SECTION 1: Identification

1.1. Identification

Product name: BORON n-BUTOXIDE
Product code: AKB155
Product form: Substance
Physical state: Liquid
Formula: C12H27BO3
Synonyms: TRIBUTYL BORATE; TRIBUTOXYBORANE; BORIC ACID, TRIBUTYL ESTER
Chemical family: ESTER

1.2. Recommended use and restrictions on use

Recommended use: Chemical intermediate

1.3. Supplier

GELEST, INC.
11 East Steel Road
Morrisville, PA 19067
USA
T 215-547-1015 - F 215-547-2484 - (M-F): 8:00 AM - 5:30 PM EST
info@gelest.com - www.gelest.com

1.4. Emergency telephone number

Emergency number: CHEMTREC: 1-800-424-9300 (USA); +1 703-527-3887 (International)

SECTION 2: Hazard(s) identification

2.1. Classification of the substance or mixture

GHS-US classification

Flammable liquids Category 4
Skin corrosion/irritation Category 2
Serious eye damage/eye irritation Category 2A
Specific target organ toxicity (single exposure) Category 3

Full text of H statements: see section 16

2.2. GHS Label elements, including precautionary statements

GHS US labeling

Hazard pictograms (GHS US): ☢️

Signal word (GHS US): Warning

Hazard statements (GHS US):
H227 - Combustible liquid
H315 - Causes skin irritation
H319 - Causes serious eye irritation
H335 - May cause respiratory irritation

Precautionary statements (GHS US):
P280 - Wear protective gloves/protective clothing/eye protection/face protection.
P210 - Keep away from heat, open flames, sparks. - No smoking.
P261 - Avoid breathing vapors.
P264 - Wash hands thoroughly after handling.
P271 - Use only outdoors or in a well-ventilated area.
P302+P352 - If on skin: Wash with plenty of water
P304+P340 - If inhaled: Remove person to fresh air and keep comfortable for breathing
P305+P351+P338 - IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing
P312 - Call a doctor if you feel unwell
P321 - Specific treatment (see first aid instructions on this label)
P332+P313 - If skin irritation occurs: Get medical advice/attention.
P337+P313 - If eye irritation persists: Get medical advice/attention.
P362+P364 - Take off contaminated clothing and wash it before reuse.
P370+P378 - In case of fire: Use water spray. Foam, carbon dioxide, dry chemical to extinguish.
P403+P233 - Store in a well-ventilated place. Keep container tightly closed.
P403+P235 - Keep in a cool place
P405 - Store locked up.
P501 - Dispose of contents/container to licensed waste disposal facility.
BORON n-BUTOXIDE
Safety Data Sheet

2.3. Hazards not otherwise classified (HNOC)
No additional information available

2.4. Unknown acute toxicity (GHS US)
Not applicable

SECTION 3: Composition/Information on ingredients

3.1. Substances
Substance type: Mono-constituent
Name: BORON n-BUTOXIDE
CAS-No.: 688-74-4

<table>
<thead>
<tr>
<th>Name</th>
<th>Product identifier</th>
<th>%</th>
<th>GHS-US classification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tributyl borate</td>
<td>(CAS-No.) 688-74-4</td>
<td>&gt; 95</td>
<td>Flam. Liq. 4, H227, Skin Irrit. 2, H315, Eye Irrit. 2A, H319, STOT SE 3, H335</td>
</tr>
<tr>
<td>n-Butanol</td>
<td>(CAS-No.) 71-36-3</td>
<td></td>
<td>Flam. Liq. 3, H226, Acute Tox. 4 (Oral), H302, Skin Irrit. 2, H315, Eye Irrit. 2A, H319, STOT SE 3, H335</td>
</tr>
</tbody>
</table>

Full text of hazard classes and H-statements: see section 16

3.2. Mixtures
Not applicable

SECTION 4: First-aid measures

4.1. Description of first aid measures
First-aid measures general: Remove contaminated clothing and shoes. In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible). If possible show this sheet; if not available show packaging or label.

First-aid measures after inhalation: Remove victim to fresh air and keep at rest in a position comfortable for breathing. If you feel unwell, seek medical advice.

First-aid measures after skin contact: Wash with plenty of soap and water. Get medical advice/attention.

First-aid measures after eye contact: Immediately flush eyes thoroughly with water for at least 15 minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Get medical advice/attention.

First-aid measures after ingestion: Never give anything by mouth to an unconscious person. Get medical advice/attention.

4.2. Most important symptoms and effects (acute and delayed)
Symptoms/effects after inhalation: May cause respiratory irritation.
Symptoms/effects after skin contact: Causes skin irritation.
Symptoms/effects after eye contact: Causes serious eye irritation.
Symptoms/effects after ingestion: May be harmful if swallowed.

4.3. Immediate medical attention and special treatment, if necessary
No additional information available

SECTION 5: Fire-fighting measures

5.1. Suitable (and unsuitable) extinguishing media
Suitable extinguishing media: Alcohol-resistant foam. Carbon dioxide. Dry chemical.
Unsuitable extinguishing media: Avoid water spray as n-butanol will be generated.

5.2. Specific hazards arising from the chemical
Fire hazard: Combustible liquid. Irritating fumes and organic acid vapors may develop when material is exposed to elevated temperatures or open flame.

5.3. Special protective equipment and precautions for fire-fighters
Firefighting instructions: Exercise caution when fighting any chemical fire.
Protection during firefighting: Do not enter fire area without proper protective equipment, including respiratory protection. Avoid all eye and skin contact and do not breathe vapor and mist.

SECTION 6: Accidental release measures

6.1. Personal precautions, protective equipment and emergency procedures
General measures: Remove ignition sources. Use special care to avoid static electric charges.

6.1.1. For non-emergency personnel
Protective equipment: Wear protective equipment as described in Section 8.
Emergency procedures: Evacuate unnecessary personnel.
6.1.2. For emergency responders

Protective equipment: Do not attempt to take action without suitable protective equipment. Equip cleanup crew with proper protection. For further information refer to section 8: "Exposure controls/personal protection".

6.2. Environmental precautions

Prevent entry to sewers and public waters. Notify authorities if liquid enters sewers or public waters.

6.3. Methods and material for containment and cleaning up

For containment: Contain any spills with dikes or absorbents to prevent migration and entry into sewers or streams.

Methods for cleaning up: Clean up any spills as soon as possible, using an absorbent material to collect it. Sweep or shovel spills into appropriate container for disposal. Use only non-sparking tools.

6.4. Reference to other sections

See Heading 8. Exposure controls and personal protection.

SECTION 7: Handling and storage

7.1. Precautions for safe handling

Precautions for safe handling: Avoid all eye and skin contact and do not breathe vapor and mist. Provide good ventilation in process area to prevent accumulation of vapors. Take precautionary measures against static discharge. Containers and transfer lines require grounding during use. Use only non-sparking tools.

Hygiene measures: Wash hands and other exposed areas with mild soap and water before eating, drinking or smoking and when leaving work. Wash contaminated clothing before reuse.

7.2. Conditions for safe storage, including any incompatibilities

Technical measures: Ground/bond container and receiving equipment.

Storage conditions: Keep container tightly closed.

Incompatible materials: Water.

Storage area: Store in a well-ventilated place. Store away from heat.

SECTION 8: Exposure controls/personal protection

8.1. Control parameters

<table>
<thead>
<tr>
<th>Compound</th>
<th>ACGIH</th>
<th>ACGIH TWA (ppm)</th>
<th>100 ppm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tributyl borate (688-74-4)</td>
<td>ACGIH</td>
<td>ACGIH TWA (ppm)</td>
<td>100 ppm</td>
</tr>
<tr>
<td>n-Butanol (71-36-3)</td>
<td>ACGIH</td>
<td>ACGIH TWA (ppm)</td>
<td>20 ppm</td>
</tr>
<tr>
<td></td>
<td>OSHA</td>
<td>OSHA PEL (TWA) (mg/m³)</td>
<td>300 mg/m³</td>
</tr>
<tr>
<td></td>
<td>OSHA</td>
<td>OSHA PEL (TWA) (ppm)</td>
<td>100 ppm</td>
</tr>
<tr>
<td></td>
<td>IDLH</td>
<td>US IDLH (ppm)</td>
<td>1400 ppm (10% LEL)</td>
</tr>
<tr>
<td></td>
<td>NIOSH</td>
<td>NIOSH REL (ceiling) (mg/m³)</td>
<td>150 mg/m³</td>
</tr>
<tr>
<td></td>
<td>NIOSH</td>
<td>NIOSH REL (ceiling) (ppm)</td>
<td>50 ppm</td>
</tr>
</tbody>
</table>

8.2. Appropriate engineering controls

Appropriate engineering controls: Provide local exhaust or general room ventilation.

8.3. Individual protection measures/Personal protective equipment

Personal protective equipment:

Avoid all unnecessary exposure. Emergency eye wash fountains and safety showers should be available in the immediate vicinity of any potential exposure.

Hand protection:

Neoprene or nitrile rubber gloves

Eye protection:

Chemical goggles. Contact lenses should not be worn

Skin and body protection:

Wear suitable protective clothing

Respiratory protection:

Where exposure through inhalation may occur from use, respiratory protection equipment is recommended
SECTION 9: Physical and chemical properties

9.1. Information on basic physical and chemical properties

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical state</td>
<td>Liquid</td>
</tr>
<tr>
<td>Appearance</td>
<td>Liquid.</td>
</tr>
<tr>
<td>Molecular mass</td>
<td>230.16 g/mol</td>
</tr>
<tr>
<td>Color</td>
<td>Water white.</td>
</tr>
<tr>
<td>Odor</td>
<td>Slight, Pungent.</td>
</tr>
<tr>
<td>Odor threshold</td>
<td>No data available</td>
</tr>
<tr>
<td>Refractive index</td>
<td>1.41</td>
</tr>
<tr>
<td>pH</td>
<td>No data available</td>
</tr>
<tr>
<td>Relative evaporation rate (butyl acetate=1)</td>
<td>No data available</td>
</tr>
<tr>
<td>Melting point</td>
<td>No data available</td>
</tr>
<tr>
<td>Freezing point</td>
<td>&lt; -70 °C</td>
</tr>
<tr>
<td>Boiling point</td>
<td>230 - 235 °C</td>
</tr>
<tr>
<td>Flash point</td>
<td>93 °C</td>
</tr>
<tr>
<td>Auto-ignition temperature</td>
<td>No data available</td>
</tr>
<tr>
<td>Decomposition temperature</td>
<td>No data available</td>
</tr>
<tr>
<td>Flammability (solid, gas)</td>
<td>Combustible liquid</td>
</tr>
<tr>
<td>Vapor pressure</td>
<td>10 mm Hg @ 106°C</td>
</tr>
<tr>
<td>Relative vapor density at 20 °C</td>
<td>7.95 (butanol)</td>
</tr>
<tr>
<td>Relative density</td>
<td>0.853</td>
</tr>
<tr>
<td>% Volatiles</td>
<td>&gt; 90 %</td>
</tr>
<tr>
<td>Solubility</td>
<td>Reacts with water.</td>
</tr>
<tr>
<td>Log Pow</td>
<td>No data available</td>
</tr>
<tr>
<td>Log Kow</td>
<td>No data available</td>
</tr>
<tr>
<td>Viscosity, kinematic</td>
<td>2 cSt @ 21.4 °C</td>
</tr>
<tr>
<td>Viscosity, dynamic</td>
<td>No data available</td>
</tr>
<tr>
<td>Explosive properties</td>
<td>No data available</td>
</tr>
<tr>
<td>Oxidizing properties</td>
<td>No data available</td>
</tr>
<tr>
<td>Explosion limits</td>
<td>No data available</td>
</tr>
</tbody>
</table>

9.2. Other information

No additional information available

SECTION 10: Stability and reactivity

10.1. Reactivity

No additional information available

10.2. Chemical stability

Stable.

10.3. Possibility of hazardous reactions

Material decomposes slowly in contact with air by reaction with moisture, liberating n-butanol and boric acid. Avoid contact with water.

10.4. Conditions to avoid

Heat. Open flame. Sparks.

10.5. Incompatible materials

Water.

10.6. Hazardous decomposition products

Boron oxide fumes. Organic acid vapors.

SECTION 11: Toxicological information

11.1. Information on toxicological effects

Acute toxicity: Not classified

<table>
<thead>
<tr>
<th>Substance</th>
<th>LD50 oral mouse 1740 mg/kg</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tributyl borate (688-74-4)</td>
<td></td>
</tr>
<tr>
<td>n-Butanol (71-36-3)</td>
<td>700 mg/kg</td>
</tr>
<tr>
<td>LD50 oral rat</td>
<td></td>
</tr>
<tr>
<td>LD50 dermal rabbit</td>
<td>3402 mg/kg</td>
</tr>
<tr>
<td>LC50 inhalation rat (ppm)</td>
<td>&gt; 8000 ppm/4h</td>
</tr>
</tbody>
</table>
**BORON n-BUTOXIDE**

**Safety Data Sheet**

### n-Butanol (71-36-3)

| ATE US (oral) | 700 mg/kg body weight |
| ATE US (dermal) | 3402 mg/kg body weight |

**Skin corrosion/irritation**

- Causes skin irritation.

**Serious eye damage/irritation**

- Causes serious eye irritation.
  
  
  *Ranking, rabbit eye - 100mg: moderate*

**Respiratory or skin sensitization**

- Not classified

**Germ cell mutagenicity**

- Not classified

**Carcinogenicity**

- Not classified

**Reproductive toxicity**

- Not classified

**Specific target organ toxicity – single exposure**

- May cause respiratory irritation.

**Specific target organ toxicity – repeated exposure**

- Not classified

**Aspiration hazard**

- Not classified

**Symptoms/effects after inhalation**

- May cause respiratory irritation.

**Symptoms/effects after skin contact**

- Causes skin irritation.

**Symptoms/effects after eye contact**

- Causes serious eye irritation.

**Symptoms/effects after ingestion**

- May be harmful if swallowed.

**Reason for classification**

- Expert judgment

### SECTION 12: Ecological information

#### 12.1. Toxicity

**n-Butanol (71-36-3)**

<table>
<thead>
<tr>
<th>Test</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>LC50 fish 1</td>
<td>1730 - 1910 mg/l (Exposure time: 96 h - Species: Pimephales promelas [static])</td>
</tr>
<tr>
<td>EC50 Daphnia 1</td>
<td>1983 mg/l (Exposure time: 48 h - Species: Daphnia magna)</td>
</tr>
<tr>
<td>LC50 fish 2</td>
<td>1740 mg/l (Exposure time: 96 h - Species: Pimephales promelas [flow-through])</td>
</tr>
<tr>
<td>EC50 Daphnia 2</td>
<td>1897 - 2072 mg/l (Exposure time: 48 h - Species: Daphnia magna [Static])</td>
</tr>
</tbody>
</table>

#### 12.2. Persistence and degradability

- No additional information available

#### 12.3. Bioaccumulative potential

**n-Butanol (71-36-3)**

<table>
<thead>
<tr>
<th>Test</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>BCF fish 1</td>
<td>0.64</td>
</tr>
<tr>
<td>Log Pow</td>
<td>0.785 (at 25 °C)</td>
</tr>
</tbody>
</table>

#### 12.4. Mobility in soil

- No additional information available

#### 12.5. Other adverse effects

- Other adverse effects: This substance may be hazardous to the environment.
- Effect on the ozone layer: No additional information available

### SECTION 13: Disposal considerations

#### 13.1. Disposal methods

**Sewage disposal recommendations**

- Do not dispose of waste into sewer.

**Product/Packaging disposal recommendations**

- Dispose in a safe manner in accordance with local/national regulations. Dispose of contents/container to licensed waste disposal facility.

**Ecology - waste materials**

- Avoid release to the environment.

### SECTION 14: Transport information

#### 14.1. UN number

- Not regulated for transport.

#### 14.2. UN proper shipping name

- Not applicable

#### 14.3. Additional information

- Other information: No supplementary information available.
BORON n-BUTOXIDE
Safety Data Sheet

Transport by sea
No additional information available

Air transport
No additional information available

SECTION 15: Regulatory information

15.1. US Federal regulations

<table>
<thead>
<tr>
<th>Tributyl borate (688-74-4)</th>
<th>Listed on the United States TSCA (Toxic Substances Control Act) inventory</th>
</tr>
</thead>
<tbody>
<tr>
<td>n-Butanol (71-36-3)</td>
<td>Listed on the United States TSCA (Toxic Substances Control Act) inventory</td>
</tr>
<tr>
<td></td>
<td>Subject to reporting requirements of United States SARA Section 313</td>
</tr>
<tr>
<td>EPA TSCA Regulatory Flag</td>
<td>T - T - indicates a substance that is the subject of a final TSCA section 4 test rule. Y2 - Y2 - indicates a polymer that is a polyester and that was exempt under the 1984 polymer exemption rule. The polyester is made only from reactants included in a specified list of low-concern reactants that comprises one of the eligibility criteria for the 1984 polymer exemption rule.</td>
</tr>
<tr>
<td>SARA Section 313 - Emission Reporting</td>
<td>1 %</td>
</tr>
</tbody>
</table>

15.2. International regulations

CANADA

<table>
<thead>
<tr>
<th>Tributyl borate (688-74-4)</th>
<th>Listed on the Canadian NDSL (Non-Domestic Substances List)</th>
</tr>
</thead>
<tbody>
<tr>
<td>n-Butanol (71-36-3)</td>
<td>Listed on the Canadian DSL (Domestic Substances List)</td>
</tr>
<tr>
<td>WHMIS Classification</td>
<td>Class B Division 2 - Flammable Liquid</td>
</tr>
<tr>
<td></td>
<td>Class D Division 2 Subdivision B - Toxic material causing other toxic effects</td>
</tr>
</tbody>
</table>

EU-Regulations

<table>
<thead>
<tr>
<th>Tributyl borate (688-74-4)</th>
<th>Listed on the EEC inventory EINECS (European Inventory of Existing Commercial Chemical Substances)</th>
</tr>
</thead>
<tbody>
<tr>
<td>n-Butanol (71-36-3)</td>
<td>Listed on the EEC inventory EINECS (European Inventory of Existing Commercial Chemical Substances)</td>
</tr>
</tbody>
</table>

National regulations

<table>
<thead>
<tr>
<th>Tributyl borate (688-74-4)</th>
<th>Listed on the AICS (Australian Inventory of Chemical Substances)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Listed on IECSC (Inventory of Existing Chemical Substances Produced or Imported in China)</td>
</tr>
<tr>
<td></td>
<td>Listed on the Japanese ENCS (Existing &amp; New Chemical Substances) inventory</td>
</tr>
<tr>
<td></td>
<td>Listed on the Japanese ISHL (Industrial Safety and Health Law)</td>
</tr>
<tr>
<td></td>
<td>Listed on NZIoC (New Zealand Inventory of Chemicals)</td>
</tr>
<tr>
<td></td>
<td>Japanese Pollutant Release and Transfer Register Law (PRTR Law)</td>
</tr>
<tr>
<td></td>
<td>Listed on the Canadian IDL (Ingredient Disclosure List)</td>
</tr>
<tr>
<td>n-Butanol (71-36-3)</td>
<td>Listed on the AICS (Australian Inventory of Chemical Substances)</td>
</tr>
<tr>
<td></td>
<td>Listed on IECSC (Inventory of Existing Chemical Substances Produced or Imported in China)</td>
</tr>
<tr>
<td></td>
<td>Listed on the Japanese ENCS (Existing &amp; New Chemical Substances) inventory</td>
</tr>
<tr>
<td></td>
<td>Listed on the Japanese ISHL (Industrial Safety and Health Law)</td>
</tr>
<tr>
<td></td>
<td>Listed on the Korean ECL (Existing Chemicals List)</td>
</tr>
<tr>
<td></td>
<td>Listed on NZIoC (New Zealand Inventory of Chemicals)</td>
</tr>
<tr>
<td></td>
<td>Listed on PICCS (Philippines Inventory of Chemicals and Chemical Substances)</td>
</tr>
<tr>
<td></td>
<td>Listed on the Canadian IDL (Ingredient Disclosure List)</td>
</tr>
<tr>
<td></td>
<td>Listed on INSO (Mexican National Inventory of Chemical Substances)</td>
</tr>
<tr>
<td></td>
<td>Listed on CICR (Turkish Inventory and Control of Chemicals)</td>
</tr>
</tbody>
</table>

15.3. US State regulations

California Proposition 65 - This product does not contain any substances known to the state of California to cause cancer, developmental and/or reproductive harm

<table>
<thead>
<tr>
<th>Tributyl borate (688-74-4)</th>
<th>U.S. - Massachusetts - Right To Know List</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>U.S. - Pennsylvania - RTK (Right to Know) List</td>
</tr>
</tbody>
</table>
BORON n-BUTOXIDE
Safety Data Sheet

n-Butanol (71-36-3)
U.S. - Massachusetts - Right To Know List
U.S. - New Jersey - Right to Know Hazardous Substance List
U.S. - Pennsylvania - RTK (Right to Know) List

SECTION 16: Other information

Full text of H-phrases:

<table>
<thead>
<tr>
<th>H226</th>
<th>Flammable liquid and vapor</th>
</tr>
</thead>
<tbody>
<tr>
<td>H227</td>
<td>Combustible liquid</td>
</tr>
<tr>
<td>H302</td>
<td>Harmful if swallowed</td>
</tr>
<tr>
<td>H315</td>
<td>Causes skin irritation</td>
</tr>
<tr>
<td>H319</td>
<td>Causes serious eye irritation</td>
</tr>
<tr>
<td>H335</td>
<td>May cause respiratory irritation</td>
</tr>
</tbody>
</table>

Abbreviations and acronyms:

Abbreviations: ND: Not Determined, No Data; NA: Not Applicable; LD: Lethal Dose; LC: Lethal Concentration; ATE: Acute Toxicity Estimates; H: hour; °: °C unless otherwise stated; mm: millimeters Hg, torr; PEL: permissible exposure level; TWA: time weighted average; TLV: threshold limit value; TG: Test Guideline; NIOSH: National Institute for Occupational Safety and Health; IARC: International Agency for Research on Cancer; NTP: National Toxicology Program; HMIS: Hazardous Material Information System; CAS No.: Chemical Abstract Service Registration Number; EC No.: European Commission Registration Number; EC Index No.: European Commission Index Number; OECD: The Organisation for Economic Co-operation and Development; GHS: The Globally Harmonized System of Classification and Labelling; APF: Assigned Protection Factor.

Hazard Rating

Health: 2 Moderate Hazard - Temporary or minor injury may occur

Flammability: 2 Moderate Hazard - Materials which must be moderately heated or exposed to high ambient temperatures before ignition will occur. Includes liquids having a flash point at or above 100 F but below 200 F. (Classes II & IIIA)

Physical: 1 Slight Hazard - Materials that are normally stable but can become unstable (self-react) at high temperatures and pressures. Materials may react non-violently with water or undergo hazardous polymerization in the absence of inhibitors.

Prepared by safety and environmental affairs.

Date of issue: 08/17/2015 Version: 1.0

SDS US (GHS HazCom 2012) - Custom

According to Federal Register / Vol. 77, No. 58 / Monday, March 26, 2012 / Rules and Regulations

The information contained in this document has been gathered from reference materials and/or Gelest, Inc. test data and is to the best knowledge and belief of Gelest, Inc. accurate and reliable. Such information is offered solely for your consideration, investigation and verification. It is not suggested or guaranteed that the hazard precautions or procedures described are the only ones which exist. Gelest, Inc. makes no warranties, express or implied, with respect to the use of such information and assumes no responsibility therefore. Information on this safety data sheet is not intended to constitute a basis for product specifications.

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