1,4 Butanediol (BDO)

SECTION 1: IDENTIFICATION

Product Name: 1,4 Butanediol (BDO)
CAS Number: 110-63-4
Chemical Name: 1,4 Butanediol (BDO)
Synonyms: BUTYLENE GLYCOL; 1,4-BUTYLENE GLYCOL; 1,4-DIHYDROXYBUTANE; TETRAMETHYLENE 1,4-DIOL; TETRAMETHYLENE GLYCOL; 1,4-TETRAMETHYLENE GLYCOL; BUTANEDIOL; BUTANE- 1,4- DIOL; 1,4-TETRAMETHYL GLYCOL; DIOL 14B; SUCOL B
Uses: Chemical intermediate for tetrahydrofuran and gammabutryrolactone synthesis, reactant polybutylene terephthalate resins, chain extender for polyurethane (PU) resins.

Company
Silver Fern Chemical, Inc.
2226 Queen Anne Avenue North
Suite #C
Seattle WA 98109, USA

Business Contact
Customer Service: 1-866-282-3384
info@silverfernchemical.com

24 Hour Emergency Contact
Infotrac 800-535-5053
Outside USA & Canada 352-323-3500

SECTION 2: HAZARD IDENTIFICATION

Warning

Hazard Statements:
H302: Harmful if swallowed
H433: Harmful to terrestrial vertebrates

Precautionary Statements:
P264: Wash skin thoroughly after handling.
P270: Do not eat, drink or smoke when using this product.
P301+P312: IF SWALLOWED: Call a POISON CENTER or doctor/physician if you feel unwell.
P330: Rinse mouth.
P501: Dispose of contents/container to all governmental regulations. Incineration is a preferred method.

Hazards not otherwise classified (HNOC) or not covered by GHS - none

SECTION 3: COMPOSITION / INFORMATION ON INGREDIENTS

<table>
<thead>
<tr>
<th>CAS #</th>
<th>Content (W/W)</th>
<th>Ingredients</th>
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</thead>
<tbody>
<tr>
<td>110-63-4</td>
<td>&lt;= 100%</td>
<td>1,4 BUTANEDIOL (BDO)</td>
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</tbody>
</table>

SECTION 4: FIRST AID MEASURES

**Eye Contact:**
Check for and remove any contact lenses. Immediately flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. Get medical attention immediately.

**Skin Contact:**
Immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. Clean shoes thoroughly before reuse. Get medical attention immediately.

**Inhalation:**
Move exposed person to fresh air. If not breathing, if breathing is irregular or if respiratory arrest occurs, provide artificial respiration or oxygen by trained personnel. Loosen tight clothing such as a collar, tie, belt or waistband. Get medical attention immediately.

**Ingestion:**
Wash out mouth and water. Do not induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. Get medical attention immediately.

SECTION 5: FIRE FIGHTING MEASURES

**Flash Point:** >121 °C/250 °F

**Lower/Upper explosion limit:** 1.95%/18.3%

**Extinguishing media:**
Suitable extinguishing media: Water spray (fog), dry chemical, CO2, foams
Unsuitable extinguishing media: Do not use a water jet.

**Special hazards arising from the substance or mixture:**
Vapors are heavier than air and may spread along floor surfaces.

**Advice for fire fighters:**
Special protective equipment for fire fighters: Fire fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode. Prevent mixing with alkali and amines materials.

SECTION 6: ACCIDENTAL RELEASE MEASURES

**Personal precautions, protective equipment and emergency procedures:**
Advice for non-emergency personnel: Evacuate the danger zone; follow emergency precautions. Secure emergency assistance immediately. Avoid contact with the material; do not breath dusts. If possible, provide additional ventilation.

**Advice for emergency responders:**
Do not take action without proper training and emergency equipment. See Section 8 for additional information. Evacuate surrounding areas. Eliminate all ignition sources including flares and all open flames.
Avoid all contact with spilled material. Maintain adequate ventilation and wear appropriate respiratory protection.

Environmental precautions:
Avoid dispersal of spilled material, runoff and contact with soil, waterways, drains and sewers. Inform the relevant authorities if the product has caused environmental pollution (sewers, waterways, soil or air).

Methods and materials for containment:
Stop leak or spill if without risk. Move containers from spill area. Approach release from upwind. Prevent entry into sewers, surface waters, basements or confined areas. Wash spillage into effluent treatment plant. Contain and collect spillage using appropriate personal protective equipment. Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products or if a risk assessment indicates this is necessary. Collect and contain spillage with non-combustible, absorbent material (e.g. sand, earth, vermiculite or diatomaceous earth) and place in a container for disposal according to local regulations. Use spark-proof tools and explosion proof equipment if flammable gasses, liquids or vapors are present in the spill area. Contaminated absorbent material may pose the same hazard(s) as the spilled product.

SECTION 7: HANDLING AND STORAGE

Handling:
Observe all label precautions. Use appropriate personal protective equipment. Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking. Do not get in eyes or on skin or clothing. Do not ingest. Avoid breathing vapor or mist. Use only with adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Do not enter storage areas and confined spaces unless adequately ventilated. Keep in the original container or an approved alternative made from a compatible material, kept tightly closed when not in use. Store and use away from heat, sparks, open flame or any other ignition source. To avoid fire or explosion, dissipate static electricity during transfer by grounding and bonding containers and equipment before transferring material. Empty containers retain product residue and can be hazardous. Do not reuse container.

Storage:
Observe all label precautions. Do not enter storage areas and confined spaces unless adequately ventilated. Keep in the original container or an approved alternative made from a compatible material, kept tightly closed when not in use. Store and use away from heat, sparks, open flame or any other ignition source. To avoid fire or explosion, dissipate static electricity during transfer by grounding and bonding containers and equipment before transferring material. Empty containers retain product residue and can be hazardous. Do not reuse container.

SECTION 8: EXPOSURE CONTROLS AND PERSONAL PROTECTION

Personal Protective Equipment (PPE)

Respiratory protection:
A properly fitted air purifying respirator or air supply respirator should be worn if a risk assessment indicates that respiratory protection is necessary. Respirator selection must be based upon known or measured levels of exposure.

Eye/face protection:
Safety eyewear complying with an approved standard should be used when a risk assessment indicates this is necessary to avoid exposure to product dusts, liquid splashes or mists. Goggles should be worn where eye contact is possible.

Skin protection:
Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without
touching glove’s outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

**Hand protection:**
Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is required.

**Hygiene measures:**
Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Appropriate techniques should be used to remove potentially contaminated clothing. Discard contaminated clothing or wash thoroughly before reusing. Ensure that eyewash stations and safety showers are close to the workstation location:

### SECTION 9: 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>
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<tr>
<td>Color</td>
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</tr>
<tr>
<td>Physical Form</td>
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<tr>
<td>Odor</td>
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<td>Texture</td>
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<td>Evaporation Rate</td>
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<tr>
<td>LEL</td>
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<tr>
<td>UEL</td>
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<td>Autoignition</td>
<td>350 °C</td>
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<td>Vapor Pressure</td>
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<tr>
<td>Vapor Density (air = 1)</td>
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<tr>
<td>Density</td>
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<tr>
<td>Specific Gravity (water = 1)</td>
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<tr>
<td>Water Solubility</td>
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<tr>
<td>Coeff. Water/Oil Dist</td>
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<tr>
<td>Viscosity</td>
<td>84.9 cP 20 °C</td>
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<td>Volatility</td>
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<tr>
<td>Molecular Weight</td>
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</tbody>
</table>
**Molecular Formula:** H-O-(C-H2)4-O-H

**Solvent Solubility**

**Soluble:** alcohols, slightly soluble ethers

### SECTION 10: STABILITY AND REACTIVITY

**Reactivity:**
No hazardous reactivity.

**Chemical stability:**
Stable at normal temperatures and pressure

**Possibility of hazardous reactions:**
May polymerizes with evolution of heat. Avoid contact with heat, acids or amines.

**Conditions to avoid:**
Avoid heat, flames, sparks and other sources of ignition. Avoid contact with incompatible materials

**Incompatible materials:**
Acids, oxidizing materials, metal oxides, metal salts,

**Hazardous decomposition products:**
Thermal decomposition will yield oxides of carbon.

### SECTION 11: TOXICOLOGICAL INFORMATION

**Information on toxicological effects:**
- Acute oral toxicity LD50 rat: 1525 mg/kg (RTECS)
- Dermal LD50 rabbit: >2000 mg/kg (RTECS)
- Acute inhalation toxicity: >5.1 mg/kg 4 hours (IUCLID)
- Skin irritation: Mild irritation on repeated exposure. (RTECS)
- Eye irritation (rabbit): May cause eye irritation (RTECS)
- Sensitization (guinea pig): Negative
- Genotoxicity and Reproductive Effects: No impairment of reproductive performance expected (Lit))
- Ames test: negative (IUCLID)

**Specific target organ toxicity - single exposure:**
- May cause respiratory irritation.

**Specific target organ toxicity - repeated exposure:**
- This substance is not classified as a specific target organ toxicant, repeated exposure.

**Aspiration hazard:**
No information available

**Additional information:**
After uptake of large quantities:
- Systemic effects: May aggravate existing skin disorders and allergies. Ingestion: May cause nausea and vomiting. Central nervous system effects may include excitation, euphoria, headache, dizziness, drowsiness, dullness, blurred vision, fatigue, tremors, convulsions, unconsciousness, severe narcosis, coma, respiratory arrest, and death, a result of collapse of the sympathetic and parasympathetic nervous system. May also affect renal function and cause renal damage. Animal studies also noted constriction of pupils and total loss of reflexes. One study using rats showed a weight loss during the first 8 of 29 weeks. Another study using rats given 30 mg/kg/day, for 6 months, showed blood cholinesterase depression, changes in protein fraction of the serum, and decrease in sh-groups of the blood. The no effect level was 25 mg/kg/day.
- Further data: Handle using good occupational and environmental health practices.

### SECTION 12: ECOLOGICAL INFORMATION
Toxicity
Toxicity in fish LC50: >10000 mg/L (96 hr Static, Leuciscus idus)
Toxicity to daphnia and other aquatic invertebrates: 813 mg/L (48hr, Daphnia magna)
Toxicity to algae >500 mg/L (96hr, Desmodesmus subspicatus)

Persistence and degradability:
Expected to be readily biodegradable

Bio accumulative potential:
Bioaccumulation not expected.
Mobility in soil:
No information available.

Results of PBT and vPvB assessment:
Assessment not available.

Other adverse effects:
No additional environmental adverse effects are known.
Additional ecological information: Do not allow product to enter surface waters, wastewater or soil.

SECTION 13: DISPOSAL CONSIDERATIONS

Waste treatment methods:
The generation of waste should be avoided or minimized wherever possible. Empty containers or liners may retain some product residues. This material and its container must be disposed of in a safe way. Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Disposal of this product, solutions and any by-products should at all times comply with the requirements of environmental protection and waste disposal legislation and any regional local authority requirements. Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers.

SECTION 14: TRANSPORT INFORMATION

The transport regulations are cited according to international and/or harmonized transport regulations. Possible national deviations and country specific requirements are not considered.
US DOT Information: No Classification assigned.
TDG Information: No Classification assigned.
ADR Information: No Classification assigned.
RID Information: No Classification assigned.
IATA Information: No Classification assigned.
ICAO Information: No Classification assigned.
IMDG Information: No Classification assigned

This information is not intended to convey all specific regulatory or operational requirements/information relating to this product. It is the responsibility of the transporting organization to follow all applicable laws, regulations and rules relating to the transportation of the material.

SECTION 15: REGULATORY INFORMATION

Safety, health and environmental regulations/legislation specific for the substance or mixture:
U.S. Federal Regulations
None of this products components are listed under SARA Section 302 (40 CFR 355 Appendix A),
SARA Section
311/312 (40 CFR 370.21), SARA Section 313 (40 CFR 372.65), CERCLA (40 CFR 302.4), TSCA 12(b), or require an OSHA process safety plan.
SARA Section 311/312 (40 CFR 370 Subparts B and C)
Acute Health: No Chronic Health: No Fire: No Pressure: No Reactive: No

U.S. State Regulations
None of this product’s components are listed on the state lists from CA, MA, MN, NJ or PA. Not listed under California Proposition 65

Germany Water Classification (110-63-4): ID Number 1338, hazard class 1 - low hazard to waters
Symbol(s): Xn Harmful
Risk Phrases
R22 Harmful if swallowed.

Safety Phrases
S2 Keep out of the reach of children.
S13 Keep away from food, drink and animal feedingstuffs.
S24 Avoid contact with skin.
S36 Wear suitable protective clothing.
S46 If swallowed, seek medical advice immediately and show this container or label.

<table>
<thead>
<tr>
<th>Regulatory Inventory Status</th>
<th>CAS 110-63-4</th>
<th>US</th>
<th>CA</th>
<th>EU</th>
<th>AU</th>
<th>PH</th>
<th>JP</th>
<th>KR</th>
<th>CH</th>
<th>NZ</th>
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</thead>
<tbody>
<tr>
<td>Component</td>
<td>1,4 butanediol</td>
<td>Yes</td>
<td>DSL</td>
<td>E1N</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
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</tr>
</tbody>
</table>

Taiwan GHS Classifications
Information below presented according to Taiwan’s Bureau of Standards, Metrology and Inspection (BSMI) of the Ministry of Economic Affairs. This agency has published a series of standards (CNS 15030 1-27 Chemical Classification and Labeling) which provide guidance on classification and labeling of chemicals according to GHS.

1,4-BUTANEDIOL (110-63-4)

Taiwan:
Acute toxicity - Oral - Category 4
H302 Harmful if swallowed.
Aspiration hazard - Category 2
H305 May be harmful if swallowed and enters airways.

SECTION 16: OTHER INFORMATION

DISCLAIMER OF RESPONSIBILITY

The information on this SDS was obtained from sources which we believe are reliable. However, the information is provided without any warranty, expressed or implied, regarding its correctness. Some information presented and conclusions drawn herein are from sources other than direct test data on the substance itself. The conditions or methods of handling, storage, use and disposal of the product are beyond our control and may be beyond our knowledge. For this and other reasons, we do not assume responsibility and expressly disclaim liability for loss, damage, or expense arising out of or in any way connected with handling, storage, use, or disposal of this product. If the product is used as a component in another product, this SDS information may not be applicable.

Revision Date: 02/07/2012

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