



# Safety Data Sheet

## Section 1 – Identification

**Product Identifier:** Fuel Grade Isobutanol

**Product Code:** IBF001

**Synonyms:** See section 16 for complete information

**Recommended Use:** Motor Fuel, Refinery Blendstock

**Manufacturer/Supplier:** Gevo Inc.  
345 Inverness Dr. South  
Bldg C, Suite 310  
Englewood, CO 80112

**General Assistance:** (303)858-8358

**Emergency Telephone:** (CHEMTREC USA): 1-800-424-9300

## Section 2 – Hazard(s) Identification

<b>Physical Hazards:</b>	Flammable Liquids	Category 3
<b>Health Hazards:</b>	Acute Toxicity – Inhalation	Category 4
	Skin Corrosion/Irritation	Category 2
	Eye Irritant	Category 2A
	Specific target organ toxicity – single exposure	Category 3
<b>OSHA Defined Hazards:</b>	Not Classified	

**Label Elements:**



**Signal Word:** Danger

**Hazard Statement:** Flammable liquid and vapor. Harmful if inhaled (vapor). Causes skin irritation. Causes eye irritation. May cause respiratory irritation. May cause drowsiness or dizziness.

### Precautionary Statement

**Prevention** Obtain special instructions before use. Do not handle until all safety precautions have been read and understood. Keep away from heat/sparks/open flames/hot surfaces. No smoking. Keep container tightly closed. Ground/bond container and receiving equipment. Use explosion-proof electrical/ventilating/lighting equipment. Use only non-sparking tools. Take precautionary measures against static discharges. Wear protective gloves/protective clothing/eye protection/face protection.

**Response** If exposed or concerned: Get medical advice/attention. If swallowed: Immediately call a poison center/doctor. Do NOT induce vomiting. If on skin (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower. In case of fire:

**Storage** Use AFFF foam, carbon dioxide, dry powder or water fog for extinction. Store in a well-ventilated place. Keep cool.

**Disposal** Dispose of contents/container in accordance with local, regional, national, and international regulations.

**Hazard(s) Not Otherwise Classified (HNOC)** None known

### Section 3 – Composition/information on ingredients

Chemical Name	PERCENTAGE (weight)	CAS-No.
Isobutyl Alcohol	96-99%	78-83-1
Water	1-2%	7789-20-0

### Section 4 – First-aid Measures

<b>Inhalation</b>	Move to fresh air. If breathing is difficult, give oxygen. If not breathing, give artificial respiration. Get medical attention.
<b>Skin contact</b>	Remove contaminated clothing and shoes. Wash off immediately with soap and plenty of water. Get medical attention if irritation develops or persists. Wash clothing separately before reuse. Destroy or thoroughly clean contaminated shoes. If high pressure injection under the skin occurs, always seek medical attention.
<b>Eye contact</b>	Immediately flush eyes with plenty of water for at least 15 minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Get medical attention.
<b>Ingestion</b>	Rinse mouth thoroughly. Do not induce vomiting without advice from poison control center. Do not give mouth-to-mouth resuscitation. If vomiting occurs, keep head low so that stomach content does not get into the lungs. Never give anything by mouth to a victim who is unconscious or is having convulsions. Get medical attention immediately.
<b>Most important symptoms/effects, acute and delayed</b>	Irritation of nose and throat. Irritation of eyes and mucous membranes. Skin irritation. Unconsciousness. Corneal damage. Narcosis. Cyanosis (blue tissue condition, ,nails, lips, and/or skin). Decrease in motor functions. Behavioral changes. Edema. Liver enlargement. Jaundice. Conjunctivitis. Proteinuria. Defatting of the skin. Rash.
<b>Indication of immediate medical attention and special treatment needed</b>	In case of shortness of breath, give oxygen. Keep victim warm. Keep victim under observation. Symptoms may be delayed.
<b>General information</b>	If exposed or concerned: get medical attention/advice. Ensure that medical personnel are aware of the material(s) involved, and take precautions to protect themselves. Show this safety data sheet to the doctor in attendance. Wash contaminated clothing before re-use.

### Section 5 – Fire-fighting Measures

<b>Suitable extinguishing media</b>	Water spray. Water fog. Foam. Dry chemical powder. Carbon dioxide (CO2).
<b>Unsuitable extinguishing media</b>	Do not use a solid water stream as it may scatter and spread fire.
<b>Specific hazards arising from the chemical</b>	The product is highly flammable, and explosive vapor/air mixtures may be formed even at normal room temperatures. Vapor may cause flash fire. Vapors can flow along surfaces to distant ignition source and flash back. Sensitive to static discharge. Thermal decomposition or combustion may liberate toxic gases or fumes.
<b>Special protective equipment and precautions for firefighters</b>	Wear full protective clothing, including helmet, self-contained positive pressure or pressure demand breathing apparatus, protective clothing and face mask.
<b>Fire-fighting equipment</b>	Wear full protective clothing, including helmet, self-contained positive pressure or

**/instructions**

pressure demand breathing apparatus, protective clothing and face mask. Withdraw immediately in case of rising sound from venting safety devices or any discoloration of tanks due to fire. Fight fire from maximum distance or use unmanned hose holders or monitor nozzles. Move containers from fire area if you can do it without risk. In the event of fire, cool tanks with water spray. Cool containers exposed to flames with water until well after the fire is out. For massive fire, use unmanned hose holders or monitor nozzles; if this is impossible, withdraw from area and let fire burn. Vapors may form explosive air mixtures even at room temperature. Prevent buildup of vapors or gases to explosive concentrations. Some of these materials, if spilled, may evaporate leaving a flammable residue. Water runoff can cause environmental damage. Use compatible foam to minimize vapor generation as needed.

**Specific methods**

Use water spray to cool unopened containers.

**Section 6 – Accidental Release Measure****Personal Precautions,  
protective equipment and  
emergency procedures**

Keep unnecessary personnel away. Local authorities should be advised if significant spills cannot be contained. Ventilate closed spaces before entering. Do not touch damaged containers or spilled material unless wearing appropriate protective clothing. See Section 8 of the MSDS for Personal Protective Equipment. Use personal protective equipment. Avoid breathing vapors, mist or gas. Ensure adequate ventilation. Remove all sources of ignition. Beware of vapors accumulating to form explosive concentrations. Vapors can accumulate in low areas.

**Methods and materials  
for containment and  
cleaning up**

Eliminate all ignition sources (no smoking, flares, sparks, or flames in immediate area). Stop leak if you can do so without risk. This material is a water pollutant and should be prevented from contaminating soil or from entering sewage and drainage systems and bodies of water. Dike the spilled material, where this is possible. Prevent entry into waterways, sewers, basements or confined areas.

Use non-sparking tools and explosion-proof equipment.

Small Spills: Absorb spill with vermiculite or other inert material, then place in a container for chemical waste. Clean surface thoroughly to remove residual contamination. This material and its container must be disposed of as hazardous waste.

Large Spills: Use a non-combustible material like vermiculite, sand or earth to soak up the product and place into a container for later disposal. Prevent product from entering drains. Do not allow material to contaminate ground water system. Should not be released into the environment.

**Environmental  
Precautions:**

If facility or operation has an "oil or hazardous substance contingency plan", activate its procedures. Stay upwind and away from spill. Wear appropriate protective equipment including respiratory protection as conditions warrant. Do not enter or stay in area unless monitoring indicates that it is safe to do so. Isolate hazard area and restrict entry to emergency crew. Flammable. Review Fire Fighting Measures, Section 5, before proceeding with clean up. Keep all sources of ignition (flames, smoking, flares, etc.) and hot surfaces away from release. Contain spill in smallest possible area. Recover as much product as possible (e.g. by vacuuming). Stop leak if it can be done without risk. Use water spray to disperse vapors. Spilled material may be absorbed by an appropriate absorbent, and then handled in accordance with environmental regulations. Prevent spilled material from entering sewers, storm drains, other unauthorized treatment or drainage systems and natural waterways. Contact fire authorities and appropriate federal, state and local agencies. If spill of any amount is made into or upon navigable waters, the contiguous zone, or adjoining shorelines, contact the National Response Center at 1-800-424-8802. For highway or railways spills, contact Chemtrec at 1-800-424-9300.

## Section 7 – Handling and Storage

### Precautions for safe handling

Keep away from fire, sparks and heated surfaces. No smoking near areas where material is stored or handled. The product should only be stored and handled in areas with intrinsically safe electrical classification.

### Conditions for safe storage, including any Incompatibilities

Hydrocarbon liquids including this product can act as a non-conductive flammable liquid (or static accumulators), and may form ignitable vapor-air mixtures in storage tanks or other containers. Precautions to prevent static-initiated fire or explosion during transfer, storage or handling, include but are not limited to these examples:

- (1) Ground and bond containers during product transfers. Grounding and bonding may not be adequate protection to prevent ignition or explosion of hydrocarbon liquids and vapors that are static accumulators.
- (2) Special slow load procedures for "switch loading" must be followed to avoid the static ignition hazard that can exist when higher flash point material (such as fuel oil or diesel) is loaded into tanks previously containing low flash point products (such as gasoline or naphtha).
- (3) Storage tank level floats must be effectively bonded. For more information on precautions to prevent static-initiated fire or explosion, see NFPA 77, Recommended Practice on Static Electricity (2007), and API Recommended Practice 2003, Protection Against Ignitions Arising Out of Static, Lightning, and Stray Currents (2008).

Keep away from flame, sparks, excessive temperatures and open flame. Use approved containers. Keep containers closed and clearly labeled. Empty or partially full product containers or vessels may contain explosive vapors. Do not pressurize, cut, heat, weld or expose containers to sources of ignition. Store in a well-ventilated area. The storage area should comply with NFPA 30 "Flammable and Combustible Liquid Code". The cleaning of tanks previously containing this product should follow API Recommended Practice (RP) 2013 "Cleaning Mobile Tanks In Flammable and Combustible Liquid Service" and API RP 2015 "Cleaning Petroleum Storage Tanks".

## Section 8 – Exposure Controls/Personal Protection

### Occupational exposure limits

US. OSHA Table Z-1 Limits for Air Contaminants (29 CFR 1910.1000)

<u>Material</u>	<u>Type</u>	<u>Value</u>
Isobutanol (CAS 78-83-1)	PEL	100 ppm

US. ACGIH Threshold Limit Values

<u>Material</u>	<u>Type</u>	<u>Value</u>
Isobutanol (CAS 78-83-1)	TWA	50 ppm

US. NIOSH: Pocket Guide to Chemical Hazards

<u>Material</u>	<u>Type</u>	<u>Value</u>
Isobutanol (CAS 78-83-1)	TWA	50 ppm

### Appropriate engineering controls

Provide adequate general and local exhaust ventilation. Use process enclosures, local exhaust ventilation, or other engineering controls to control airborne levels below recommended exposure limits. Use explosion-proof equipment.

### Individual protection measures, such as personal protective equipment

#### Eye/face protection

Wear safety glasses. If splash potential exists, wear full face shield or chemical goggles.

#### Hand protection

Wear chemical-resistant, impervious gloves. Be aware that the liquid may penetrate the gloves. Frequent change is advisable.

#### Other

Full body suit and boots are recommended when handling large volumes or in emergency situations. Flame retardant protective clothing is recommended.

<b>Respiratory protection</b>	Use a properly fitted, air-purifying or air-fed respirator complying with an approved standard if a risk assessment indicates this is necessary. Respirator selection must be based on known or anticipated exposure levels, the hazards of the product and the safe working limits of the selected respirator. If workplace exposure limits for product or components are exceeded, NIOSH approved equipment should be worn. Proper respirator selection should be determined by adequately trained personnel, based on the contaminants, the degree of potential exposure and published respiratory protection factors. This equipment should be available for non-routine and emergency use.
<b>Thermal hazards</b>	Wear appropriate thermal protective clothing, when necessary.
<b>General hygiene considerations</b>	Consult supervisor for special handling instructions. Avoid contact with eyes. Avoid contact with skin. Keep away from food and drink. Wash hands before breaks and immediately after handling the product. Provide eyewash station and safety shower. Handle in accordance with good industrial hygiene and safety practice.

### Section 9 – Physical and Chemical Properties

<b>Appearance</b>	Colorless liquid.
<b>Physical state</b>	Liquid.
<b>Form</b>	Liquid.
<b>Color</b>	Colorless
<b>Odor</b>	Strong, similar to alcohol
<b>Odor threshold</b>	Not available.
<b>pH</b>	Not available.
<b>Melting point/freezing point</b>	< -162 °F (< -107-78 °C)
<b>Initial boiling point and boiling range</b>	226 °F (107.8 °C)
<b>Flash point</b>	82 °F (27.8 °C) (closed cup)
<b>Evaporation rate</b>	0.82 (butyl acetate = 1)
<b>Upper/lower flammability or explosive limits</b>	
<b>Flammability limit – lower (%)</b>	1.7%
<b>Flammability limit – upper (%)</b>	10.6%
<b>Vapor pressure</b>	8 hPa (6 mmHg) at 20 °C (68 °F)
<b>Vapor density</b>	2.6
<b>Relative density</b>	Not available.
<b>Solubility</b>	Soluble in ether, alcohol, and actone
<b>Partition coefficient (n-octanol/water)</b>	logKow=0.76
<b>Auto-ignition temperature</b>	> 779 °F (> 415 °C)
<b>Decomposition temperature</b>	Not available.
<b>Viscosity</b>	Not available.
<b>Other information</b>	
<b>VOC (Weight %)</b>	100 %

### Section 10 – Stability and Reactivity

<b>Reactivity</b>	Stable
<b>Chemical stability</b>	Stable under normal temperature conditions and recommended use.
<b>Conditions to avoid</b>	Avoid high temperatures, open flames, sparks, welding, smoking and other ignition sources. Keep away from strong oxidizers.
<b>Materials to avoid</b>	Keep away from strong oxidizers such as nitric and sulfuric acids.
<b>Incompatible materials</b>	Strong oxidizing agents, Acid chlorides, Acid anhydrides.
<b>Hazardous decomposition products</b>	Risk of explosion. In case of fire hazardous decomposition products may be produced such as: Smoke. Hydrocarbons. Carbon Monoxide and Carbon Dioxide.

### Section 11 – Toxicological Information

#### Information on likely routes of exposure

<b>Ingestion</b>	May be fatal if swallowed and enters airways.
<b>Inhalation</b>	Inhalation of vapors/fumes generated by heating this product may cause respiratory irritation with throat discomfort, coughing or difficulty breathing.
<b>Skin contact</b>	Prolonged contact may cause redness, irritation and dry skin.
<b>Eye contact</b>	May cause eye irritation on direct contact.

**Symptoms related to the physical, chemical and toxicological characteristics** Irritation of nose and throat. Irritation of eyes and mucous membranes. Skin irritation. Unconsciousness. Corneal damage. Narcosis. Cyanosis (blue tissue condition, nails, lips, and/or skin). Decrease in motor functions. Behavioral changes. Edema. Liver enlargement. Jaundice. Conjunctivitis. Proteinuria. Defatting of the skin. Rash.

#### Information on toxicological effects

<b>Acute toxicity</b>	Harmful: may cause lung damage if swallowed.
<b>Skin corrosion/irritation</b>	Irritating to skin with redness, pain and dryness.
<b>Serious eye damage/eye irritation</b>	Irritating and may cause damage to eyes with redness and pain.

#### Respiratory or skin sensitization

<b>Respiratory sensitization</b>	Based on available data, the classification criteria are not met.
<b>Skin sensitization</b>	Based on available data, the classification criteria are not met.
<b>Germ cell mutagenicity</b>	Based on available data, the classification criteria are not met.
<b>Carcinogenicity</b>	Based on available data, the classification criteria are not met.
<b>Reproductive toxicity</b>	Based on available data, the classification criteria are not met.

#### Specific target organ toxicity (STOT)-single exposure

May cause central nervous system disorders with headache, muscle weakness, dizziness and unconsciousness. May cause respiratory irritation with cough and shortness of breath.

#### Specific target organ toxicity (STOT) - repeated exposure

May cause liver damage in cases of repeated or prolonged exposure. May cause dryness after repeated and prolonged contact with skin.

#### Aspiration hazard

If this liquid is swallowed, aspiration into the lungs may result in chemical pneumonitis.

#### Further information

Symptoms may be delayed.

### Section 12 – ECOLOGICAL INFORMATION

**Ecotoxicity** Not classified as hazardous to aquatic organisms.

#### Aquatic

<u>Material</u>		<u>Species</u>	<u>Test Results</u>
Isobutanol (CAS 78-83-1)			
Fish	LC50	Fathead minnow	1,430 mg/l, 96 hours
Water Flea	EC-50	Water Flea	1,220 mg/l, 96 hours
Aquatic Plant	EC-50	Pseudokirchneriella subcapitata	1,799 mg/l, 72 hours

#### Persistence and degradability

Expected low persistence and high degradability. Expected low bioaccumulative potential in aquatic organisms.

#### Bioaccumulative potential

BCF: 3

**Partition coefficient  
n-octanol/water (log Kow)** Isobutanol (CAS 78-83-1) – Log Kow 0.76

**Mobility in soil** High mobility in soil  
**Other adverse effects** Not available.

### Section 13 – DISPOSAL CONSIDERATIONS

**Disposal instructions** Whatever cannot be saved for recovery or recycling should be handled as hazardous waste and sent to a RCRA approved waste facility. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations.

**Waste from residues/  
unused products** Dispose of container and unused contents in accordance with federal, state and local requirements.

**Contaminated  
Packaging** Empty remaining contents. Do not re-use empty containers. Empty containers should be transported/delivered using a registered waste carrier to local recyclers for disposal. Dispose of container and unused contents in accordance with federal, state and local requirements.

### Section 14 – TRANSPORTATION

#### DOT

**Reportable Quantity** 5,000 lbs (isobutyl alcohol)  
**UN number** UN1212  
**UN proper shipping name** Isobutanol  
**Class** 3  
**Transport hazard class(es)**  
**Subsidiary risk** -  
**Packing group** III  
**Special precautions for user** Read safety instructions, SDS and emergency procedures before handling.

#### IATA

**UN number** UN1212  
**UN proper shipping name** Isobutanol  
**Class** 3  
**Transport hazard class(es)**  
**Subsidiary risk** -  
**Label(s)** 3  
**Packing group** III  
**Environmental hazards** No  
**Special precautions for user** Read safety instructions, SDS and emergency procedures before handling.

#### IMDG

**UN number** UN1212  
**UN proper shipping name** Isobutanol  
**Class** 3  
**Transport hazard class(es)**  
**Subsidiary risk** -  
**Label(s)** 3  
**Packing group** III  
**Marine pollutant** No

**Special precautions for user** Read safety instructions, SDS and emergency procedures before handling.  
This product is a liquid and when transported in bulk is covered under MARPOL 73/78 Annex II.

### Section 15 – REGULATORY INFORMATION

---

**US federal regulations** This product is a "Hazardous Chemical" as defined by the OSHA Hazard Communication Standard, 29 CFR 1910.1200. All components are on the U.S. EPA TSCA Inventory List.

**TSCA Section 12(b) Export Notification (40 CFR 707, Subpt. D)** Not regulated.

**SARA 302 Extremely hazardous substance** -Not listed.

**SARA 311/312 Hazardous chemical** - Yes

**SARA 313 (TRI reporting)** Not regulated.

**Other federal regulations**

**Clean Air Act (CAA) Section 112 Hazardous Air Pollutants (HAPs) List** Not regulated.

**Clean Air Act (CAA) Section 112(r) Accidental Release Prevention (40 CFR 68.130)** Not regulated.

**Safe Drinking Water Act (SDWA)** Not regulated.

**US. Massachusetts RTK - Substance List**

Isobutanol (CAS 78-83-1)

**US. New Jersey Worker and Community Right-to-Know Act**

Isobutanol (CAS 78-83-1)

**US. Pennsylvania Worker and Community Right-to-Know Law**

Isobutanol (CAS 78-83-1)

**US. California Proposition 65**

This product does not contain any chemicals known to the State of California to cause cancer, birth, or any other reproductive defects.

**International Inventories**

**Country(s) or region Inventory name On inventory (yes/no)**

Australia Australian Inventory of Chemical Substances (AICS)	Yes
Canada Domestic Substances List (DSL)	Yes
China Inventory of Existing Chemical Substances in China (IECSC)	Yes
European Inventory of Existing Commercial Chemical Substances (EINECS)	Yes
Japan Inventory of Existing and New Chemical Substances (ENCS)	Yes
Korea Existing Chemicals List (ECL)	Yes
Philippine Inventory of Chemicals and Chemical Substances (PICCS)	Yes
United States Toxic Substances Control Act (TSCA) Inventory	Yes



---

**Section 16 – OTHER INFORMATION**

---

**Prepared By:** Gevo Inc.**DATE:** May 28, 2015

**OTHER INFORMATION:** This Material Safety Data Sheet applies to the listed products and synonym descriptions for Hazard Communication purposes only. Technical Specifications vary greatly depending on the products and are not reflected in this document. Consult specification sheets for technical information.

**DISCLAIMER:** This Material Safety Data Sheet (MSDS) was prepared in accordance with 29 CFR 1910.1200 by Gevo Inc., ("GEVO"). GEVO does not assume any liability arising out of product use by others. The information, recommendations, and suggestions presented in this MSDS are based upon test results and data believed to be reliable. The end user of the product has the responsibility for evaluating the adequacy of the data under the conditions of use, determining the safety, toxicity and suitability of the product under these conditions, and obtaining additional or clarifying information where uncertainty exists. No guarantee expressed or implied is made as to the effects of such use, the results to be obtained, or the safety and toxicity of the product in any specific application. Furthermore, the information herein is not represented as absolutely complete, since it is not practicable to provide all the scientific and study information in the format of this document, plus additional information may be necessary under exceptional conditions of use, or because of applicable laws or government regulations.