



NATIONAL TRANSPORTATION SAFETY BOARD
Investigative Hearing

Norfolk Southern Railway general merchandise freight train 32N
derailment with subsequent hazardous material release and fires,
in East Palestine, Ohio, on February 3, 2023

GROUP	D
EXHIBIT	
24	

Agency / Organization

Title

Ethylene Glycol Monobutyl Ether Safety Data Sheet

ETHYLENE GLYCOL MONOBUTYL ETHER

Class 3 (Flammable Liquid) or Combustible Liquid

GENERAL INFORMATION

Ethylene glycol monobutyl ether (EGBE) is a clear, flammable liquid with a mild, ether-like odor. It is also commonly known as 2-Butoxyethanol and is toxic by all routes of exposure. It has many different applications from being used in all-purpose and household solvents to making pesticides and rust removers. It has a flash point of 144°F and therefore flammable, but it can be identified as a flammable or combustible liquid when in transportation. It is reactive with strong acids, bases, caustics and some metals. On exposure to light or air, EGBE may form peroxides. It is completely soluble in water and most organic solvents. The product weighs approximately 7.5 pounds per gallon.

Ethylene glycol monobutyl ether is regarded as the most toxic glycol ether used as a solvent. Symptoms of exposure may include headaches, drowsiness, weakness, slurred speech, tremor and blurred vision. EGBE has an evaporation rate of .08 and is therefore considered a slow evaporator; nevertheless, vapors are heavier than air and may travel to a distant source of ignition and flash back. Excessive heat may cause rupture of containers.

Initial downwind evacuation should be considered for at least 300 meters (1000 feet) if product is leaking but not on fire. If container of ethylene glycol monobutyl ether is exposed to direct flame or a fire becomes uncontrollable, evacuate for one-half (1/2) mile in all directions for protection from flying debris if the container should rupture violently.

CHEMICAL/PHYSICAL DATA

Solubility in Water: Complete

Solubility in Other Chemicals: Soluble in ethanol, acetone, mineral oil, ether and most organic solvents.

Specific Gravity (Liquid): 0.9

Vapor Density: 4.07

Boiling Point: 340°F (171°C)

Melting Point: See freezing point.

Freezing Point: -107°F (-77°C)

Molecular Weight: 118.2

Heat of Combustion: 30 kJ/g

Evaporation Rate (butyl acetate=1): .08

Vapor Pressure: 0.8 mm Hg at 68°F (20°C); 300 mm Hg at 284°F (140°C)

Flash Point: 144°F (62°C) closed cup; 158°F (70°C) open cup

Autoignition Temperature: 460°F (238°C)

Burning Rate: Unavailable

Flammable Limits: 1.1% (LFL) - 12.7% (UFL)

Stability: Stable under normal conditions, however, is sensitive to light and air.

Polymerization Potential: Will not occur

pH: 10.5 - 11.5 (reported by one source)

Reactivity with Water: None

Reactivity and Incompatibility: Strong oxidizers, strong caustics, strong bases and zinc. Incompatible with reactive metals such as aluminum and magnesium. May form peroxides on exposure to light and air. It attacks some forms of plastics, rubber and coatings.

IDENTIFICATION

Shipping Name(s): Flammable liquid, n.o.s. (Ethylene glycol monobutyl ether) (USDOT & IMO); Combustible liquid, n.o.s. (Ethylene glycol monobutyl ether) (USDOT)

Synonyms and Tradenames: 2-Butoxyethanol; 2-butoxy-1-ethanol; Butyl Cellosolve®; Butyl oxitol; Dowanol® EB; EGBE; Ektasolve EB®; Jeffersol EB

CAS Registry No.: 111-76-2

Chemical Formula: C₄H₉OCH₂CH₂OH or C₆H₁₄O₂

Constituent Components (% each): 99% to 100% pure

UN/NA Designation: UN1993 (Flammable liquid); NA1993 (Combustible liquid)

IMO Designation: 3, Flammable liquids

RTECS Number: KJ8575000

NFPA 704 Hazard Rating: 2 (Health); 2 (Flammability); 0 (Reactivity)

Physical Form as Shipped: Liquid

Physical Form as Released: Liquid

Color of the Shipped Material: Clear colorless liquid

Odor Characteristics: Mild, ether-like odor.

Common Uses: All-purpose solvent often used in water-base paint formulations and hard surface cleaners. Solvent for nitrocellulose, natural and synthetic resins, soluble oils, lacquers, varnish and enamels. Used in textile dyeing and printing, in the treatment of leather, as a stabilizer in metal and household cleaners, in hydraulic fluids, insecticides, herbicides and rust removers.

ADDITIONAL INFORMATION AND ASSISTANCE: FOR 24-HOUR TECHNICAL SUPPORT FOR ACCIDENTS INVOLVING SPILLS, LEAKS, FIRES OR EXPOSURES TO CHEMICALS, CONTACT CHEMTREC AT (800) 424-9300 OR (703) 527-3887 (COLLECT).



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POTENTIAL HAZARDS

GENERAL HAZARDS

Threshold Odor Concentration: Approximately 4 ppm

Unusual Hazards: Product is toxic. Fumes and vapors are heavier than air. May form peroxides on exposure to light and air.

Short Term Exposure Limit (STEL): Unavailable

Time Weighted Average (TLV-TWA): 5 ppm (24 mg/m³) (NIOSH); 50 ppm (240 mg/m³) (OSHA)

Ceiling (C) Limit: Unavailable

IDLH: 700 ppm

Conditions to Avoid: Heat or sources of ignition; contact with incompatible materials; runoff to sewers or water bodies; inhalation, ingestion or direct physical contact.

HEALTH HAZARDS

Public Health Hazards: Ethylene glycol monobutyl ether is regarded as the most toxic of all glycol ethers. Major hazard to public is inhalation of fumes or vapors in air but ingestion and direct physical contact is also to be strictly avoided. Chemical is usually detected by its objectionable odor prior to high levels.

Hazards of Skin or Eye Contact: May cause headache, dizziness, incoordination, nausea, vomiting, diarrhea and general weakness. Brief contact may cause slight irritation with itching and local redness. Prolonged contact may cause more severe irritation, with discomfort or pain, local redness and swelling and possible tissue destruction.

Hazards of Inhalation: High concentrations of vapor cause irritation of the respiratory tract, experienced as nasal discomfort and discharge, with chest pain and coughing. Headache, nausea, vomiting, dizziness and drowsiness may occur.

Hazards of Ingestion: May cause headache, dizziness, incoordination, nausea, vomiting, diarrhea and general weakness. Ingestion of significant quantities may result in red blood cell hemolysis.

FIRE HAZARDS

Lower Flammable Limit: 1.1%

Upper Flammable Limit: 12.7%

Behavior in Fire: Flammable liquid. Vapors are heavier than air, may collect in low areas, and may travel to a source of ignition and flash back. Containers may rupture violently in fire. May generate large quantities of flammable and toxic vapors upon release.

Hazardous Combustion Products: May include carbon monoxide, carbon dioxide and irritating and toxic fumes and gases.

EXPLOSION HAZARDS

Explosive Potential: Containers may rupture violently in fire. Explosion may result if vapors are ignited in a confined area. Peroxidizable compounds can form and accumulate peroxides, which may explode when subjected to heat or shock.

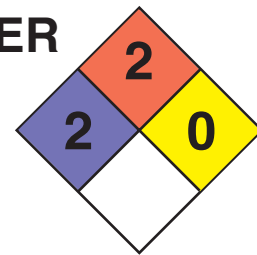
PERSONAL PROTECTIVE CLOTHING AND EQUIPMENT

Protective Clothing Required: Equipment should prevent any possibility of skin or eye contact with the spilled product. This may include rubber boots, gloves, face shields, splash-proof safety goggles, and other impervious and resistant clothing.

Fully encapsulating suits with self-contained breathing apparatus (SCBA) may be advisable in some cases to prevent contact with high vapor or fume concentrations in air. Compatible materials may include Viton®, butyl rubber, nitrile and neoprene (reported to have a greater than 8 hour breakthrough time). Natural rubber has a reported breakthrough time of 67 minutes and is, therefore, not recommended.

Respiratory Protection: For unknown concentrations, fire fighting or high concentrations, a self-contained breathing apparatus (SCBA) with full facepiece (or the equivalent). For lesser concentrations, an air purifying respirator (APR) with chin-style or front or back mounted organic vapor canister or an organic vapor cartridge respirator with a full facepiece within the use limitations of these devices.

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FIRST AID

Nonspecific Symptoms: Irritation or burns of any bodily tissues.

First Aid for Inhalation: Remove victim to fresh air and keep warm and at rest. If breathing becomes difficult, give oxygen. If breathing has stopped, administer artificial respiration. Get medical attention immediately. (Caution: Administration of mouth-to-mouth resuscitation may expose the first aid provider to chemical within the victim's lungs or vomit.)

First Aid for Skin Contact: Remove all contaminated clothing. Wash affected body areas with large amounts of water. Provide supportive care and seek immediate medical assistance by a physician from the nearest medical treatment facility. Decontaminate the patient thoroughly before transporting to a medical treatment facility to prevent the potential for secondary contamination.

First Aid for Eye Contact: In case of eye contact, immediately flush eyes with plenty of water for at least 20 minutes, while holding eyelids apart in order to rinse entire surface of eye and lids with water. Provide supportive care and seek immediate medical assistance by a physician from the nearest medical treatment facility.

First Aid for Ingestion: If victim is conscious, administer large quantities of water immediately. Seek medical advice on whether or not to make the victim vomit. Get medical attention immediately.

FIRE RESPONSE

Extinguishing Agents: Dry chemical, regular foam, water spray or carbon dioxide.

Extinguishing Techniques: Toxic vapor or fume hazard. Stay upwind. Avoid all bodily contact. Wear breathing apparatus and appropriate protective clothing. Wear chemical vapor protective clothing if contact with material or dense fumes/smoke anticipated. Move container from fire area if no risk. Be alert to container rupture potential. Use water from side and from safe distance to keep fire-exposed containers cool. Do not use a solid stream of water, since the stream will scatter and spread the fire. Water spray may be used to dilute spills to nonflammable mixtures, protect personnel attempting to stop leak and disperse vapors.

SPILL RESPONSES

General Information: Ethylene glycol monobutyl ether is a highly toxic and flammable liquid that may cause environmental contamination. Proceed with caution. Restrict access to area. Keep unprotected personnel upwind of spill area. Avoid contact with spilled product. Personnel must wear the appropriate level of personal protective clothing and equipment for spill response operations. Eliminate ignition sources. Prevent liquid from entering sewers and confined spaces. Notify proper authorities, downstream sewer and water treatment operations, and other downstream users of potentially contaminated water. Note that intake of highly contaminated water may result in rupture or explosion of boilers or industrial process equipment. All containers should be checked for product compatibility and properly bonded and grounded during product transfer operations to eliminate the potential for ignition. Use explosion-proof and non-sparking equipment to minimize the potential for ignition. Compatibility of vacuum trucks and equipment must be determined prior to commencing clean-up operations. Stop or control the leak if it can be accomplished safely. Water spray may be used to reduce the generation of vapors. Establish a decontamination area remote from the contaminated zone. Ensure that all protective clothing and equipment is isolated for disposal or cleaning. Ensure proper decontamination of emergency personnel before they leave the scene. Personnel should monitor for the presence of hazardous vapors before removing respiratory protection equipment. Use a massive rinse on the outer shell of protective clothing. Maintain respiratory protection throughout the decontamination process. Dispose of contaminated material as soon as possible in accordance with applicable local, state and federal environmental regulations. Consult environmental specialists for assistance, as needed. Do not use combustible materials, such as sawdust.

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AIR RELEASE

TECHNIQUE

EVACUATION . . . If conditions are not suitable for sheltering in place, evacuate local and downwind areas to prevent exposure and to allow vapors or fumes to dissipate. Product may expose downwind areas to toxic or flammable concentrations over considerable distances in some cases. Fumes may be heavier than air.

CONSEQUENCE

Need to notify, organize, transport and house evacuees.

MITIGATION

Stop leak if without risk and if proper equipment available. Allow vapors and fumes to dissipate completely before reentering spill area without special protective gear. Consult qualified experts for assistance.

TECHNIQUE

WATER FOG OR SPRAY . . . Water fog or spray applied to vapors or fumes may absorb vapors, knockdown fumes and accelerate their dispersal in the atmosphere. Water should be applied at a point upwind of the spill.

CONSEQUENCE

Increases in spill surface area and atmospheric conditions may increase the rate of vapor generation. In enclosed areas, runoff may add to spill volume and overflow impoundments. Water runoff may contain a small amount (if any) of product from contact with airborne vapors or fumes.

MITIGATION

Contain contaminated water and remove or treat as soon as possible to prevent spread of contamination. Be alert to conditions such as fire hose runoff or rainwater that may add to spill volume and overflow impoundments.

TECHNIQUE

FOAM . . . Foam applied to the surface of liquid pools may slow the release of vapors into the atmosphere.

CONSEQUENCE

The effects of foam may be short term. As the foam breaks down, or in high wind conditions, the integrity of the foam blanket may be compromised. A visible foam blanket on the surface of the liquid does not necessarily ensure an adequate level of vapor suppression.

MITIGATION

Continue foam applications until spilled product is removed. Contain foam runoff and treat as hazardous waste.

TECHNIQUE

DILUTION . . . The use of water in flooding quantities may reduce the generation of vapors. Use this technique only for small spills and only on the advisement of product experts.

CONSEQUENCE

Vapor or fume evolution may be vastly increased during and immediately after water application, thus increasing downwind and local hazards for a time. Flashes of fire may be observed.

MITIGATION

Some possibilities include knockdown of vapors or fumes via water fog or spray and temporary evacuation of downwind populations and other vulnerable resources. Proceed with caution. Consult qualified experts.

LAND SPILL

TECHNIQUE

CONFINEMENT DIKES . . . Ethylene glycol monobutyl ether may be contained by building dikes or barriers using soil, dry sand or other non-combustible materials.

CONSEQUENCE

Contained product may percolate into soil or seep through dike material. This may result in loss of contained product and spread of contamination.

MITIGATION

Remove or neutralize contained product as soon as possible to prevent spread of contamination. Be alert to conditions such as fire hose runoff or rainwater that may overflow impoundments. Where possible, line collection basins with compatible impervious material.

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TECHNIQUE

EXCAVATION . . . A trench or ditch may be excavated to contain leaking product.

CONSEQUENCE

Material may leach into soil. Deep excavations may increase the potential for groundwater contamination in some areas. This may result in loss of confined product and spread of contamination.

MITIGATION

Remove material from contaminated area as quickly as possible to prevent possible contamination beyond the spill area. Water sprays may be used to reduce vapors, except in enclosed areas where runoff may accumulate and overflow impoundments. Be alert to conditions such as increasing spill volume with runoff or rainwater which may overflow diked areas. If possible, confinement areas should be lined with suitable, impervious material to prevent penetration into soil.

TECHNIQUE

PUMPING/VACUUM SUCTION . . . Spilled material contained in diked areas may be recovered using compatible hoses, pumps and vacuum trucks. All product transfer equipment should be properly bonded and grounded.

CONSEQUENCE

Equipment that is not compatible with the spilled product may become damaged and present a safety hazard for response personnel. Mechanical equipment will become contaminated with removed product.

MITIGATION

Use equipment constructed of materials compatible with the spilled product. Decontaminate equipment.

TECHNIQUE

ABSORPTION . . . Spreading of spilled product may be controlled by absorbing liquid with dry sand, earth, fly ash, cement powder, vermiculite, fullers earth or other absorbent, non-combustible and compatible substances.

CONSEQUENCE

Once used, sorbent materials pose the same hazards as the spilled product. Their use adds to the overall volume of contaminated material.

MITIGATION

Deplete accumulated liquid pools with pumps or vacuum trucks if possible before applying sorbents. Remove contaminated sorbents to safe storage by mechanical means. Where necessary, neutralize sorbents under guidance of qualified expert.

TECHNIQUE

MECHANICAL REMOVAL . . . Soil contaminated with spilled material may be removed by shovels, as well as a variety of heavy equipment such as backhoes and loaders.

CONSEQUENCE

Removal equipment may become contaminated and present a hazard to later users. Incompatible equipment may be damaged or corroded. Improper storage of removed materials may result in future spread of contamination. Any flammable vapors or gases present in the area may be ignited by motorized removal equipment.

MITIGATION

Decontaminate all equipment after use. Use equipment compatible with spilled product. Store contaminated materials in a safe and secure location. Do not operate motorized equipment in potentially flammable atmospheres. Consult qualified experts for advice where necessary.

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WATER SPILL

TECHNIQUE

STOP USE . . . Notify downstream industrial, municipal and public users to stop water intake or to monitor water for contamination.

CONSEQUENCE

Alternative water supplies may need to be established. Consult environmental specialists for assistance, as needed.

MITIGATION

Provide alternative water supplies as needed until water supply is declared safe.

TECHNIQUE

CONTAINMENT DIKES . . . Water with dissolved chemical may be contained (or diverted to impoundment area) by diking upper and/or lower bounds to limit volume of water affected and spread of contamination. Clean water can be diverted around contaminated impoundments by excavation of diversion channels.

CONSEQUENCE

Earthen dikes may become saturated with water and seep through or collapse. Additional water may cause overflow of diked area or water body boundaries.

MITIGATION

Reinforce or modify dikes as necessary. Be alert to conditions that may lead to overflow or dike collapse. Remove contaminated water to impoundment or storage area for later treatment or disposal.

TECHNIQUE

ADSORPTION . . . Addition of activated carbon or peat moss to the contaminated water, followed by effective mixing, may capture spilled product that has dissolved in water. Adsorbent materials may later be removed by mechanical means.

CONSEQUENCE

Recovery of activated carbon may require dredging in a process that poses risk of environmental damage. Recovered adsorbent materials will be contaminated with spilled product, as may recovery equipment.

MITIGATION

Consult qualified experts for safe adsorption techniques. Consider pumping water through tank containing adsorbent on land. Handle and store recovered materials safely. Decontaminate equipment as necessary.

TECHNIQUE

AERATION . . . Water containing dissolved volatile chemicals may be decontaminated to some degree by aeration, air stripping or air sparging techniques. These involve the use of air compressors and perforated piping to bubble large quantities of air through the contaminated water body.

CONSEQUENCE

The air bubbles entering the atmosphere will be contaminated with some amount of chemical vapors if the technique is effective.

MITIGATION

Consult qualified experts for advice and assistance in obtaining and deploying necessary equipment. Apply alternative techniques where air emissions may pose a downwind hazard.