by the reaction of borate salts with a strong acid (see boron products). The most common process uses sulfuric acid to acidulate sodium tetraborate pentahydrate:

$$Na_2B_4O_7 \cdot 5H_2O + H_2SO_4 \text{ -----> } 4H_3BO_3 + Na_2SO_4$$

The leading basic producer in the United States is the US Borax Company. US Borax has withdrawn all direct food uses for boric acid.

1) Interactions

Oxidizes slowly at room temperature, but is steam volatile.
Finely divided dust in air ignitable and can be explosive.
Chemical interactions can be controlled through proper trap construction.

2) Toxicity

The California Environmental Protection Agency has sought to close a number of data gaps in reviewing the registration of boric acid. Contact Oleta Melnicoe 916-324-3913 for more information.

3) Manufacture

The main source in the United States is from the US Borax open-pit mine in Boron, CA. Research did not uncover any extraordinary adverse environmental consequences from the operation of the mine, officials were unaware of any current violations of environmental protection laws.

4) Human Health

Boric acid has a relatively low acute toxicity to mammals and humans, although accidental poisonings have been reported. Exposure to workers and consumers can be limited by restriction of use to traps, and in crack-and-crevice in food processing and storage with proper safety equipment. The NTIS study (enclosed) has an exhastive literature review.

5) Biology

Decomposes into boron salts (see boron products). No hazardous decomposition products.

6) Alternatives

There are numerous alternatives for ant and roach management: sanitation, diatomaceous earth, sticky barriers, sticky traps, sanitation. However, these are not practical in every situation, particularly with small cracks and crevices.

7) Compability

Most organic certifiers allow boric acid in traps and in cracks-and-crevices as long as the boric acid does not come into contact with food, crop or soil being certified.

Recommendation: Allowed synthetic for insect traps provided there is no contact with food, crop or soil. Crack-and-crevice for organic handling operations in compliance with Good Manufacturing Practices and EPA label restrictions.

Brian Baker
3/14/95

NOSB Materials Database

Identification

Common Name **Boric Acid** **Chemical Name** H3BO3

Other Names Orthoboric Acid; Borofax; Boracic Acid; Copper metaborate

Code #: CAS 10043-35-3 **Code #: Other** NIOSH/RTECS: ED4550000

N. L. Category Synthetic Allowed

Chemistry

Composition 99% H3BO3 See: Technical Data Sheet **Family** Inorganic Borates

Properties Colorless, odorless solid. Melting point 171 C, specific gravity 1.44, moderate solubility in water. Occurs naturally in water, fruits, vegetables. See EPA R.E.D.

How Made

Use/Action

Type of Use Crops

Use(s) Ant and cockroach control as a stomach poison. Used as bait in buildings and in adjacent areas to food production, handling and storage. Also used as insecticide, fungicide and herbicide.

Action Insecticide: aphids, carpenter ants, beetles, moths, scabies, silverfish stomach poison.

Combinations

Status

OFPA 2118 (c) (1) (B)(i) synthetic on exemption list as used in insect traps.

N. L. Restriction Shall not be used on edible plant parts.

EPA, FDA, etc See EPA R.E.D.

Registration

Directions Follow label instructions.

Safety Guidelines Keep container closed. Store in general chemical storage area.

State Differences

Historical status Allowed by a wide majority of certification groups for uses not in contact with food.

International status OCIA: Acceptable

NOSB Materials Database

OFPA Criteria

2119(m)1:chem. inter. -Incompatible with potassium metal, water and strong bases
-Reacts as a weak acid and may cause corrosion of base metals
-Reaction with strong reducing agents-metal hydride or alkali metals generate hydrogen gas.

2119(m)2: toxicity EPA on August 20, 1993 issued an exemption from the requirement of a tolerance for boric acid and its sodium salts on all raw agricultural commodities when used as an active ingredient in pesticides, preharvest or postharvest in accordance with good agricultural practices (40 CFR 180.1121).

2119(m)3:manufacture Mining presumably results in environmental damage.

2119(m)4:humans -No carcinogenicity.
-Ingestion is harmful and may be fatal.
-Dust inhalation may cause tightness and pain in chest, coughing, and difficulty breathing.
-Contact with skin or eyes may cause irritation.
-Generally exhibits low to moderate acute toxicity and is placed in EPA Toxicology Category III. LD50(Oral-Rat)(Mg/Kg) - 2660; LD50(SCU-Rat)(Mg/Kg) - 1400; LD50(IC-Rat)(Mg/Kg) - 1330. See: MSDS by U.S. Borax .

2119(m)5: biology -Large amounts can be harmful to boron sensitive plants and other ecological systems if applied to soil.

2119(m)6:alternatives cinnamon as repellent, Diatomaceous earth, cultural practices to discourage ants.

2119(m)7:compatible

References

Olkowsk, W, S. Daar, H. Olkowski. 1991. Common Sense Pest Control. Conneticut. Tauton Press. pg 112-114.

VanWaters & Rogers Inc: 206-889-3400

MATERIAL SAFETY DATA SHEET

BORIC ACID INSECTICIDE

U.S.BORAX

EFFECTIVE DATE: May 1, 1993
Supersedes August 1990 Version

1 CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Product Name:	BORIC ACID INSECTICIDE
Grades:	Technical, S.Q., NF
Chemical Formula:	H_3BO_3
Chemical Name/Synonyms:	Boric Acid, Orthoboric Acid, Boracic Acid
Chemical Family:	Inorganic Borates
CAS Registry Number:	10043-35-3
TSCA Inventory Number:	10043-35-3
EPA Pesticide Reg. No.:	1624-117

MANUFACTURER: U.S. Borax Inc.*
26877 Tourney Rd.
Valencia, CA 91355

*Formerly United States Borax & Chemical Corporation

EMERGENCY PHONE NUMBERS:

24 Hr. Info. Service:	**(800) 228-5635 EXT. 144**
CHEMTREC:	**(800) 424-9300**

2 COMPOSITION/INFORMATION ON INGREDIENTS' OSHA HAZARDS

This product contains greater than 99 percent (%) Boric Acid (H_3BO_3). Boric Acid is hazardous under the OSHA Hazard Communication Standard based on animal chronic toxicity studies. Refer to Sections 3 and 11 for details on hazards.

3 HAZARD IDENTIFICATION

EMERGENCY OVERVIEW:
Boric Acid is a white odorless, powdered substance that is not flammable, combustible, or explosive, and it presents no unusual hazard if involved in a fire. Boric Acid presents little or no hazard (to humans) and has low acute oral and dermal toxicities. Care should be taken to minimize the amount of Boric Acid released to the environment to avoid ecological effects.

POTENTIAL ECOLOGICAL EFFECTS:
Large amounts of Boric Acid can be harmful to boron-sensitive plants and other ecological systems.

POTENTIAL HEALTH EFFECTS:

Routes of Exposure: Inhalation is the most significant route of exposure in occupational and other settings. Dermal exposure is not usually a concern because Boric Acid is not absorbed through intact skin.

Inhalation: Occasional mild irritation effects to nose and throat may occur from inhalation of Boric Acid dusts at levels greater than 10 mg/m^3.

Eye Contact: Boric Acid is non-irritating to eyes in normal industrial use.

Skin Contact: Boric Acid does not cause irritation to intact skin.

Ingestion: Products containing Boric Acid are not intended for ingestion. Boric Acid has a relatively low acute toxicity. Small amounts (e.g. a teaspoonful) swallowed accidentally are not likely to cause effects; swallowing amounts larger than that may cause gastrointestinal symptoms.

Cancer: Boric Acid did not cause cancer in long-term animal studies, and is not considered a carcinogen.

Reproductive: Long- term, high dose animal ingestion studies have demonstrated reproductive effects in male animals. A human study of occupational exposure to borate dust showed no adverse effect to reproduction.

Developmental: High dose animal ingestion studies have demonstrated developmental effects in fetuses of pregnant animals, including fetal weight loss.

Target Organs: No target organ has been identified in humans. High dose animal ingestion studies indicate the testes are the target organs in male animals.

Signs and Symptoms of Exposure: Symptoms of accidental over-exposure to Boric Acid have been associated with ingestion or by absorption through large areas of damaged skin. These may include nausea, vomiting, and diarrhea, with delayed effects of skin redness and peeling.
Refer to Section 11 for details on Toxicological Data.

4 FIRST AID MEASURES

Inhalation: No specific treatment is necessary since Boric Acid is not likely to be hazardous by inhalation. Prolonged exposure to dust levels in excess of regulatory limits should always be avoided.

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 because non-irritating.

Ingestion: Swallowing less than 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.

NOTE TO PHYSICIANS: Observation only is required for adult ingestion of less than 6 grams of Boric Acid. For ingestion in excess of 6 grams, maintain adequate kidney function and force fluids. Gastric lavage is recommended for symptomatic patients only.Hemodialysis should be reserved for massive acute ingestion or patients with renal failure. Boric Acid analyses of urine or blood are only useful for documenting exposure and should not be used to evaluate severity of poisoning or to guide treatment. (Further Information: 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). 24 hour Medical consultation is available at (800) 228-5635 EXT. 144.

13 DISPOSAL CONSIDERATIONS

Disposal Guidance: Small quantities of Boric Acid can usually be disposed of at Municipal Landfill sites. No special disposal treatment is required, but refer to state and local regulations for applicable site-specific requirements. Tonnage quantities of product are not recommended to be sent to landfills. Such product should, if possible, be re-used for an appropriate application.

RCRA (40 CFR 261): Boric Acid is not listed under any sections of the Federal Resource Conservation and Recovery Act (RCRA).

California Hazardous Waste Designation: California identifies substances with acute LD_{50}'s less than 5000 mg/kg as "hazardous wastes". Boric Acid is therefore a "hazardous waste" if spilled in California, and should be handled in accordance with applicable state regulations.

Refer to Section 15 for additional regulatory information.

14 TRANSPORT INFORMATION

DOT Hazardous Material Classification: Boric Acid is not a U.S. Department of Transportation (DOT) Hazardous Material.

DOT Hazardous Substances Classification: Boric Acid is not a DOT Hazardous Substance.

International Transportation: Boric Acid has no U.N. Number, and is not regulated under international rail, highway, water or air transport regulations.

15 REGULATORY INFORMATION

TSCA No.: (10043-35-3) Boric Acid appears on the EPA TSCA inventory list.

FIFRA: Boric Acid is registered with the EPA, in accordance with Section 3 of FIFRA, as a pesticide product. Refer to EPA approved product label for additional product Hazard and Precautionary information.

RCRA: Boric Acid is not listed as a hazardous waste under any sections of the Resource Conservation and Recovery Act or regulations (40 CFR 261 et seq.).

Superfund: CERCLA/SARA. Boric Acid is not listed under CERCLA (the Comprehensive Environmental Response Compensation and Liability Act) or its 1986 amendments, SARA, (the 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.

Safe Drinking Water Act: Boric Acid 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.

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

(a) Boric Acid 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.

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

OSHA/Cal OSHA: This MSDS document meets the requirements of both OSHA (29 CFR 1910.1200) and Cal OSHA (Title 8 CCR 5194(g)) hazard communication standards. Refer to Section 8 for regulatory exposure limits.

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

NTP Annual Report on Carcinogens: Boric Acid is not listed.

OSHA Carcinogen: Boric Acid is not listed.

California Proposition 65: Boric Acid is not listed on any Proposition 65 lists of carcinogens or reproductive toxicants.

16 OTHER INFORMATION

Product Label Text Hazard Information:

Refer to EPA approved product label for additional product Hazard and Precautionary information.

National Fire Protection Association (NFPA) Classification:

Health	0
Flammability	0
Reactivity	0

Hazardous Materials Information Systems (HMIS):

Red: (Flammability)	0
Yellow: (Reactivity)	0
Blue: (Acute Health)	1*

* Chronic Effects

Contact U.S. Borax Inc. Occupational Health & Product Safety Department for further information:

(805) 287-6050

1 - PRODUCT IDENTIFICATION

PRODUCT NAME: BORIC ACID
FORMULA: H3BO3 FORMULA WT: 61.83
CAS NO.: 10043-35-3 NIOSH/RTECS NO.: ED4550000
COMMON SYNONYMS: BORACIC ACID; ORTHOBORIC ACID; BOROFAX
PRODUCT CODES: 0084,5168,0090,0091,9820
EFFECTIVE: 10/03/86 REVISION #02

PRECAUTIONARY LABELLING BAKER SAF-T-DATA(TM) SYSTEM

HEALTH - 2 MODERATE
FLAMMABILITY - 0 NONE
REACTIVITY - 0 NONE
CONTACT - 2 MODERATE
HAZARD RATINGS ARE 0 TO 4 (0 = NO HAZARD; 4 = EXTREME HAZARD).

LABORATORY PROTECTIVE EQUIPMENT
SAFETY GLASSES; LAB COAT; VENT HOOD; PROPER GLOVES

PRECAUTIONARY LABEL STATEMENTS
WARNING CAUSES IRRITATION
HARMFUL IF SWALLOWED OR ABSORBED THROUGH SKIN
AVOID CONTACT WITH EYES, SKIN, CLOTHING.
AVOID BREATHING DUST. KEEP IN TIGHTLY CLOSED CONTAINER. USE WITH ADEQUATE VENTILATION. WASH THOROUGHLY AFTER HANDLING.

SAF-T-DATA(TM) STORAGE COLOR CODE: ORANGE (GENERAL STORAGE)

2 - HAZARDOUS COMPONENTS

COMPONENT	%	CAS NO.
BORIC ACID	90-100	10043-35-3

3 - PHYSICAL DATA

BOILING POINT: N/A VAPOR PRESSURE(MM HG): 15

MELTING POINT: 171 C (340 F) VAPOR DENSITY(AIR=1): N/A

SPECIFIC GRAVITY: 1.44 (H2O=1) EVAPORATION RATE: N/A (BUTYL ACETATE=1)

SOLUBILITY(H2O): MODERATE (1 TO 10 %) % VOLATILES BY VOLUME: 0

APPEARANCE & ODOR: COLORLESS, ODORLESS SOLID.

4 - FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (CLOSED CUP: N/A

FLAMMABLE LIMITS: UPPER - N/A % LOWER - N/A %

FIRE EXTINGUISHING MEDIA
USE EXTINGUISHING MEDIA APPROPRIATE FOR SURROUNDING FIRE.

SPECIAL FIRE-FIGHTING PROCEDURES
FIREFIGHTERS SHOULD WEAR PROPER PROTECTIVE EQUIPMENT AND SELF-CONTAINED BREATHING APPARATUS WITH FULL FACEPIECE OPERATED IN POSITIVE PRESSURE MODE.

TOXIC GASES PRODUCED: OXIDES

5 - HEALTH HAZARD DATA

TOXICITY: LD50 (ORAL-RAT)(MG/KG) - 2660
LD50 (SCU-RAT)(MG/KG) - 1400
LD50 (IV-RAT) (MG/KG) - 1330

CARCINOGENICITY: NTP: NO IARC: NO Z LIST: NO OSHA REG: NO

EFFECTS OF OVEREXPOSURE
INGESTION IS HARMFUL AND MAY BE FATAL.
DUST INHALATION MAY CAUSE TIGHTNESS AND PAIN IN CHEST, COUGHING, AND DIFFICULTY IN BREATHING.
CONTACT WITH SKIN OR EYES MAY CAUSE IRRITATION.

PROLONGED EXPOSURE MAY CAUSE DERMATITIS.
INGESTION MAY CAUSE NAUSEA, VOMITING, HEADACHES, DIZZINESS, GASTROINTESTINAL IRRITATION.
CHRONIC EFFECTS OF OVEREXPOSURE MAY INCLUDE KIDNEY AND/OR LIVER DAMAGE.

TARGET ORGANS: NONE IDENTIFIED

MEDICAL CONDITIONS GENERALLY AGGRAVATED BY EXPOSURE: DAMAGED SKIN

ROUTES OF ENTRY: INGESTION, INHALATION, SKIN CONTACT, EYE CONTACT

EMERGENCY AND FIRST AID PROCEDURES: CALL A PHYSICIAN.

IF SWALLOWED, IF CONSCIOUS, GIVE LARGE AMOUNTS OF WATER. INDUCE VOMITING.
IF INHALED, REMOVE TO FRESH AIR. IF NOT BREATHING, GIVE ARTIFICIAL RESPIRATION. IF BREATHING IS DIFFICULT, GIVE OXYGEN.
IN CASE OF CONTACT, IMMEDIATELY FLUSH EYES OR SKIN WITH PLENTY OF WATER FOR AT LEAST 15 MINUTES.

6 - REACTIVITY DATA

STABILITY: STABLE HAZARDOUS POLYMERIZATION: WILL NOT OCCUR
CONDITIONS TO AVOID: MOISTURE, HEAT

INCOMPATIBLES: POTASSIUM METAL, WATER, STRONG BASES
DECOMPOSITION PRODUCTS: OXIDES

7 - SPILL AND DISPOSAL PROCEDURES

STEPS TO BE TAKEN IN THE EVENT OF A SPILL OR DISCHARGE
WEAR SELF-CONTAINED BREATHING APPARATUS AND FULL PROTECTIVE CLOTHING. WITH CLEAN SHOVEL, CAREFULLY PLACE MATERIAL INTO CLEAN, DRY CONTAINER AND COVER; REMOVE FROM AREA. FLUSH SPILL AREA WITH WATER.

DISPOSAL PROCEDURE
DISPOSE IN ACCORDANCE WITH ALL APPLICABLE FEDERAL, STATE, AND LOCAL ENVIRONMENTAL REGULATIONS.

8 - PROTECTIVE EQUIPMENT

VENTILATION: USE ADEQUATE GENERAL OR LOCAL EXHAUST VENTILATION TO KEEP FUME OR DUST LEVELS AS LOW AS POSSIBLE.

RESPIRATORY PROTECTION: NONE REQUIRED WHERE ADEQUATE VENTILATION CONDITIONS EXIST. IF AIRBORNE CONCENTRATION IS HIGH, USE AN APPROPRIATE RESPIRATOR OR DUST MASK.
EYE/SKIN PROTECTION: SAFETY GLASSES WITH SIDESHIELDS, UNIFORM, RUBBER GLOVES ARE RECOMMENDED.

9 - STORAGE AND HANDLING PRECAUTIONS

SAF-T-DATA(TM) STORAGE COLOR CODE: ORANGE (GENERAL STORAGE)

SPECIAL PRECAUTIONS
KEEP CONTAINER CLOSED. SUITABLE FOR ANY GENERAL CHEMICAL STORAGE AREA.

10 - TRANSPORTATION DATA AND ADDITIONAL INFORMATION

DOMESTIC (D.O.T.)
PROPER SHIPPING NAME CHEMICALS, N.O.S. (NON-REGULATED)

INTERNATIONAL (I.M.O.)
PROPER SHIPPING NAME CHEMICALS, N.O.S. (NON-REGULATED)

From: Jerald Fellson

USDA/TAP Comments on Material Database

Boric Acid

Chemistry

Composition: Please refer to the enclosed Boric Acid Technical Data Sheet published by U.S. Borax.

Properties: As stated in the U.S. EPA Reregistration Eligibility Document (R.E.D.), "Boric acid, borax and boron-containing salts are ubiquitous in the environment. The element boron occurs naturally in water, fruits, vegetables and forage crops, and is an essential nutrient for plants as well as an essential element for many organisms." Please refer to the enclosed EPA R.E.D. Facts on boric acid for further information.

Use/Action

Type of Use: Boric acid is also used for pest control purposes through **Non-Crop** applications. Crack and crevice treatment and application to poultry litter and bedding are just two examples of non-crop uses.

Use/Action: As stated in the EPA R.E.D., "Pesticide products containing boric acid and its sodium salts are registered in the U.S. for use as insecticides, fungicides, and herbicides. As insecticides, some act as stomach poisons in ants, cockroaches, silverfish and termites, while others abrade the exoskeletons of insects. As herbicides, some cause desiccation or interrupt photosynthesis in plants, while others suppress algae in swimming pools and sewage systems. As fungicides, several are wood preservatives which control decay-producing fungi in lumber and timber products."

Boric acid is also widely used as an EPA-registered insecticide to control lesser mealworm (darkling beetles) and hide beetles, and flies in poultry high-rise layer and broiler house facilities. During these uses, boric acid is applied to poultry bedding, litter and manure. The organic poultry industry would seem to benefit greatly from having access to using boric acid in this capacity.

N.L. Restriction: On August 20, 1993, the U.S. EPA issued an exemption from the requirement of a tolerance for boric acid and its sodium salts on all raw agricultural commodities when used as an active ingredient in insecticides, herbicides, or fungicides preharvest or postharvest in accordance with good agricultural practices (40 CFR § 180.1121). Thus, when used according to EPA-registered product labels, boric acid may be used on edible plant parts without concern of unlawful residues. Enclosed is a copy of EPA's final rule of this tolerance exemption.

Status

Please refer to the enclosed EPA R.E.D. Facts on Boric Acid for further information on Registration Directions.

OFPA Criteria

2119(m)2 - Toxicity: Please refer to the enclosed Material Safety Data Sheet (MSDS) completed by U.S. Borax for a thorough toxicological profile on boric acid.

2119(m)4 - Humans: Boric acid generally exhibits low to moderate acute toxicity, which places the material in EPA Toxicology Category III for most acute effects including oral and dermal toxicity, and eye and skin irritation. For example, acute oral LD_{50} data from U.S. Borax shows a LD_{50} of 3500 to 4100 mg/kg of body weight in rats. Please refer to the EPA R.E.D. Facts sheet for further information.

The above comments and enclosed information are provided in an attempt to accurately complete the NOSB Materials Database for the review of boric acid as an acceptable material under the Organic Foods Production Act.

Sincerely,

Jerry Feitelson
Reviewer for the USDA/TAP

BORIC ACID H_3BO_3

Orthoboric Acid

GRANULAR AND POWDERED TECHNICAL GRADES

THEORETICAL COMPOSITION

Boric Oxide (B_2O_3)	56.30%
Water (H_2O)	43.70

PHYSICAL and CHEMICAL PROPERTIES

Formula Weight	61.83
Specific Gravity @ 14°C	1.5128
Heat of Solution @ 18°C (64°F)	BTU per pound (absorbed) 157
Melting Point (heated in closed space)	170.9°C ± 0.2°C (340°F)

CAS / TSCA NUMBER 1303-86-2

NOTE: When heated above 100°C (212°F) in the open, it gradually loses water, first changing to Metaboric Acid, HBO_2, of which three monotropic forms exist. These have melting points, respectively, of 176°C (349°F); 201°C (392°F); and 236°C (457°F). Dehydration stops at the composition HBO_2 unless the time of heating is extended or the temperature raised above 150°C (292°F). On continued heating and higher temperatures, all water is removed leaving the anhydrous oxide, B_2O_3, the crystalline form of which melts at 450°C (842°F). The amorphous form has no definite melting point, softening at about 325°C (617°F) and becoming fully fluid at about 500°C (932°F).

STABILITY: BORIC ACID is stable at ordinary temperatures. It is volatile in steam without decomposition.

HYDROGEN ION CONCENTRATION: Aqueous solutions of BORIC ACID are acidic, the pH decreasing with increasing concentration.

% H_3BO_3 by wt. of solution	pH @ 20°C (68°F)	% H_3BO_3 by wt. of solution	pH @ 20°C (68°F)
0.1%	6.1	2.0%	4.5
0.5	5.6	3.0	4.2
1.0	5.1	4.0	3.9
		4.72 (saturated @ 20°C)	3.7

(See chart on "pH Values of Borate Solutions", Supplementary Data Section)

BORIC ACID

SOLUBILITY IN WATER

Temperature °C	Temperature °F	Wt. % H_3BO_3	Parts H_3BO_3 per 100 Parts H_2O by Weight	Pounds Boric Acid per U.S. Gallon of Water
0.0	32.0	2.52	2.59	0.216
5.0	41.0	2.98	3.07	0.256
10.0	50.0	3.49	3.62	0.302
15.0	59.0	4.08	4.25	0.355
20.0	68.0	4.72	4.95	0.413
25.0	77.0	5.46	5.78	0.481
30.0	86.0	6.23	6.64	0.552
35.0	95.0	7.12	7.67	0.636
40.0	104.0	8.08	8.79	0.728
45.0	113.0	9.12	10.02	0.830
50.0	122.0	10.27	11.45	0.944
55.0	131.0	11.55	13.06	1.074
60.0	140.0	12.97	14.90	1.223
65.0	149.0	14.42	16.85	1.379
70.0	158.0	15.75	18.69	1.526
75.0	167.0	17.41	21.08	1.715
80.0	176.0	19.10	23.61	1.914
85.0	185.0	21.01	26.60	2.151
90.0	194.0	23.27	30.33	2.444
95.0	203.0	25.22	33.73	2.707
100.0	212.0	27.53	37.99	3.039
103.3	217.9	29.27	41.38	3.301

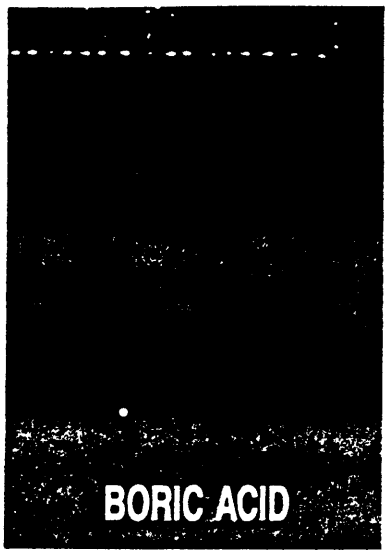
NOTE: The solubility of BORIC ACID in water is influenced by the presence of certain other substances. Sodium chloride, lithium chloride and mineral acids decrease the solubility. Potassium nitrate, sulfate and chloride, and sodium nitrate and sulfate increase the solubiltiy. Borax raises the solubility of BORIC ACID due to formation of sodium polyborates, refer to chart "Borax 10 MOL - Boric Acid Mixtures of Max. Sol. - Supplementary Data Section".

SOLUBILITY IN SOME ORGANIC SOLVENTS

		Percent Borax by weight	
Glycerol (98.5%)	@20°C (68°F)	19.9%	H_3BO_3
Glycerol (86.5%)	@20°C	21.1%	"
Ethylene Glycol	@25°C (77°F)	18.5%	"
Di-Ethylene Glycol	@25°C	13.6%	"
Ethyl Acetate	@25°C	1.5%	"
Acetone	@25°C	.6%	"
Glacial Acetic Acid	@30°C (86°F)	6.3%	"
		Grams Per Liter	
Ethyl Alcohol	@25°C	94.4	H_3BO_3
Methyl Alcohol	@25°C	179.3	"
n-Propyl Alcohol	@25°C	59.4	"
i-Butyl Alcohol	@25°C	42.8	"
i-Amyl Alcohol	@25°C	35.3	"

INDUSTRIAL USES include:

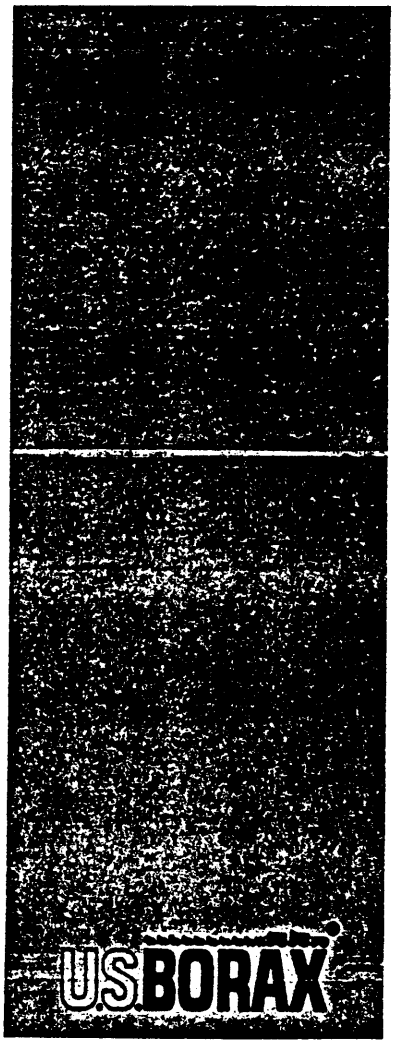
- Ceramics
  - Glazes and Colors
- Chemical Manufacturing
  - Boron Fluorides, Fluoborates, Borides, Boron alloys, Boron Carbide, Ferroboron
- Cosmetics
- Dye stabilizer
- Electroplating (nickel)
- Electrolytic condensers
- Enamels
- Flameproofing
- Fluxes; welding and brazing
- Glass; optical, fiber, borosilicate
- Latex base paints
- Leather finishing compounds
- Deliming hides and skins
- Pesticides
- Pharmaceuticals
- Sand-casting magnesuim alloys
- Textile finishing compounds



Boric Acid, H_3BO_3 is available in the following forms:

TECHNICAL — GRANULAR AND POWDERED

TECHNICAL GRADES



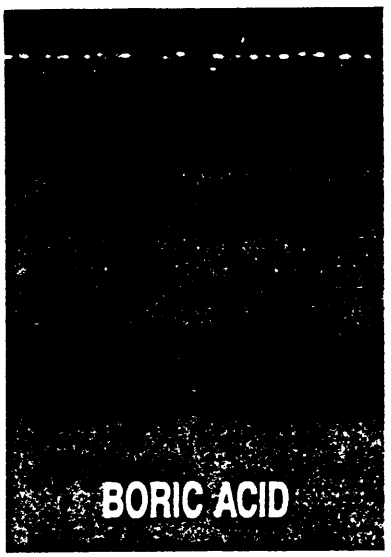
CHEMICAL SPECIFICATIONS	Guaranteed	Typical
Boric Acid (H_3BO_3)	99.9% min.	100.3%
B_2O_3	56.3 - 56.8%	56.5%
Chloride (Cl)	0.0018% max.	0.0006%
Sulfate (SO_4)	0.0450% max.	0.025%
Total Iron (Fe)	0.0006% max.	0.0001%

SCREEN SPECIFICATIONS			AVG. BULK DENSITY	
			Pounds per Cubic Foot	
Mesh Designation	U.S. Standard Sieve No.	Retained	Loose Pack	Tight Pack
Granular	+ 20	2% Max.	55	68
Powdered	+200	10% Max.	37	48

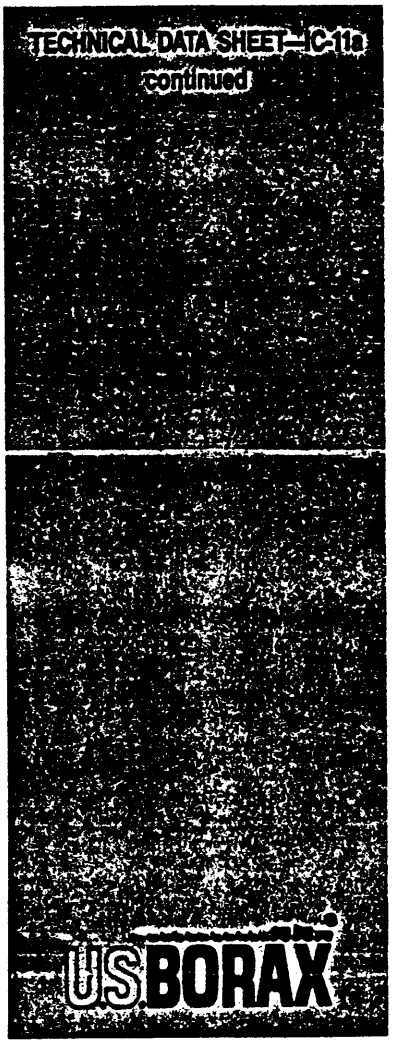
Granular material has an angle of repose of approximately 55°.

CONTAINERS

Multiwall paper bags with a polyethylene free film moisture-resistant barrier, granular, 100 lbs. net and 50 lbs. net; Powdered, 50 lbs. net; or fiber drums with polyethylene liner, net weight as follows: Granular, 300 lbs., Powdered, 250 lbs. Impalpable, 225 lbs.



TECHNICAL GRADE



U.S. BORAX INC., 26877 Tourney Rd., Valencia, CA 91355-1847
Sales Office at One O'Hare Centre, 6250 River Rd., Suite 7020, Rosemont, Illinois 60018 (800) 729-2672.

ON ALL PRODUCTS, AVOID PROLONGED INHALATION OR PROLONGED SKIN CONTACT. NOT FOR FOOD OR DRUG USE. READ MATERIAL SAFETY DATA SHEETS AND ALL INSTRUCTIONS RELATING TO THE PRODUCTS BEFORE USE.

If possible uses of these products have been mentioned herein, it is not intended that the above products be used to practice any applicable patent, whether mentioned in this Technical Data Sheet or not, without procurement of a license. If necessary, from the owner, following investigation by the user. Nor is it intended or recommended that the products be used for any such described purposes without verification of their safety and efficacy for such purposes.

Statements concerning this product are based on data believed to be reliable. Because the use of this product is beyond the control of the manufacturer. No guarantee is made as to the effects of such or the results to be obtained.

NOTICE: SELLER MAKES NO EXPRESS WARRANTIES ON THIS PRODUCT, EXCEPT AS STATED HEREIN AND ON SELLER'S LABEL AND SERVICE BULLETINS, OR IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR AND PARTICULAR PURPOSE. SELLER SHALL HAVE NO LIABILITY FOR CONSEQUENTIAL DAMAGES.

United States Environmental Protection Agency | Prevention, Pesticides And Toxic Substances (7508W) | EPA-738-F-93-006 September 1993

EPA R.E.D. FACTS

Boric Acid

Pesticide Reregistration

All pesticides sold or used in the United States must be registered by EPA, based on scientific studies showing that they can be used without posing unreasonable risks to people or the environment. Because of advances in scientific knowledge, the law requires that pesticides which were first registered years ago be reregistered to ensure that they meet today's more stringent standards.

In evaluating pesticides for reregistration, EPA obtains and reviews a complete set of studies from pesticide producers, describing the human health and environmental effects of each pesticide. The Agency imposes any regulatory controls that are needed to effectively manage each pesticide's risks. EPA then reregisters pesticides that can be used without posing undue hazards to human health or the environment.

When a pesticide is eligible for reregistration, EPA announces this and explains why in a Reregistration Eligibility Decision (RED) document. This fact sheet summarizes the information in the RED document for boric acid and its sodium salts, which includes the seven active ingredients boric acid, sodium tetraborate decahydrate (borax decahydrate), sodium tetraborate pentahydrate (borax pentahydrate), sodium tetraborate (anhydrous borax), disodium octaborate tetrahydrate, disodium octaborate (anhydrous), and sodium metaborate.

Use Profile

Pesticide products containing boric acid and its sodium salts are registered in the U.S. for use as insecticides, fungicides and herbicides. As insecticides, some act as stomach poisons in ants, cockroaches, silverfish and termites, while others abrade the exoskeletons of insects. As herbicides, some cause desiccation or interrupt photosynthesis in plants, while others suppress algae in swimming pools and sewage systems. As fungicides, several are wood preservatives which control decay-producing fungi in lumber and timber products.

Boric acid and its sodium salts are used on several agricultural and many non-agricultural sites including residential, commercial, medical, veterinary, industrial, forestry and food/feed handling areas. They are marketed in many formulations including liquids, soluble and emulsifiable concentrates, granulars, powders, dusts, pellets, tablets, solids, paste, baits, and crystalline rods.

The quantities of boric acid and its sodium salts applied as pesticides are modest compared to amounts used for other, non-pesticidal purposes. Further, boric acid, borax and boron-containing salts are ubiquitous in the environment. Boron occurs naturally in water, fruits, vegetables and forage crops, and is an essential nutrient for plants as well as an essential element for many organisms.

Regulatory History

Boric acid was first registered as a pesticide in the U.S. in 1948. Currently, 189 pesticide products are registered which contain boric acid or one of its sodium salts as an active ingredient.

In February 1986, EPA issued two related documents dated November 1985, the "Boric Acid and Boron Containing Salts Registration Standard" (NTIS #PB87-101903), and a General Registration Standard entitled, "Guidance for the Registration and Reregistration of End-Use Pesticide Products Containing the Insecticidal Uses of Boric Acid." About 43 boric acid products, used indoors for cockroach and silverfish control, were reregistered under the General Registration Standard. Producers of those products need only submit current labels and Confidential Statements of Formula for the products to remain reregistered.

EPA has determined that, because they are of low toxicity and occur naturally, boric acid and its sodium salts should be exempted from the requirement of a tolerance (maximum residue limit) for all raw agricultural commodities. The Agency has established such exemptions and removed the previously established tolerances for residues of boric acid and certain derivatives in cotton seed and citrus fruits (please see 58 FR 44282); two other derivatives will be similarly exempted soon. Because boric acid is registered for crack and crevice use in food and feed handling establishments, the potential exists, though unlikely, for residues to occur in food. EPA therefore is establishing food and feed additive tolerances for boric acid and its sodium salts.

In developing this RED, the active ingredient sodium metaborate was added from another reregistration case. Also, this RED originally was to have included boric oxide as an active ingredient. However, since no registered products currently contain that active ingredient, it is not included.

Human Health Assessment

Human Toxicity

The toxicity of boric acid and its six sodium salts are expected to be similar. Information on the effects of these boron-related compounds in humans, supplemented by data from laboratory animal studies, were used by EPA to evaluate their toxicity.

Boric acid generally is of moderate acute toxicity, and has been placed in Toxicity Category III for most acute effects including oral and

dermal toxicity, and eye and skin irritation. Sodium tetraborate (anhydrous borax) products have been placed in Toxicity Category I indicating a high degree of acute toxicity for eye irritation effects.

A subchronic borax feeding study using dogs resulted in blood and metabolism disorders as well as effects to the testes, endocrine system, brain weight, and size ratios among various organs and glands.

In chronic oncogenicity studies using mice, rats and beagle dogs, boric acid and borax were found not to be carcinogenic; however, testicular effects and decreases in body weight resulted at high dose levels. EPA has classified boric acid as a "Group E" carcinogen, indicating that it shows "evidence of noncarcinogenicity" for humans.

In reproductive and developmental toxicity studies using rats, mice and rabbits, maternal liver and kidney effects and decreased weight gain as well as decreased fetal body weights were observed. In two studies, at the highest dose levels, no litters were produced. Prenatal mortality occurred at the highest dose levels in the rabbit study. Boric acid does not cause mutagenicity.

Dietary Exposure

Tolerances were established for residues of boron resulting from the use of boric acid and its sodium salts on cottonseed (30 ppm) and citrus fruits, postharvest (8 ppm) (please see 40 CFR 180.271.) EPA's review of new toxicology studies raised no concerns. Further, boron occurs naturally in fruits and vegetables at much higher levels (200 to 300 ppm in red cabbage). Therefore, the Agency is exempting these compounds from the requirement of a tolerance and revoking the existing tolerances. EPA is establishing food/feed additive regulations to cover the use of boric acid salts for crack and crevice treatments at food and feed handling establishments (please see 58 FR 44282, and a soon-to-be-issued Federal Register notice).

Occupational and Residential Exposure

Boric acid and its sodium salts are applied both indoors and outdoors, in residential, commercial, medical, veterinary and industrial areas, in food handling establishments, in swimming pools and sewage systems, in lakes, ponds and reservoirs, and in treating wood. Depending on the use site, boric acid may be applied using aircraft, a spreader, airblower, power duster, squeeze applicator, aerosol can or knife/spatula. The potential for dermal and inhalation exposure exists among applicators and people reentering treated areas.

As a prudent measure to reduce any potential risks to handlers, EPA is requiring that all products containing boric acid and its sodium salts (except products for residential use) bear personal protective equipment (PPE) requirements. These must consist of at least the use of a long-sleeved shirt, long pants, shoes, socks and chemical-resistant gloves.

If end-use product labeling already bears PPE requirements that are more protective than these items, the more protective requirements must be retained.

The Worker Protection Standard (WPS) for Agricultural Pesticides (40 CFR 156 and 170) established an interim restricted-entry interval (REI) of 12 hours for boric acid and its sodium salts. EPA is retaining this REI for uses within the scope of the WPS, as a prudent risk mitigation measure to protect workers. During the REI, workers may enter treated areas only under the few narrow exceptions allowed in the WPS.

Human Risk Assessment

Dietary risk is not a concern with boric acid and its sodium salts since no direct food uses are registered and tolerances have been revoked. Applicators and others in treatment areas may be exposed to boric acid and its sodium salts during or after application. However, there is no reasonable expectation that these pesticide uses may constitute a hazard or risk to people involved in, or near to, handling or application activities. Proper care and adhering to label directions and precautions should reduce exposure and any associated risk.

Environmental Assessment

Environmental Fate

No new environmental fate data are required for reregistration of boric acid and its sodium salts because only relatively small amounts of boric acid are used as pesticides, and significant amounts of boron are present naturally in soil and water. Surface soil contains relatively high levels of boron. Boron salts occur naturally in low concentrations in most unpolluted waterways (both surface water and seawater). In some areas, boron occurs in surface waters in concentrations that have been shown to be toxic to commercially important plants.

Ecological Effects

Available studies indicate that technical boric acid is practically nontoxic to birds, fish and aquatic invertebrates, and relatively nontoxic to beneficial insects. The boric acid rights-of-way herbicide use pattern poses a potential risk to aquatic invertebrates, including some that are endangered. However, risk probably is mitigated by the practice of limiting treatment to small strips of land, thereby limiting the amount of contaminated runoff into adjacent aquatic environments.

Boric acid's noncrop herbicidal use also may harm endangered or threatened plants. EPA is requiring three phytotoxicity studies (seed germination, seedling emergence and vegetative vigor) to assess these risks. EPA is deferring endangered species labeling requirements until the Agency publishes the Endangered Species Protection Program plan and guidance for registrants. Labeling will refer users to county bulletins for area-specific use limitations.

Ecological Effects Risk Assessment

EPA's concerns regarding risks to birds, fish and wildlife species are minimal. Boric acid's limited outdoor use patterns, low toxicity, and natural presence in terrestrial and aquatic environments are mitigating factors for any potential risk to nontarget organisms.

Additional Data Required

EPA is requiring three phytotoxicity studies to further assess the risks of boric acid and its sodium salts to non-target plants and endangered plant species. However, these studies are not part of the target data base and do not affect the reregistration eligibility of boric acid and related active ingredients. The Agency also is requiring product-specific data including product chemistry, acute toxicity and efficacy studies, revised Confidential Statements of Formula, and revised product labeling for reregistration.

EPA already has reregistered all 43 boric acid products covered by the General Registration Standard. For these products, only current labeling and Confidential Statement of Formulas must be submitted to ensure that they still meet the criteria set forth in that document.

Product Labeling Changes Required

The labeling of all end-use products containing boric acid and its sodium salts must comply with EPA's current pesticide labeling requirements. In addition:

- **Compliance with Worker Protection Standard (WPS)** - Any product whose labeling permits use in the production of an agricultural plant on any farm, forest, nursery or greenhouse must comply with the labeling requirements of:
  - PR Notice 93-7, "Labeling Revisions Required by the Worker Protection Standard (WPS)," and
  - PR Notice 93-11, "Supplemental Guidance for PR Notice 93-7."

Unless specifically directed in the RED, all statements required by these two PR Notices must appear on product labeling exactly as instructed in the Notices. Labels must be revised by April 21, 1994, for products distributed or sold by the primary registrant or supplementally registered distributors, and by October 23, 1995, for products distributed or sold by anyone.

- **Personal Protective Equipment (PPE) Requirements**

  Products NOT Primarily Intended for Home Use

  The PPE requirement for handlers of all end-use products except those intended primarily for home use is:

  "Applicators and other handlers must wear:

  --Long-sleeved shirt and long pants

  --Chemical-resistant or waterproof gloves*

  --Shoes plus socks

* The glove statement is that established through the instructions in Supplement Three of PR Notice 93-7."

Registrants must compare the PPE requirements in this section with those on their product labeling, and retain the more protective PPE.

Products Primarily Intended for Home Use

No new PPE requirements need to be added. However, any PPE requirements on current product labeling must be retained.

- **Entry Restrictions**

Products NOT Primarily Intended for Home Use

o Uses Within the Scope of the WPS: A 12-hour restricted entry interval (REI) is required for all uses within the scope of the WPS, except on products intended primarily for home use. The PPE for early entry should be that required for applicators of boric acid and its sodium salts, except that the requirement for an apron or respirator is waived. Registrants should insert this REI and PPE into the standardized statements required by PR Notice 93-7.

- Sole Active Ingredient Products: Must be revised to adopt the entry restrictions set forth in this section, and any conflicting entry restrictions on current labeling must be removed.

- Multiple Active Ingredient Products: Registrants must compare the entry restrictions set forth in this section to the entry restrictions on their current labeling and retain those which are more protective. A specific time period in hours or days is considered more protective than "until sprays have dried" or "dusts have settled."

o Uses Not Within the Scope of the WPS: No new entry restrictions must be added. However, any entry restrictions on current product labeling must be retained.

Products Primarily Intended for Home Use

No new entry restrictions need to be added. However, any entry restrictions on current product labeling must be retained.

- **Products Under the General Boric Acid Registration Standard**

Labels must comply with the format labels issued with the Standard. Five copies of current labeling must be submitted.

- **Products Not Under the General Registration Standard**

Labels must bear the following Environmental Hazards statements, if appropriate:

- Terrestrial Food and Feed Use and Non-Crop Products

  "Do not apply directly to water, or to areas where surface water is present or to intertidal areas below the mean high-water mark. Do not contaminate water when disposing of equipment washwaters or rinsate."

- Indoor Use Products with Effluent

  "Do not discharge effluent containing this product into lakes, streams, ponds, estuaries, oceans or other waters unless in accordance with the requirements of a National Pollutant Discharge Elimination System (NPDES) permit and the permitting authority has been notified in writing prior to discharge. Do not discharge effluent containing this product to sewer systems without previously notifying the sewage treatment plant authority. For guidance, contact your State Water Board or Regional Office of the EPA."

Labels with uses on carpets and floors to combat fleas, cockroaches, ants and silverfish must bear the following under Directions for Use:

- Use Restrictions

  "Children and pets should not be in treatment area until after application is completed. Do not treat pets with this product. Avoid contamination of feed and foodstuff. Avoid contamination of ornamental plants."

- Carpets

  "Apply to dry surfaces only. Apply directly on carpets where pets frequently traffic or sleep. Work powder deeply into fibers and mat with a broom or rug rake. Any powder visible after application must be brushed into carpet fibers or removed."

- Upholstery

  "Remove loose cushions. Apply along creases and into corners and furniture wells. Do not apply product to exposed fabric. Any product visible after application must be removed."

Regulatory Conclusion

The use of currently registered pesticide products containing boric acid and its sodium salts in accordance with approved labeling will not pose unreasonable risks or adverse effects to humans or the environment. Therefore, all uses of these products are eligible for reregistration. These products will be reregistered once the required product-specific data, Confidential Statements of Formula and revised labeling are received and accepted by EPA.

Boric acid products that already have been reregistered under the General Registration Standard will remain reregistered as long as current labeling and Confidential Statements of Formula are submitted, and demonstrate that these products still meet the criteria set forth in the Standard.

Boric acid products which also contain other active ingredients will be reregistered only after the other active ingredients are determined to be eligible for reregistration.

For More Information

EPA is requesting public comments on the Reregistration Eligibility Decision (RED) document for boric acid and its sodium salts during a 60-day time period, as announced in a Notice of Availability published in the Federal Register. To obtain a copy of the RED document or to submit written comments, please contact the Pesticide Docket, Public Response and Program Resources Branch, Field Operations Division (7506C), Office of Pesticide Programs (OPP), US EPA, Washington, DC 20460, telephone 703-305-5805.

Following the comment period, the boric acid RED document will be available from the National Technical Information Service (NTIS), 5285 Port Royal Road, Springfield, VA 22161, telephone 703-487-4650.

For more information about EPA's pesticide reregistration program, the boric acid and its sodium salts RED, or reregistration of individual products containing these active ingredients, please contact the Special Review and Reregistration Division (7508W), OPP, US EPA, Washington, DC 20460, telephone 703-308-8000.

For information about the health effects of pesticides, or for assistance in recognizing and managing pesticide poisoning symptoms, please contact the National Pesticides Telecommunications Network (NPTN). Call toll-free 1-800-858-7378, between 8:00 am and 6:00 pm Central Time, Monday through Friday.

U.S.BORAX

February 13, 1992

Mr. Brian Baker
California Certified Organic Farmers
P.O. Box 8136
Santa Cruz, CA 95061

RE: California EPA - Notice of Impending Suspension of Boric Acid Containing Pesticide Registrations

Dear Mr. Baker:

On January 16, 1992, the Cal EPA Department of Pesticide Regulation issued "Notices of Impending Suspension" to registrants of over 3,000 products. One of the active ingredients subject to this action is "boric acid". As the primary data supporter for boric acid pesticide registrations in California, the United States Borax & Chemical Corporation has been monitoring related regulatory and legislative activities for the past year. U.S. Borax also received a Notice of Impending Suspension for the active ingredient "boric acid", that is purchased for formulation into end-user and customer products. This letter is designed to bring you up-to-date on our strategy for addressing Cal-EPA's recent action and to provide you with additional information on these issues.

By way of background, the 1984 Birth Defects Prevention Act of California required pesticide registrants to generate and submit data regarding the toxicology and health effects of specific pesticide ingredients. New State legislation enacted January 1, 1992, requires Cal EPA to ensure that all data has been submitted and to <u>suspend</u> the registrations for products with remaining data gaps. U.S. Borax, as the primary data generator for "boric acid for cockroach control", has been submitting data to fulfill these requirements, and as of January 1, 1992, seven of ten data requirements have been met. (See Attachment A).

U.S. Borax has been working with Cal EPA (and its predecessor CDFA) since early 1991 to get the remaining three chronic toxicity data requirements waived. Our purpose is to get boric acid (and <u>all</u> boric acid containing pesticides) designated as having a "complete" data package that is sufficient for the Agency to conduct necessary risk assessments. Instead of conducting additional costly chronic studies, we elected to seek a waiver of the requirements themselves, and we committed to conduct relevant exposure studies instead. Similar waivers have previously been granted for other chemical active ingredients (e.g. chlorine, sulfur, creosote). Our official waiver request

UNITED STATES BORAX & CHEMICAL CORPORATION • 3075 WILSHIRE BOULEVARD • LOS ANGELES, CA 90010-1294 • (213) 251-5400
MAIL ADDRESS: P.O. BOX 75128, SANFORD STATION, LOS ANGELES, CA 90075-0128

was filed in February 1991, and a decision has not yet been issued from Cal EPA.

On December 13, 1991, all boric acid registrants received Notice from Cal EPA acknowledging that there were remaining data gaps, and that a Notice of Impending Suspension would be issued if gaps were not filled by year-end. (See Attachment B: Cal Notice 91-13). Cal EPA Secretary Jim Strock issued a press release on January 16, 1992, announcing the possible suspensions of products for failure to fill all data requirements. "Boric Acid" is specifically mentioned as one of those "facing suspension". (See Attachment C). Strock stressed that these chemicals were facing suspension, "...not because they posed known hazards, but because manufacturers had failed to meet deadlines to submit required studies." Cal EPA also issued a "Question & Answer" document with background on this program (Attachment D).

All Notices of Impending Suspension were mailed on January 16, 1992. Since U.S. Borax has an official waiver request still pending before Cal EPA, we have been assured by Agency representatives that no action is required on our part at this time. We have been further advised that there will be no further suspension activities from Cal EPA regarding boric acid towards us or other registrants, until <u>after</u> the waiver is acted upon. Cal EPA officials advise this may take "from one week to six months". **Until further notice is received from Cal EPA, all boric acid registrations remain active and valid, and sale of your pesticide products may continue as usual.**

The Notice you received provides an opportunity to request: (1) an Extension of Time to Submit Required Studies; or (2) a Deferral of Suspension based on specific hardship criteria. In the case of boric acid, U.S. Borax has no intention of selecting either option at this time; we do not want to conduct additional studies and we do not clearly meet the hardship criteria. For your information, it is not required that your individual company officially respond to the Cal EPA Notice.

Though not specifically required, we <u>do</u> plan to respond to Cal EPA's Notice on behalf of all boric acid registrants. USB's letter will reiterate our waiver request and discuss our understanding of the process at this time. We will keep you informed on the status of our waiver request at the Agency. If our waivers are granted as we hope, there will be no change in your present status and ability to sell boric acid pesticide products in California.

If the waiver request is eventually denied, all boric acid registrations <u>ultimately</u> will be suspended in California. In this event, however, a formal Notice of Intent to Suspend will be issued to all registrants, and we will have an opportunity to request a formal hearing before suspension is final. Under State regulations, products could be sold or used under certain circumstances for up to two years following official suspension (See details in Cal EPA Notice).

In summary, we will continue to pursue our waiver requests at Cal EPA to reduce data requirements, and thereby maintain your ability to sell boric acid products within California. I hope the above information clarifies the present status of these issues. If you have any questions relative to these regulatory matters, please feel free to contact representatives of our Product Safety Department (213) 251-5677.

Sincerely,

H. H. Schmitt

Herbert H. Schmitt
General Sales Manager
Marketing Department

cc: Ms. Maureen Lennon, Director
Mr. Josh Dunn, Advisor
U.S. Borax Product Safety Department

ENVIRONMENTAL PROTECTION AGENCY

40 CFR Part 180

[OPP-300287A; FRL-4635-4]

RIN 2070-AB78

Boric Acid and its Salts, Borax (Sodium Borate Decahydrate), Disodium Octaborate Tetrahydrate, Boric Oxide (Boric Anhydride), Sodium Borate and Sodium Metaborate; Tolerance Exemptions

AGENCY: Environmental Protection Agency (EPA).

ACTION: Final rule.

SUMMARY: This document establishes exemptions from the requirement of a tolerance for residues of boric acid and its salts, borax (sodium borate decahydrate), disodium octaborate tetrahydrate, boric oxide (boric anhydride), sodium borate, and sodium metaborate, in or on raw agricultural commodities when used as an active ingredient in insecticides, herbicides, or fungicides preharvest or postharvest in accordance with good agricultural practices. This regulation was requested by Bushwacker Associates, Galveston, TX. The tolerance exemptions supersede the tolerances for boron established under 40 CFR 180.271; therefore, the document also removes § 180.271.

EFFECTIVE DATE: This regulation becomes effective (*insert date of publication in the* Federal Register).

ADDRESSES: Written objections, identified by the document control number, [OPP-300287A], may be submitted to: Hearing Clerk (A-110), Environmental Protection Agency, Rm. M3708, 401 M St., SW., Washington, DC 20460.

FOR FURTHER INFORMATION CONTACT: By mail: Robert A. Forrest, Product Manager (PM 14), Registration Division, Environmental Protection Agency, 401 M St., SW., Washington, DC 20460. Office location and telephone number: Rm. 219, CM #2, 1921 Jefferson Davis Highway, Arlington, VA 22202, (703)-305-6600.

SUPPLEMENTARY INFORMATION: In the Federal Register of June 30, 1993 (58 FR 34972), EPA issued a proposed rule that gave notice that Bushwacker Associates, Inc., Division of Bethurum Research & Development, Inc., P.O. Box 3436, Galveston, TX, had submitted a pesticide petition, (PP) 2F4132, to EPA requesting that the Administrator, pursuant to section 408(e) of the Federal Food, Drug, and Cosmetic Act (21 U.S.C. 346a(e)), propose to amend 40 CFR part 180 by establishing exemptions from the requirement of a tolerance for residues of boric acid and its salts, borax (sodium borate decahydrate), disodium octaborate tetrahydrate, boric oxide (boric anhydride), sodium borate, and sodium metaborate in or on raw agricultural commodities when used as an active ingredient in insecticides, herbicides, or fungicides preharvest or postharvest in accordance with good agricultural practices.

There were no comments or requests for referral to an advisory committee received in response to the proposed rule.

The data submitted in the petition and other relevant material have been evaluated and discussed in the proposed rule. Based on the data and information considered, the Agency concludes that the tolerance exemptions will protect the public health. Therefore, the tolerance exemptions are established as set forth below.

Any person adversely affected by this regulation may, within 30 days after publication of this document in the Federal Register, file written objections with the Hearing Clerk, at the address given above (40 CFR 178.20). The objections submitted must specify the provisions of the regulation deemed objectionable and the grounds for the objections (40 CFR 178.25). Each objection must be accompanied by the fee prescribed by 40 CFR 180.33(i). If a hearing is requested, the objections must include a statement of the factual issue(s) on which a hearing is requested, the requestor's contentions on such issues, and a summary of any evidence relied upon by the objector (40 CFR 178.27). A request for a hearing will be granted if the Administrator determines that the material submitted shows the following: There is a genuine and substantial issue of fact; there is a reasonable possibility that available evidence identified by the requestor would, if established, resolve one or more of such issues in favor of the requestor, taking into account uncontested claims or facts to the contrary; and resolution of the factual issue(s) in the manner sought by the requestor would be adequate to justify the action requested (40 CFR 178.32).

The Office of Management and Budget has exempted this rule from the requirements of section 3 of Executive Order 12291.

Pursuant to the requirements of the Regulatory Flexibility Act (Pub. L. 96-354, 94 Stat. 1164, 5 U.S.C. 601-612), the Administrator has determined that regulations establishing new tolerances or food additive regulations or raising tolerance levels or food additive regulations or establishing exemptions from tolerance requirements do not have a significant economic impact on a substantial number of small entities. A certification statement to this effect was published in the Federal Register of May 4, 1981 (46 FR 24950).

List of Subjects in 40 CFR Part 180

Administrative practice and procedure, Agricultural commodities, Pesticides and pests, Reporting and recordkeeping requirements.

Dated:_____

_____

Director, Office of Pesticide Programs.

Therefore, 40 CFR part 180 is amended as follows:

PART 180—[AMENDED]

1. The authority citation for part 180 continues to read as follows:

Authority: 21 U.S.C. 346a and 371.

§ 180.271 [Removed]

2. In subpart C, § 180.271 *Boron; tolerances for residues* is removed.

3. In subpart D, by adding new § 180.1121, to read as follows:

§ 180.1121 Boric acid and its salts, borax (sodium borate decahydrate), disodium octaborate tetrahydrate, boric oxide (boric anhydride), sodium borate and sodium metaborate; exemptions from the requirement of a tolerance.

An exemption from the requirement of a tolerance is established for residues of the pesticidal chemical boric acid and its salts, borax (sodium borate decahydrate), disodium octaborate tetrahydrate, boric oxide (boric anhydride), sodium borate and sodium metaborate, in or on raw agricultural commodities when used as an active ingredient in insecticides, herbicides, or fungicides preharvest or postharvest in accordance with good agricultural practices.

[FR Doc. 93–????? Filed ??–??–93; 8:45 am]

BILLING CODE 6560–50–F

NOSB NATIONAL LIST
FILE CHECKLIST

CROPS

MATERIAL NAME: **Boron Products, Soluble**

CATEGORY: Synthetic **Complete?:** _____

✓ **NOSB Database Form**

✓ **References**

✓ **MSDS (or equivalent)**

✓ **Date file mailed out:** 1/17/95, 2/20/95

~~2/20/95~~ ✓

✓ **TAP Reviews from:**

Philip Van Buskirki

Lynn S. Coody

Brian Baker

✓ **Supplemental Information:**

MISSING INFORMATION: _____

NOSB/NATIONAL LIST COMMENT FORM/BALLOT

Use this page to write down comments and questions regarding the data presented in the file of this National List material. Also record your planned opinion/vote to save time at the meeting on the National List.

Name of Material Boron Products, Soluble

Type of Use: ✓ **Crops;** ____ **Livestock;** ____ **Processing**

TAP Review by:

1. Philip Van Buskirki
2. Lynn S. Coody
3. Brian Baker

Comments/Questions:

My Opinion/Vote is:

Signature _____ **Date** _____

USDA/TAP REVIEWER COMMENT FORM

Use this page or an equivalent to write down comments and summarize your evaluation regarding the data presented in the file of this potential National List material. Attach additional sheets if you wish.

This file is due back to us within 30 days of: due: MAR 01 15...

Name of Material: Boron Products

Reviewer Name: Philip VanBuskirki

Is this substance Natural or Synthetic? Explain (if appropriate)

Most come from synthetic process.

Please comment on the accuracy of the information in the file:

good.

This material should be added to the National List as:

__✓__ **Synthetic Allowed** ____ **Prohibited Natural**

or, ____ **This material does not belong on the National List because:**

Are there any restrictions or limitations that should be placed on this material by use or application on the National List?

NO.

Any additional comments or references?

NO

Signature Philip VanBuskirki **Date** 2/14/95

ORGANIC FOOD PRODUCTION ACT/NATIONAL LIST SECTIONS

MAR - 7 1995

USDA/TAP REVIEWER COMMENT FORM

Use this page or an equivalent to write down comments and summarize your evaluation regarding the data presented in the file of this potential National List material. Attach additional sheets if you wish.

This file is due back to us within 30 days of: due: March 20

Name of Material: Boron Products

Reviewer Name: Brian Baker

Is this substance Natural or Synthetic? Explain (if appropriate)

Please comment on the accuracy of the information in the file:

This material should be added to the National List as:

____ **Synthetic Allowed** ____ **Prohibited Natural**

or, ✓ **This material does not belong on the National List because:** Borates are non-synthetic and should not be prohibited

Are there any restrictions or limitations that should be placed on this material by use or application on the National List?
Not at present. See attached.

Any additional comments or references?
See attached

Signature _____ **Date** 3/14/95

ORGANIC FOOD PRODUCTION ACT/NATIONAL LIST SECTIONS

USDA/TAP REVIEWER COMMENT FORM

Use this page or an equivalent to write down comments and summarize your evalua[illegible] regarding the data presented in the file of this potential National List material. Attach additional sheets if you wish.

This file is due back to us within 30 days of: due: 3/20/95

Name of Material: Boron Products

Reviewer Name: Paul Sachs

Is this substance Natural or Synthetic? Explain (if appropriate)

Synthetic. The product is purified from mined tincal.

Please comment on the accuracy of the information in the file:

I am unqualified to either deny or confirm the accuracy

This material should be added to the National List as:

__x__ **Synthetic Allowed** ____ **Prohibited Natural**

or, ____ **This material does not belong on the National List because:**

Are there any restrictions or limitations that should be placed on this material by use or application on the National List?

Use of the material should be justified by need as evidenced by a soil test.

Any additional comments or references?

Signature Paul O. Sachs **Date** 17 March 1995

ORGANIC FOOD PRODUCTION ACT/NATIONAL LIST SECTIONS

ORGANIC AGSYSTEMS CONSULTING

1241 Jefferson St.
Cottage Grove, OR 97424

phone and fax: (503) 942-7717

Date: February 3, 1995
To: Zea Sonnabend
From: Lynn S. Coody
Subject: Evaluation of Boron Products for TAP to NOSB

Boron Products, Soluble

Natural or synthetic:
The information in the data base indicates that the material is synthetic. Under the section on Chemistry, it states that the material is "Found naturally in combination with sodium, calcium, magnesium and oxygen as borates". In the part of the database related to Manufacturing, there is no information provided on how the natural ore is converted into fertilizer. Hawley's Condensed Chemical Dictionary (Lewis 1993) mentions the Trona process, a method used for separation and purification of soda ash, anhydrous sodium sulfate, boric acid, borax, potassium sulfate, bromine, and potassium chloride from lake brine. Due to my difficulties in researching materials with the chemical names used in the database (see #1 below), I am not sure whether or not this is the manufacturing process used to create any or all of these materials and I cannot evaluate whether the materials are synthetic.

Accuracy of the information:
1. I could not find listings for the chemical names provided on the database in Hawley's. Other books, including Western Fertilizer Handbook (Soil Improvement Committee California Fertilizer Association 1985) and Soil Fertility and Fertilizers (Tisdale, Nelson et al. 1985) also supply names which differ from those used on the database. The most common reference to boron fertilizers used in these sources is sodium tetraborate.

I think that a listing for "boron products" is too vague. I would interpret it to mean that any and all synthetic boron products are allowed. I recommend that the listing contain language which specifies the chemical names of the types of boron which are acceptable.

2. All references supplied with the data base are about the use of boron as a fertilizer. I do not question the accuracy of the information but I do not find the references particularly useful in trying to determine the material's acceptability under OFPA except to underscore the necessity of providing a source for boron which is essential to the success of cropping systems in many parts of the United States.

3. In general, I find the information provided on the database to be accurate in comparison to my previous knowledge of the use of boron in crop production and the data in my own files and library. I also thought the information addressed many of the evaluation criteria mentioned in OFPA very well. However, I did not think that the information was adequate for me to make a decision on how well boron products would fare under the following evaluation criteria:

- Manufacturing,
- Alternatives to using the substance, and
- Compatibility with a system of sustainable agriculture.

4. The toxicity data in the database does not reflect the statement on the Kerr McGee information sheet that "Long term effects may include reproductive and fetal abnormalities", and that "Lung, kidney, and nerve disorders may be aggravated by this material".

→ **This material should be:** Added to the National List as synthetic allowed. Boron is an essential micronutrient and soils in significant portions of the United States are deficient in boron. In my opinion, it is important for the National List to provide a usable source of boron for organic growers. If the production of soluble boron fertilizers results in their characterization as a synthetic material, I have no objection to listing soluble boron as an allowed synthetic. However, I strongly recommend that the wording of the list incorporate the specific chemical names of the types of synthetic boron which are acceptable. An example of this language follows: "Boron products, but only sodium metaborate hydrate, boric acid monosodium salt, trone, amorphous boron, and elemental boron." The major factor determining the types of boron listed should be the character and amounts of breakdown products (such as sodium) deposited in the soil.

Restrictions or limitations: Because of the possibility of long term effects and the lack of through investigation of the toxicological properties (as stated on the MSDS), I suggest that the list caution growers to avoid ingesting the material, breathing its dust, and allowing the material to contact eyes.

Additional comments or references:
The limitations for this evaluation due to its volunteer nature do not allow me adequate time to research references other than those mentioned in the text. Another source of information about boron is:
U.S. Borax, 6250 River Road, Suite 7020, Rosemont, IL 60018-4288

Signature: 

Date: Feb. 3, 1995

REFERENCES:

Lewis, R. J., Sr. (1993). Hawley's Condensed Chemical Dictionary. New York, NY, Van Nostrand Reinhold.

Soil Improvement Committee California Fertilizer Association (1985). Western Fertilizer Handbook. Danville, IL, The Interstate Printers and Publishers, Inc.

Tisdale, S. L., W. L. Nelson, et al. (1985). Soil Fertility and Fertilizers. New York, Macmillan Publishing Company.

TAP Review by
Brian Baker

BORON PRODUCTS

Boron is an essential micronutrient for plant growth, but concentrations slightly higher than optimum can be toxic to plants. Some plants, such as citrus and stonefruit, are more sensitive to excessive boron than others. Symptoms of boron deficiency include: 1) death of terminal growth, 2) thickened, curled, wilted and chlorotic leaves, 3) soft or necrotic spots in fruit or tubers and 4) reduced flowering or improper pollination. Boron toxicity symptoms include a brown speckling pattern on leaves, grading into marginal necrosis.[1]

Borax ore is the most commercial source of refined borate salts, with colemanite and kernite two other possible sources. The ore is crushed, dissolved in water and recrystallized.[2] This yields sodium tetraborate pentahydrate ($Na_2B_4O_7 \cdot 5H_2O$) and disodium octaborate tetrahydrate ($Na_2B_8O_{13} \cdot 4H_2O$).

Agronomic use of boron is generally through foliar feeding of one of the soluble refined salts in an aqueous solution, with soil and irrigation water application less common. Borates have, at various times, been used to dessicate and defoliate cotton. As a result, the EPA has published tolerances for use as defoliants in cottonseed.[3] Registration for use as a cotton defoliant and non-selective herbicide has been discontinued, therefore any use without an experimental use or special local need permit would not comply with FIFRA.

Disodium octaborate tetrahydrate was recently registered by US EPA as a wood preservative. It has been shown to inhibit fungus and termite infestation of structural lumber. It has been used in Europe, Australia and New Zealand for forty years.

2119(m) criteria:

1) **Interactions**

Combustible.
Oxidizes slowly at room temperature.
Finely divided dust in air ignitable and can be explosive.

2) Toxicity

LD_{50} for $Na_2B_4O_7 \cdot 5H_2O$: 2,550 mg/kg
LD_{50} for $Na_2B_8O_{13} \cdot 4H_2O$: 3,400 - 3,800 mg/kg
May contain trace amounts of arsenic as an impurity.

3) Manufacture

The main source in the United States is from the US Borax open-pit mine in Boron, CA. Research did not uncover any extraordinary adverse environmental consequences from the operation of the mine, officials were unaware of any current violations of environmental protection laws.

4) Human Health

Borate products have low toxicity to mammals and humans. It is still commonly used in such household products as detergents and contact-lense cleaners. The NTIS study (enclosed) provides an exhaustive account of the human health impacts of exposure. More recent Materials Safety Data Sheets don't indicate any more recent concerns. Consumer exposure through fertilizer use is minimal. Use as a cotton defoliant would require more data. Farmworker exposure greatest with foliar and lumber treatment. Worker safety information is contained on the MSDS.

5) Biology

Boron is an essential mineral nutrient in plants. While it does not occur in pure form, it is found as an oxide in combination with sodium and calcium.

6) Alternatives

As boron is an essential micronutrient, there are at least two natural sources, but there is no substitute. While there are synthetic sources of boron, these are no more compatible with organic production and, if anything, by their nature they are less compatible.[4]

There are several cultural alternatives to borates available as defoliants, including water management, picking without defoliants, stripper picking, hand-picking and, in some areas, frost. Oklahoma State performed research in the 1970s that showed thermal defoliation was an effective alternative. A number of other naturally occurring materials may be more appropriate as defoliants than the borates in certain areas. For wood treatment, untreated wood is a possibility, but the service life in some parts of the country is greatly reduced. Disodium octaborate tetrahydrate is not recommended for outdoor installations at present. Copper-chromium borate (CCB) and zinc borate (ZB) are being experimented with as alternatives to copper-chromium arsenate (CCA). If registration for these is pursued, the NOSB may want to consider their use in treated lumber as a production aid. The chromium in CCB would be of greater environmental and toxicological concern than the boron.

7) Compability

Refined boron products are allowed under the Caillfornia Organic Foods Act; use as a cotton defoliant and non-selective herbicide is questionable. Use as a wood preservative in structural pest control would be preferable to copper-chromium arsenate, but may not be suitable or registered for outdoor installations, such as trellises, unless some means is found to reduce leaching.

Recommendation: That the NOSB not prohibit the use of the refined borates used to correct nutrient imbalances. While there might be a fine line for certain crops between deficiency and phytotoxicity, any material might be used to excess. The grower should have discretion to make management decisions. The NOSB might want to reconsider use as a cotton defoliant or non-selective herbicide if a manufacturer interested in pursuing FIFRA registration petitions the NOSB and generates new toxicology data, but there is no reason for the NOSB to preclude its use as such at the present time. Borax should also be acceptable for cleaning equipment and facilities without restriction.

REFERENCES

1.Soil Improvement Committee, California Fertilizer Association, *Western Fertilizer Handbook* (Danville, IL: Interstate Publishing Co., 1990): 86-87.

2.William G. Walker, Manager, US Borax and Chemical Co., Los Angeles, Personal Communication, December 21, 1990).

3.40 C.F.R. 180.271.

4.W.G. Burkman, D.C. Adriano and J.L. Afre, Phytoavailability of Boron from Organic Sources, *J. Environ. Qual.* 16(4): 416-421. The "organic" source of boron in question is sodium tetraphenyl boron (NaTPB), which is used to precipitate ^{137}Cs from high-level nuclear wastes.

Brian Baker
March 14, 1995

NOSB Materials Database

Identification

Common Name Boron Products, Soluble **Chemical Name** Sodium Metaborate Hydrate

Other Names Boric acid Monosodium Salt, Trone, Amorphous Boron, Elemental Boron

Code #: CAS 7440-42-8 **Code #: Other**

N. L. Category Synthetic Allowed **MSDS** ● yes ○ no

Chemistry

Composition Fine Dark Brown Powder **Family** Inorganic

Properties

How Made Found naturally in combination with sodium, calcium, magnesium and oxygen as borates.

Use/Action

Type of Use Crops

Use(s) Fertilizer for boron.

Action

Combinations

N. L. Restriction Must not contain prohibited substances.

Status

OFPA

EPA, FDA, etc

Registration

Directions

Safety Guidelines Use safety goggles. Plenty of ventilation. Do not breathe dust. Store in cook dry place

State Differences

Historical status

International status OCIA: Accepted

NOSB Materials Database

OFPA Criteria

2119(m)1:chem. Inter.

-Combustible
-Oxidizes slowly at room temperature
-Finely divided dust in air is ignitable and can be explosive.
-Ignites in contact with gaseous chlorine and fluorine at room temperatures.

2119(m)2: toxicity

Rat: Oral: LD50 (Mg/Kg):2330
Oral Mammal: LD50 300 mg/kg

2119(m)3:manufacture

2119(m)4:humans

-Harmful by inhalation, ingestion, skin absorption.
-Causes irritation to gastrointestinal tract
-Long term effects include reproductive and fetal abnormalities
-Swallowing may cause nausea, vomiting and abdominal pain
-Lung, Kidney and nerve disorders may be irritated.

2119(m)5: biology

-Essential mineral element used in growth of some plants, especially legumes.
-Does not occur in pure form, but found as the oxide in combination with sodium calcium.
-No hazardous decomposition products.

2119(m)6:alternatives

2119(m)7:compatible

References

1. Farm Chemical Handbook, 1994 pg. B14. Meister Co. Willoughby, OH
2. Olkowski, W. S. Daar, H. Olkowski, 1991. Common Sense Pest Control. Connecticut. Tauton Press. pgs. 112-114.

Kerr-McGee Chem:P.O. Box 25861 123 Roberts S. Kerr Ave. Oklahoma City, OK 8010-654-3911
Belco Res: 274 White Plains Rd. Tuckahoe N.Y. 914-961-8408
Frit Industries: P.O. Box 1589 Ozark, AL 205-774-2515

BORON REFERENCES

AU: Coetzee,-J.G.K.
TI: Evaluating calcium borate as a boron fertilizer for mature citrus trees.
SO: Appl-Plant-Sci-Toegepaste-Plantwetenskap. Sunnyside : South African Weed Science Society. 1992. v. 6 (1) p. 37-39.
CN: DNAL SB317.5.A6

AU: Odom,-J.W.
TI: Boron fertilizer applications may not be necessary for irrigated corn.
SO: Highlights-Agric-Res-Ala-Agric-Exp-Stn. Auburn University, Ala. : The Station. Spring. v. 37 (1) p. 13.
CN: DNAL 100-AL1H

AU: Chaplin,-M.H.; Martin,-L.W.
TI: The effect of nitrogen and boron fertilizer applications on leaf levels, yield and fruit size of the red raspberry Foliar diagnosis.
SO: Commun-Soil-Sci-Plant-Anal. New York, Marcel Dekker. 1980. v. 11 (6) p. 547-556. ill.
CN: DNAL S590.C63

AU: Stapel,-A-C; Bagger,-O; Sode,-J
TI: Experiments with application of boron fertilizer to red clover. effect on seed yield, nectar production, length of corolla tube, and visits by pollinating bees
OT: Undersogelser over borgodskning af rodklover. indflydelse pa froudbytte, nektarproduktlon, kronrorslaengde og bibesog
SO: Den-Statens-Forsogsvirksomhed-Plantekult-Beretn, 1970, 74 (1): 97-110.
CN: DNAL 11-D412

AN: IND 20384917
UD: 9405
AU: Michalk,-D.L.; Huang,-Z.K.
TI: Response of subterranean clover (Trifolium subterraneum) to lime, magnesium, and boron on acid infertile soil in subtropical China.
SO: Fertil-res. Dordrecht : Kluwer Academic Publishers. Aug 1992. v. 32 (2) p. 249-257.
CN: DNAL S631.F422

AU: Muckenhirn,-R.J.
TI: Response of plants to boron, copper, and manganese.
SO: J-Am-Soc-Agron. Madison, Wis. : American Society of Agronomy. Oct 1936. v. 28 (10) p. 824-842.
CN: DNAL 4-AM34P
AB: Studies were made of the influences of boron on the growth and boron content of lettuce; of kaolin on the growth and manganese content of buckwheat in quartz sand cultures; of copper, manganese, and zinc on onions and sweet clover grown on peat in pot cultures; and of the influence of these elements on onions and potatoes grown on peat soils in the field.

MATERIAL SAFETY DATA SHEET
SODIUM METABORATE

SECTION I - Product Identification

PRODUCT NAME: SODIUM METABORATE
COMPANY NAME: SIGMA CHEMICAL COMPANY
DATE: 01/10/89
EMERGENCY TELEPHONE: (314) 771-5765
RTECS: ED4640000
CAS #: 7775-19-1
SYNONYMS: BORIC ACID MONOSODIUM SALT; SODIUM METABORATE HYDRATE

SECTION II - Hazardous Components

NDA

SECTION III - Physical Data

MP: NDA
BP: NDA
APPEARANCE & ODOR: POWDER

SECTION IV - Fire and Explosion Hazard Data

FLASHPOINT: NDA
EXTINGUISHING MEDIA:
WATER SPRAY.
CARBON DIOXIDE, DRY CHEMICAL POWDER, ALCOHOL OR POLYMER FOAM.
SPECIAL FIREFIGHTING PROCEDURES: WEAR SELF-CONTAINED BREATHING APPARATUS AND PROTECTIVE CLOTHING TO PREVENT CONTACT WITH SKIN AND EYES.
UNUSUAL FIRE AND EXPLOSION HAZARDS:
NDA

SECTION V - Health Hazard Data

ACUTE EFFECTS: MAY BE HARMFUL BY INHALATION, INGESTION, SKIN ABSORPTION.
CAUSES IRRITATION.
TO THE BEST OF OUR KNOWLEDGE, THE CHEMICAL/PHYSICAL/TOXICOLOGICAL PROPERTIES HAVE NOT BEEN THOROUGHLY INVESTIGATED.
FIRST AID PROCEDURES:
IMMEDIATELY FLUSH EYES OR SKIN WITH COPIOUS AMOUNTS OF WATER FOR AT LEAST 15 MINUTES; ASSURE ADEQUATE FLUSHING BY SEPARATING EYELIDS WITH FINGERS.
IF INHALED, REMOVE TO FRESH AIR.
IF BREATHING IS DIFFICULT, CALL A PHYSICIAN.
INGESTION: WASH OUT MOUTH WITH WATER PROVIDED PERSON IS CONSCIOUS.
CALL A PHYSICIAN !!!
CONTAMINATED CLOTHING & SHOES: REMOVE AND WASH BEFORE REUSE.

SECTION VI - Reactivity Data

STABILITY: STABLE
HAZARDOUS COMBUSTION:
NDA
HAZARDOUS POLYMERIZATION: WILL NOT OCCUR

INCOMPATIBILITIES:
NDA
CONDITIONS TO AVOID:
AIR SENSITIVE

SECTION VII - Spill and Disposal Procedures

SPILLED MATERIAL:
WEAR CHEMICAL SAFETY GOGGLES, RUBBER BOOTS, HEAVY RUBBER GLOVES.
WEAR SELF-CONTAINED BREATHING APPARATUS.
AVOID RAISING DUST.
VENTILATE AREA & WASH SPILL SITE AFTER MATERIAL PICKUP IS COMPLETE.
SWEEP UP OR PICK UP & PLACE IN A BAG AND HOLD FOR WASTE DISPOSAL.
DISPOSAL: INCINERATOR
OBSERVE ALL FEDERAL, STATE AND LOCAL LAWS.

SECTION VIII - Protective Equipment

EYES: SAFETY GOGGLES
SKIN: CHEMICAL RESISTANT GLOVES, CLOTHING
VENTILATION: MECHANICAL EXHAUST
RESPIRATOR: NIOSHA/MSHA-APPROVED RESPIRATOR
OTHER: SAFETY SHOWER AND EYE WASH.
FULL PROTECTIVE CLOTHING.

SECTION IX - Storage and Handling Precautions

STORAGE PRECAUTIONS: DO NOT GET IN EYES, SKIN, CLOTHING. DO NOT PIPET BY MOUTH.
DO NOT BREATHE VAPOR.
KEEP TIGHTLY CLOSED.
WASH THOROUGHLY AFTER HANDLING.

SECTION X - Transportation Data and Additional Information

TOXICITY DATA:
ORL-RAT LD50 (MG/KG): 2330

(TM) and (R) : Registered Trademarks
N/A = Not Applicable OR Not Available
The information published in this Material Safety Data Sheet has been compiled from our experience and data presented in various technical publications. It is the user's responsibility to determine the suitability of this information for adoption of necessary safety precautions. We reserve the right to revise Material Safety Data Sheets periodically as new information becomes available.

TRONA® elemental boron

BULLETIN 0415
OCTOBER, 1986

BRAND NAME:	TRONA® elemental boron
CHEMICAL NAMES:	Elemental boron
OTHER NAMES:	Amorphous boron
FORMULA:	B
MOLECULAR WEIGHT:	10.81
CAS NUMBER:	7440-42-8
DESCRIPTION:	Fine dark brown powder
GRADES:	Standard. Standard grade meets or exceeds the requirements of Specification PA-PD-461, OS11608 and MIL-B-51092(ORD).

TYPICAL CHEMICAL ANALYSIS

	Percent
Boron .....(net as B).....	89 to 92
Water soluble boron	0.5
Magnesium .....(Mg)	4.0 to 6.0
Insoluble in H_2O_2.....	1.0
Moisture	0.5
Average particle size,microns	1.0 max.

MINOR IMPURITIES

	Percent
Iron .....(Fe)	0.20
Nitrogen .....(N)	0.10
Manganese .....(Mn).....	0.08
Calcium, Silicon and Sodium .....(Ca,Si,Na)	0.04
Aluminum, Lead and Nickel .....(Al,Pb,Ni)	0.01
Barium, Bismith, Cadmium and Copper .....(Ba,Bi,Cd,Ca)....	0.005

BULK DENSITY (absolute)

g/cc
2.38 - 2.40

PACKAGING

1, 5, 25 and 100 pound nonreturnable polyethylene lined metal containers.

HANDLING

INFORMATION CONCERNING THE HANDLING AND USE OF THIS PRODUCT IS PROVIDED IN A MATERIAL SAFETY DATA SHEET (MSDS) B-5026, AVAILABLE BY CONTACTING KERR-McGEE CHEMICAL CORPORATION, REGULATIONS COMPLIANCE DEPARTMENT.

THIS MSDS MUST BE FULLY READ AND UNDERSTOOD PRIOR TO ANY EXPOSURE, HANDLING OR USE OF THE PRODUCT.

KERR-McGEE CHEMICAL CORPORATION
KERR-McGEE CENTER ■ OKLAHOMA CITY, OKLAHOMA 73125
1-800-654-3911 405-270-1313

PROPERTIES

Absolute values for both the physical and thermodynamic properties of boron are not firmly established. The following data are offered as a guide to illustrate the unusual characteristics of boron. The original references should be checked for consistency before pursuing involved thermodynamic calculations.

Melting Point[2,3]: 2,157 - 2,177° C

Boiling Point[2,3]: 3658° C

Specific Gravity[1,2]: 2.46 α - rhomb. crystal
2.35 β - rhomb. crystal
2.35 amorphous

Thermal Neutron Absorption Cross Section[2]:
Normal natural mixture ..... 757 barns
B^{10} Isotope ..... 3837 ± 10 barns

Specific Resistance[2,4]:
at 25°C ..... $1.5—6.6 \times 10^6$ ohm-cm
at 600°C ..... 0.08 mu ohm-cm

Hardness[2,5]: ..... 9.3 Moh's Scale
..... 11.0 Extended Moh's Scale*
..... 2100—2580 Knoop Value for 99.9% B
carborundum<boron<diamond

*Extended Moh's Scale (15 divisions) eg. B_4C_{15}, BN 14, Diamond 15.

Specific Heat[1,2,3]:
(solid) at 25° C (crystalline) ..... 0.245 cal/deg/g
(solid) at 25° C(amorphous) .... 0.264 cal/deg/g
(solid) at 1000° K ..... 0.550 cal/deg/g
(liquid) at 2300—3000° K ..... 0.673 cal/deg/g
(gas) at 300—3000° K ..... 0.459 cal/deg/g

Heat of Fusion at m.p.[2,3]: ..... 5.39 kcal/g mole

Heat of Vaporization at b.p.[2,3]: 121.3 ± 4.0 kcal/g mole

Heat of Formation: ΔH_f at 25 C[1,2,3]
Boron (amorphous) ..... 0.9 kcal/g mole
Boron (gas) ..... 132.8 ± 4.0 kcal/g mole
Boric oxide (crystalline) —303.6 ± 0.40 kcal/g mole
Boric oxide (amorphous) .. —299.84 kcal/g mole
Boric oxide (gas) ..... —199.14 ± 0.5 kcal/g mole

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5. H. F. Rizzo, B. C. Weber and M. A. Schwartz, "Behavior of Ceramic Materials in a Corrosive Superheated Boron Oxide—Boron Environment," WADC Tech. Rpt. No. 57-525 (ASTIA AD 131008) 1957.

Additional Thermodynamic Data

A. Glassner, "Thermochemical Properties of the Oxides, Fluorides and Chlorides to 2500 K," ANL-5750, Argonne National Laboratory, Supt. of Documents (1957).

"Thermodynamic Properties of Boron Compounds," N.B.S. Report 4943 (1956).

Material Safety Data Sheet

TRONA elemental boron

Kerr-McGee Chemical Corporation
Kerr-McGee Center, Oklahoma City, OK 73125

For more detailed information on the hazards of this product, contact Regulatory Compliance Department or Medical Services Department at the address above. Technical Information Bulletin is also available. For emergency information, telephone (405)270-1313 any time.

PRODUCT IDENTIFICATION

Brand Name . . . . . TRONA elemental boron
Chemical Name . . . . . Boron
Common Name . . . . . Amorphous boron
Formula . . . . . B

DOT Proper
Shipping Name . . . . . Not applicable

DOT Hazard
Class . . . . . Not applicable
DOT I.D. Number . . . . . Not applicable
Reportable Quantity (RQ) Not applicable
CAS Number 7440-42-8

PHYSICAL AND CHEMICAL PROPERTIES

State . . . . . Powdered solid
Melting Point C. 2167
Boiling Point C 3658
Color . . . . . Brown/black
Odor . . . . . None
Bulk Density, lb/cu. ft. . . . 16
Weight Per Gallon . . . . . Not applicable
Specific Gravity @ 20C . . 2.35
Water Solubility . . . . . Insoluble
Flash Point and Method . . Not applicable
pH . . . . . Not applicable

HAZARDOUS INGREDIENTS

Chemical Name	Common Name	CAS Number	Hazard
Boron	Boron	7440-42-8	Nuisance dust-mild irritant to eyes, nose and throat. Long-term effects may include reproductive and fetal abnormalities

PHYSICAL HAZARD INFORMATION

Explosive: No — Upper Explosive Limit: Not known — Lower Explosive Limit: Not known
Pyrophoric: No
Flammable: No — Flammability Class: Not applicable
Combustible: Yes — Organic Peroxide: No
Oxidizer: No — Compressed Gas: No

Reactivity: Stable under normal and expected conditions. Oxidizes slowly at room temperature. Finely divided dust in air is ignitable and can be explosive.

Incompatibilities: Ignites in contact with gaseous chlorine or fluorine at room temperature. Incompatible with NH_3, Br_2, BrF_3, Cs_2C_2, Cl_2, CuO, HIO_3, PbO_2, HNO_3, NO, NOF, N_2O, $KClO_3$, KNO_3, Rb_2C_2, S, BrF_5, IF_5, metal fluorides, inter halogens, nitryl fluoride (FNO_2), OF_2, KNO_2, NO_x, Na_2O, PbO, air.

Hazardous Decomposition: None.

Conditions To Avoid: Mixing with incompatible materials and generation of dust dispersed in air.

Note: The chemicals in this product are listed on the TSCA inventory.

HEALTH INFORMATION

Precautionary Information: CAUTION! Mild irritant to eyes and mucous membranes. Irritant to the gastrointestinal tract. Studies in animals show daily ingestion of large amounts of boron based products causes effects on the male reproductive system (testicular atrophy, reduced sperm production, and sterility) and fetal developmental effects (organ and skeletal abnormalities).

Symptoms Of Exposure: Irritation or redness of the eyes, irritation of the nose, coughing or sneezing. Swallowing may cause nausea, vomiting and abdominal pain.

Restrictive Medical Conditions: Lung, kidney and nerve disorders may be aggravated by this material.

PRIMARY ROUTE(S) OF ENTRY

Ingestion (swallowing), inhalation (breathing) and eye contact.

TOXICITY INFORMATION

No toxic effects to humans exposed to elemental boron have been reported. No effects from chronic exposure to elemental boron have been reported. Oral-mouse LD_{50} 2000 mg/kg. Oral-mammal LD_{50} 300 mg/kg. Reproductive system effects, including testicular atrophy, reduced sperm count and sterility have occurred in mice, rats and dogs at daily feeding levels of 45 mg/kg of body weight of boron based product equivalents. Mutagenic effects have been noted in bacteria exposed to 17,000 ppm/24 hours. Abnormalities (fused skeletons, organ variations and non-viable fetuses) have been seen in fetuses of rabbits given doses by stomach tube of 75 mg/kg and 225 mg/kg daily during the 7th and 19th day of gestation. No fetal effects were seen at a dose of 25 mg/kg.

EXPOSURE LIMITS

OSHA: Not established
ACGIH: Not established
Other: ACGIH nuisance dust TLV-TWA is 10 mg/m^3 total dust or 5 mg/m^3 respirable dust.

Reported As A Potential Carcinogen Or Carcinogen	X Not Applicable _ OSHA	_ National Toxicology Program _ International Agency For Research on Cancer

PRECAUTIONS FOR SAFE HANDLING AND USE

Do not ingest (swallow) material. Avoid contact with eyes. Avoid generating or breathing dust. Do not allow dust to accumulate on building surfaces or equipment. Keep container closed. Store in a cool, dry place.

SPILL AND LEAK PROCEDURES

Soil Release: Sweep up into metal container. Dispose of in an industrial waste disposal facility according to federal, state and local regulations.

Water Spill: Scoop or suction up into a container. Dispose of in an industrial waste disposal facility according to federal, state and local regulations.

Air Release: Let settle. Treat appropriately for Soil Release or Water Spill.

Occupational Spill: Sweep up into metal container. Reclaim for salvage value or dispose of in accordance with Soil Release above.

RCRA Waste Code: Not applicable.

ENGINEERING CONTROLS AND PERSONAL PROTECTIVE EQUIPMENT

Ventilation: Use local exhaust or general dilution ventilation techniques.

Respirator: use NIOSH/MSHA approved dust type respirator if dust concentration exceeds the exposure limit.

Eye Protection: Wear safety goggles or safety glasses.

Gloves: No special requirements. Wear ordinary work gloves.

Clothing: No special requirements. Wear easily washable clothing. Change daily. Wash clothing before reuse.

EMERGENCY PROCEDURES

F: This product is combustible. Use approved Class "D" fire extinguisher, powdered graphite, soda ash or powdered sodium chloride (salt). Keep drums cool. Finely divided dust in air can be a fire or explosion hazard.

Spill or Leak: Shovel and sweep up into a metal container for later disposal.

FIRST AID PROCEDURES

n( )n: If swallowed, induce vomiting by giving two glasses of water and sticking finger down throat. Never give anything by mouth to an unconscious person. Call a physician.

nhalation: If inhaled, remove to fresh air.

kin Contact: Flush with water and then wash thoroughly with soap or mild detergent and water.

ye Contact: Immediately flush eyes with plenty of water for at least 15 minutes. Call a physician.

ote To Physician: Chemical of exposure is elemental boron.

mulation. It is safe for human consumption in the small amounts that are mixed with grains for insect control. However, treated grain should be rinsed before cooking.

Both swimming-pool-grade (used as a filtering agent) and natural diatomaceous earth come from the same fossil sources, but they are processed differently. The natural grades are mined, dried, ground, sifted and bagged. The pool-grade diatomaceous earth is chemically treated and partially melted; consequently, it contains crystalline silica, which is a respiratory hazard. Thus it is imperative that only natural diatomaceous earth be used for insect control. The human body is not harmed by this noncrystalline form of silica. It can, however, irritate the eyes and lungs, so wear goggles and a dust mask when applying it.

Uses and Application. In the home, diatomaceous earth can be applied in wall voids, attics and other out-of-the-way places to kill insects such as ants, cockroaches, drywood termites and many of the other insects listed in the silica-aerogel section on p. 111. It can be sprinkled on carpets to kill fleas and be placed in jars with stored grains to kill insect pests. Diatomaceous earth can also be fed to animals to control intestinal parasites, where its mode of action is probably a mild scouring effect. It is used under around vegetable and ornamental plant beds to discourage slugs and snails. Sources of diatomaceous-earth products are listed in the Resource Appendix under "Insect Management: Chemical Controls" on pp. 686-687.

Boron

Boron is probably best known for the compounds borax and boric acid, which have many uses. Early Asian artisans used borax—the most common compound of elemental boron—in welding and brazing and in glazing pottery. It was also used in drugs and pharmaceuticals. Borax has long served as a mild antiseptic and fungicide, and boric acid is commonly used as an eyewash. Today, boron finds use primarily in glass-making, but it is also used in cleaners, soaps, contact-lens solutions, flame retardants, metal flux, control rods in atomic reactors and in agricultural and wood-product chemicals.

Properties. It is important to understand the difference between boron, borate, borax and boric acid. Boron, an element, is found naturally in combination with sodium, calcium or magnesium and oxygen as borates. Borax, or sodium tetraborate, is a combination of sodium, boron and oxygen, and is mined from the soil in its crude form. Boric acid is a crystalline material derived from borax.

Mode of Action. Boric acid acts as a stomach poison when ingested. The exact mechanism is not fully understood, but some researchers think boric acid disrupts the action of protozoa or bacteria in the insect's gut, inhibiting the functioning of the enzymes that break down food. This causes the insect to starve to death.

Formulations. Borate products used in pest control (primarily boric acid) come in many formulations, including powders, pastes, aerosols, tablets and liquid solutions. Common boric-acid powder, sold in most hardware stores for use against cockroaches, is ground to a very small particle size and combined with an anticaking agent. Materials that impart a colored tinge and a bitter taste are added to some formulations to ensure that boric acid is not mistaken for other household powders. The most effective formulations exhibit an electrostatic charge that makes the powder adhere more readily to insects and surfaces.

Safety. Judging from their LD_{50} rating in rats (from 3,200 to 6,000 mg/kg depending on the formulation), borate products have low toxicity to humans and other mammals. Boric acid has been used for over 80 years in low doses as an eyewash, and is found in many contact-lens cleaners. When ingested in high doses, however, boric acid can be harmful. Therefore it must be kept away from food, children and pets. When inhaled, boric-acid powder can irritate the nose, throat and lungs. Boric acid and other borate compounds can also be absorbed through skin lesions and burns. You should wear a dust mask, gloves and eye protection when applying it. Keep boric acid in its original container and store in a safe place.

Uses and Application. Borax-based compounds are widely used in the United States as insecticides against ants, cockroaches, fleas, silverfish and other insects; as fungicides against molds on citrus; and as soil-sterilant herbicides. In Germany and other parts of Europe as well as in Australia and New Zealand, borates are used as wood preservatives. This use is increasing in the United States as well.

The most widely used borate material in pest control is boric acid. Although boric acid is effective against a number of insect pests, most research on this insecticide has been conducted in connection with cockroaches. Thus, the available boric-acid products tend to be directed at that market. When using these products against other insects, follow the same cautions and recommendations described for roaches. Remember that boric acid is only one component of the overall program for cockroach control discussed in Chapter 14.

In a series of studies testing the effectiveness of common insecticides against cockroaches, UCLA entomologist Walter Ebeling found that boric acid, which is virtually vaporless, was the only material that roaches were not repelled by, and was therefore the insecticide most likely to kill them. However, it can take 5 to 10 days before the cockroaches die, whereas some other commonly used insecticides take only one to four days. You must be patient. This delay often confuses novices, who assume that because they see roaches for a few days after using boric acid, it is not working. Although slower-acting initially, boric acid is certain to work.

This is quite different from other insecticides, which repel but do not kill roaches. If you can keep the boric acid dry, a single application will continue working for years.

Boric acid is most commonly sold as a dust or powder, but it can also be bought as an aerosol spray, as a paste for use as a caulk, in small plastic discs sold as roach or ant baits, in tablets that can be glued to walls or placed in hard-to-reach areas, as a water-soluble product for washing floors and walls and as a wood preservative. These various forms of boric acid are discussed below. Sources of boric-acid products are listed in the Resource Appendix under "Insect Management: Chemical Controls" on pp. 686-687.

Boric-Acid Powder. When purchasing boric acid as a powder, look for brands such as Roach Prufe®, made by Copper Brite, and Roach Kill®, made by R-Value, that contain an anticaking compound to help the boric acid resist the effects of moisture. Also look for brands that have an electrical charge that improves the powder's ability to adhere to the bodies of insects. The added safety features of a blue or green color and a bitter flavor help prevent children and pets from mistaking the substance for food.

To be most effective, boric-acid powder must be applied as a very thin film of dust on the target surface. The dust should be barely visible, as if you were salting food with it. When applied in piles, as from a teaspoon for example, the roaches avoid it. Piles also cake up fairly quickly and lose their effectiveness. When the boric acid is applied properly, however, roaches walk over the lightly dusted surfaces and pick up the powder on their legs, antennae and bodies. Their habit of frequent grooming (cockroaches are actually rather fastidious insects) leads to ingestion of the boric acid; thus, it also acts as a stomach poison.

The boric-acid container should have a plastic squeeze bottle with a pointed applicator tip that enables you to blow the powder into cracks and crevices where roaches and other insects hide. Unfortunately, Roach Prufe®, one of the most effective brands of boric acid, comes in a container without an applicator nozzle, and the directions call for applications by the teaspoon (just the opposite of what we suggested above). If you buy this brand, also purchase a bulb duster to apply it.

When used against cockroaches and ants indoors, boric acid is usually applied as a powder where habitat modification is difficult. Such locations include in and around stoves, in refrigerator engine cases, in electrical conduits, around ductwork and in false ceilings. It is used where caulk cannot be used or in wall voids that can be caulked shut afterward. It can be blown into voids or subfloor areas by drilling small holes in the wall or floor to allow penetration of the applicator nozzle. Do not use boric acid as a substitute for caulking, however.

In new construction, boric acid can be blown onto stud walls and subflooring before the finished wallboard and floor coverings are installed. This provides a long-lasting barrier against insects attempting to enter the house through cracks and crevices. In a test of four different materials used in the control of German roaches, boric acid/silica dust plus 0.1% Dri-Die® was found to be most effective when buildings were treated during construction. Eighteen months after a single treatment only two cockroaches were found in boric-acid-treated units, whereas untreated apartments averaged 31.

The time it takes to make large-scale applications of boric-acid powder can be reduced dramatically by using a variable-power duster called The Pest Machine®, marketed by Parker Pest Control (listed in the Resource Appendix under "Insect Management: Chemical Controls" on pp. 686-687). This machine dispenses the dust in a fine, light coating that optimizes roach control and can shoot dust into small, confined areas. Conventional power dusters can dispense a large volume of material, but the dust often lands in piles that roaches detect and avoid. Conventional dusters jam frequently. Parker's pneumatic duster operates under pressures as low as 2 psi for treatment below cabinets and in wall voids. It also imparts a strong electrostatic charge to the boric acid, which causes it adhere to surfaces and greatly increases the residual life of the application.

Boric-Acid Aerosol. To make boric acid easier to apply, particularly in crevices and other hard-to-reach places, R-Value has introduced an aerosol formulation called Borid Turbo®. This product contains 20% boric acid, a CO_2 propellant, a trichloroethane carrier and a silica-aerogel stabilizer. The Whitmire Company also produces an aerosol formulation, but it is available only to professionals. The convenience of aerosol formulations may help trigger serious interest in boric acid among pest control operators.

Boric-Acid Paste. Boric-acid baits, packaged in small covered plastic discs, contain a paste formulation that includes an attractant. Small holes in the disc allow roaches to enter and feed on the bait but deny access to children and pets. The paste can also be purchased in bulk from suppliers and applied to cracks and crevices with a caulking gun or spatula. Paste formulations are particularly useful in very moist areas.

Boric-Acid Tablets. Harris Roach Tablets®, with the active ingredient boric acid, was the first registered pesticide in the United States. These tablets are still sold in hardware and grocery stores, and they fill a gap in an IPM cockroach program where it is too wet to use dusts. They can be glued on wall surfaces or placed in hard-to-reach areas. Unfortunately, the small white tablets can be mistaken for candies or pills, so you must take care to place them where they are inaccessible to children and pets.

Water-Soluble Boric Acid. R-Value also markets a water-soluble product called Mop Up™ that can be added to water. It is used when mopping floors in food-preparation areas or to treat floors and walls in deteriorated structures that cannot be adequately caulked and screened to reduce roach breeding and migration. Boric-acid water washes can also be used on surfaces that do not come into direct contact with food, eating utensils, skin or pets, but are too vertical to retain a sufficient film of dust.

Borate Wood Preservatives. The disodium octaborate product TIM-BOR®, manufactured by U.S. Borax and Chemical Corporation, is registered for use as a wood preservative in the United States and is currently in the EPA registration process for use as a remedial control of wood-destroying pests. Studies in Australia and Europe have demonstrated that borax compounds provide wood used above ground and protected from rainfall with decades of protection from wood-boring beetles, termites and decay fungi. When borate-treated posts are placed in wet soil, however, the borate leaches out over time. In Germany, this problem is overcome by combining borate with copper and chrome (as copper/chrome/borate, or CCB), because these metals are far less likely to leach out. Scientists at U.S. Borax Research Corporation and a number of universities are currently working on other methods to reduce borate leaching, and new borate products able to protect wood in damp soil may reach the market in the future.

As health hazards associated with conventional wood preservatives such as pentachlorophenol, creosote and arsenical compounds restrict use of these materials, the United States' lumber industry is beginning to switch to pressure-treating building materials with borate products. Borax-treated wood is gradually becoming available at local lumber yards. For details on using TIM-BOR® to treat building foundations, see p. 425.

SODIUM HYPOCHLORITE

Most people are familiar with sodium hypochlorite as household bleach and use it to "whiten" their clothes or to keep their swimming pools and hot tubs free of algae. It is widely used as a disinfectant in water supplies, medical facilities and food processing plants. Sodium hypochlorite also serves as a fungicide in the nursery industry, and it is this application we focus on here.

Properties. Sodium hypochlorite is caustic in a water solution.

Mode of Action. Sodium hypochlorite is a strong oxidizing agent that kills organisms by chemically "burning," or oxidizing, their tissue. Hypochlorite compounds act by releasing chlorine-oxygen radicals.

Formulation. Sodium hypochlorite is sold as a colorless 5% solution.

Safety. In the dilute solution in which it is used, sodium hypochlorite is relatively safe for human use, although the undiluted material is quite toxic. Its oral LD_{50} in rats is 150 mg/kg. Bleach is a caustic eye and skin irritant, so it is important to wear gloves and eye protection when mixing it. Because it is highly reactive, it breaks down rapidly in soil.

Uses and Application. Bleach solutions are used to disinfect greenhouse benches, seedling flats and pots, and pruning tools to prevent fungal and bacterial infection of plants. They are also used to protect cuttings from disease organisms. In commercial nurseries, for example, the stems of rose and grape cuttings are dipped for 20 minutes in a 0.5% sodium hypochlorite solution (household bleach diluted at 1 part bleach to 9 parts water) to eliminate crown gall bacteria (*Agrobacterium tumefaciens*), which may be carried on the surface of the cuttings. A drench of 2% solution of household bleach (2½ oz. of bleach to 1 gal. of water) can also be used to arrest the development of damping-off fungi in flats of cuttings or seedlings.

Because bleach breaks down rapidly in soils, it provides little or no residual protection. Moreover, it is strongly alkaline and can raise the pH of soil. Therefore, you should apply an acidic drench of tea (the beverage type) or 25% vinegar (acetic acid) solution after every third bleach drench to counteract the alkaline effect.

PESTICIDAL SOAPS

Soaps, which are sodium or potassium salts combined with fish or vegetable oil, have been used as insecticides since the late 1700s and perhaps even earlier. Fish-oil soaps, the most widely used early insecticidal soaps, included those made with whale oil until recently, when public awareness that whales are endangered curtailed their use. Vegetable oil-based soaps, which did not have as disagreeable an odor as fish-oil soaps, were made with coconut, corn, linseed or soybean oil. "Green soap," a potassium/coconut oil soap used widely as a liquid hand soap in public restrooms years ago, has been used to control many soft-bodied insects such as aphids. Although the term "green soap" is no longer used, similar potassium/coconut oil soaps are still available on the market as hand soaps and shampoos.

Most of the research on and use of insecticidal soaps halted abruptly during World War II due to the increasing availability of inexpensive chlorinated hydrocarbon pesticides, such as DDT, which had broad toxicity. The soaps, though virtually nontoxic to humans, were relatively short-lived and could not match the persistence of the chlorinated hydrocarbons. Unfortunately, the long-term human health and environmental effects of the chlorinated hydrocarbons were not understood until years after their introduction. Today, pesticidal soaps are making a comeback.

Properties. A soap is a substance made from the action of an alkali such as sodium or potassium hydroxide on a fat. The principal components of fats are fatty acids. The old-fashioned way of making soap was by boiling animal fat and lye (sodi-