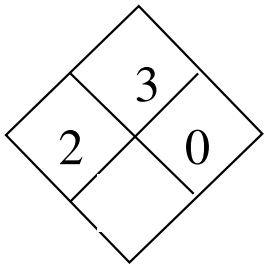
HAZARDS DIAMMOND – NFPA 704



Fire 2 – Moderate Flammability
Health 2– Dangerous
Reactivity 0 – no hazard under normal conditions

1. PRODUCT AND COMPANY IDENTIFICATION

- Product name (label): n-BUTANOL
- Supplier name, address and telephone number:
  Elekeiroz S.A. (Várzea Paulista-SP Plant) - Rua Dr. Edgardo de Azevedo Soares, 392
  CEP 13224-030
  (00-55-11) 4596-8880 or (00-55-11) 4596-8788 or (00-55-11) 4596-8768(Business hours)
  (00-55-11) 4596-8800 or (00-55-11) 9961-4808 (24h)
  Fax: (00-55-11) 4596-8881
  E-mail (customer service):
  elisabete.moskalenko@elekeiroz.com.br
  carlos.villani@elekeiroz.com.br

2. COMPOSITION AND INFORMATION ABOUT INGREDIENTS

- Common chemical name of the substance: n-Butanol.
- Synonyms:
  n-Butil Alcohol, Propylcarbinol, n-Butanol, 1-Butanol, 1-Hydroxybutane.
- Register in *Chemical Abstract Service* (nº C.A.S):
  [71-36-3]
- Hazardous ingredients:
  n-Butanol ≥ 99,3%.

3. HAZARDS IDENTIFICATION

- Hazards and most important effects:
  Irritating to yes/skin/respiratory tract. Other Acute Effects: headache, dizzines, drowsiness.
  Chronic Effects: blurred vision, sensitivity to light; hearing loss, dizziness with concurrent noise exposure.
  Flammable.
  Primary Entry Routes: inhalation, eye contact, skin contact/absorption.

4. FIRST AID MEASURES

- Inhalation:
  Remove the victim from the area. If the respiration has stopped, apply artificial respiration (by a qualified person – Physician or Paramedic). If the respiration is difficult, apply oxygen (with medical help or through a first aid trained person). Keep the victim lying down and warm.

- Contact with the skin:
  Wash immediately the affected area with water, during at least 15 minutes, while clothes are removed. Wash with water and soap, right after

- Contact with the eyes:
  Wash them immediately with water during at least 15 minutes, including under eyelids. Remove contact lenses, if applicable, with medical help. Do not allow the victim to rub his/her eyes or keep them closed.

- Ingestion:
  If more than 15 minutes from a hospital, induce a vomiting, preferably using Ipecac Syrub APF. Note: DO NOT INDUCE VOMITING in na unconscious person.

- **Observation: in any situation, the victim should be sent to emergency medical service.**

- Information to physician:
  To treat poisoning by the higher aliphatic alcohols:
  1.Gastric lavage with copious amounts of water.
  2.It may be beneficial to instill 60 mL of mineral oil into the stomach.
  3.Oxygen and artificial respiration as needed.
  4.Electrolyte balance: it may be useful to start 500 mL.M/6 sodium bicarbonate intravenously but maintain a cautions and conservative attitude toward electrolyte replacement unless shock or severe acidosis threatens.
  5.To protect the liver, maintain carbohydrate intake by intravenous infusions of glucose.
  6.Hemodialysis if coma is deep and persistent.

5. FIREFIGHTING MEASURES

- Proper extinguishing media:
  -Light fire: alcohol stable foam; dry chemical powder. Carbon dioxide. Water spray or fog – Large fires only

- Specific hazards:
  Liquid and vapor are Flammable. Moderate fire and explosion hazard when exposed to heat or flame. Vapor forms na explosive mixture with air. Vapor may travel a considerable distance to source of ignition. Heating may cause expansion or decomposition leading to violent rupture of containers. On combustion, may emit toxic fumes of carbon dioxide (CO). May emit acrid smoke.

- Fire Incompatibility:
  Avoid reaction with acid chlorides, acid anhydrides, oxidizers, reducing agents, copper and its alloys.

- Specific methods / firemen protection:
  -Wear full firefighting clothes, with selfcontained breathing apparatus.
  -Remove flammable/combustible materials from fire area, if this operation can be accomplished without risks.
  -Confine wastewaters from fire control for later disposal.
  -Cool with water the side parts of the containers exposed to flames, long time after the fire is extinguished.

6. MEASURES TO CONTROL SPILLS OR LEAKAGES

- Personal precautions:
  Isolate the area; evacuate area; keep away or eliminate heat sources; provide local ventilation, with explosion proof equipment. Prevent the contact of the product with skin, eyes and respiratory ways, wearing personal protective equipment, mentioned in item 8.

- Environmental precautions:
  Avoid product flowing off to sewage gallerires or water bodies.

- Cleaning methods:
  Every cleaning procedure should be performed using antisparking materials and equipment.
  The waste should be absorbed with sand or ash, or any other non combustible and non sparking absorbant material, packed in containers, always with a water layer covering the waste. See item 13.

7. HANDLING AND STORAGE

- Handling:
  -Avoid all personal contact, including inhalation. Wear protective clothing when risk of exposure occurs. Use in a well-ventilated area. Prevent concentration in hollows and sumps. DO NOT enter confined spaces until atmosphere has been checked. Avoid smoking, bare lights or ignition sources. Avoid contact with incompatible materials. When handling, DO NOT eat, drink or smoke. Keep containers securely sealed when not in use. Avoid physical damage to containers. Always wash hands with soap and water after handling. Work clothes should be laundered separately. Use good occupation work practices. Observe manufacture's storing and handling recommendations. Atmosphere should be regularly checked against established exposure standards to ensure safe working conditions.

- Storage:
  Metal can; metal drum; metal safety cans. Plastic containers may only be used if approved for flammable liquid. Packing as recommended by manufacturer. Check all containers are clearly labeled and free from leaks.

- Regulatory Requirements:
  Follow applicable OSHA regulations.

8. EXPOSURE CONTROL AND PERSONAL PROTECTION

- Control parameters:
  Governmental Decree 3214/78, Regulating Standard NR-15: 40 ppm (115 mg/m^3). Value (Brazil).
  ACGIH-TLV/TWA = 20ppm.

- Engineering Controls:
  General exhaust is adequate under normal operating conditions. Local exhaust ventilation may be required in specific circumstances. If risk of overexposure exists, wear NIOSH-approved respirator. Correct fit is essential to obtain adequate protection. Provide adequate ventilation in warehouse or closed storage areas.

- Personal Protective Equipment:
  -PVC, neoprene or latex rubbers.
  -Leather safety shoes or PVC or rubber boots, during residues handling.
  -Apron type trevira, tyvek or PVC, for the operador in charge of the product charge or discharge.
  -Full vision safety glasses.
  -Facial respiratory protection:
  -Exposure Range > 100 to 1000 ppm: Air Purifying, Negative Pressure, Half Mask.
  -Exposure Range > 1000 to < 1400 ppm: Supplied Air, Constant Flow/Pressure Demand, Half Mask.
  -Exposure Range 1400 to unlimited ppm: Self-contained Breathing Apparatus, Pressure Demand, Full fa
  -Cartridge Color: black.

9. CHEMICAL AND PHYSICAL PROPERTIES

- Chemical formula: $C_4H_{10}O$.
- Physical state: liquid.
- Color: colorless.
- Odour: strong similar alcohol.
- pH: not available.
- Specific temperatures at which occurs physical state changes:
  - Melting point: -89ºC.
  - Boiling point (760 mmHg): 117,7ºC.
- Flash point: 36ºC. (closed cup).
- Auto-ignition temperature: 343ºC.
- Explosion limits: lower: 1,4% per volume of air
  upper: 11,2% per volume of air
- Vapor pressure: 5,0 mmHg a 20ºC.
- Vapor density: 2,55 a 20ºC(Ar=1).
- Liquid density: 0,80980 (20ºC) a 0,81337 (15ºC). Água = 1.
- Solubility in water (25ºC): 7,36%.
- Soluble: alcohol, ether, aromatic and aliphatic solvents.

10. REACTIVITY AND STABILITY

- Specific conditions:
  The substance is considered stable under normal conditions. Hazardous polymerization will not occur.

- Incompatibility:
  Avoid oxidizing agents, acids, acid chlorides, acid anhydrides.

- Decomposition products.
  On combustion, may emit toxic fumes of carbon monoxide (CO). Other combustion products include carbon dioxide (CO2).

11. TOXICOLOGICAL INFORMATION

- Acute toxicity and effects:

  - Inhalation: The vapor is highly discomforting to the upper respiratory tract. Inhalation hazard is increased at higher temperatures. Acute effects from inhalation of high concentrations of vapor are pulmonary irritation, including coughing, with nausea; central nervous system depression - characterized by headache and dizziness, increased reaction time, fatigue and loss of coordination and may cause dizziness, disorientation, mental confusion, slurred speech. If exposure to highly concentrated solvent atmosphere is prolonged this may lead to narcosis, unconsciousness, even coma and possible death. Although n-butanol is odorous and generally possesses adequate warning properties, the olfactory senses may become fatigued.

  - Eyes: The liquid is extremely discomforting to the eyes and is capable of causing pain and severe conjunctivitis. Corneal injury may develop, with possible permanent impairment of vision, if not promptly and adequately treated. The vapor is discomforting to the eyes. The material may produce severe irritation to the eye causing pronounced inflammation. Repeated or prolonged exposure to irritants may produce conjunctivitis.

  - Skin: The liquid is discomforting to the skin and may cause burning sensation and is capable of causing skin reactions which may lead to dermatitis. Toxic effects may result from skin absorption. Exposure limits with “skin” notation indicate that vapor and liquid may be absorbed through intact skin. Absorption by skin may readilly exceed vapor inhalation exposure. Symptoms for skin absorption are the same as for inhalation. Contact with eyes and mucous membranes may also contribute to overall exposure and may also invalidate the exposure standard. Bare unprotected skin should not be exposed to this material. The material may accentuate any pre-existing skin condition. Most liquid alcohols appear to act as primary skin irritants in humans. The material may cause skin irritation after prolonged or repeated exposure and may produce a contact dermatitis (nonallergic). This form of dermatitis is often characterized by skin redness (erythema) and swelling (edema) which may progress to vesiculation, scaling and thickening of the epidermis. Histologically there may be intercellular edema of the spongy layer (spongiosis) and intracellular edema of the epidermis.

- Ingestion: The liquid is highly discomforting and may be toxic if swallowed. Ingestion may result in nausea, pain and vomiting. Vomit entering the lungs by aspiration may cause potentially lethal chemical pneumonitis. Considered na unlikely rout of entry in commercial/industrial environments. Swallowing may cause breathing difficulty, headache, nausea, vomiting, upper respiratory tract irritation, mucous membrane irritation, central nervous system depression. Effects on the nervous system characterize over-exposure to higher aliphatic alcohols. These include headache, muscle weakness, giddiness, ataxia, (loss of muscle coordination) confusion, delirium and coma. Gastrointestinal effects may include nausea, vomiting and diarrhea. Aspiration of liquid alcohols produces an especially toxic response as they are able to penetrate deeply in the lung where they are absorbed and may produce pulmonary injury. Those possessing lower viscosity elicit a greater response. The result is a high blood level and prompt death at doses otherwise tolerated by ingestion without aspiration.

- Carcinogenicity: NTP – not listed; IARC – not listed; OSHA – not listed; NIOSH – not listed; ACGIH – not listed; EPA – class D, not classifiable as to human carcinogenicity; MAK – not listed.

- Toxicity:
  Rat (oral) LD50: 790 mg/kg;
  Human (inhalation) TCLO: 25 ppm;
  Rat (inhalation) LC50: 8000 ppm/4h;
  Rabbit (dermal) LD50: 3400 mg/kg.

- Irritation:
  Rabbit (skin): 405mg/24h-moderate;
  Human (eyes): 50 ppm – irritant;
  Rabbit (eyes): 1,6 mg – severe;
  Rabbit (eyes): 24mg/24h – severe.

- Carcinogenicity:
  NTP – não listado; IARC – não listado; OSHA – não listado; NIOSH – não listado; ACGIH – não listado; EPA – não listado; MAK – não listado.

  NTP – National Toxicology Program.
  IARC – International Agency for Research on Cancer.
  OSHA – Occupational Safety and Health Administration.
  NIOSH – National Institute of Occupational Safety and Health.
  ACGIH – American Conference of Governmental Industrial Hygienists.
  EPA – Environmental Protection Act.

12. ECOLOGICAL INFORMATION

- Environmental effects, behaviors and impacts of the product:
  Release to soil may result in volatilization from the soil surface and biodegradation is expected to be significant. It should not bind strongly to soil and so is expected to leach into groundwater. Release to water is expected to result in biodegradation and in volatilization from the water surface. Photooxidation by hydroxyl radicals is expected to be slow. Bioconcentration is not expected to be significant. Vapor phase in the atmosphere is expected to react with photochemically generated hydroxyl radicals with a half-life of 1.2 (experimental)-2.3 (estimated) days.

- Ecotoxicity: LC50 Pimephales promelas (fathead minnow) 1940, 1940, 1940, 1940, & 1940 mg/l at 1, 24, 48, 72, & 96 hr, respectively, at 18 to 22 °C (Static bioassay in reconstituted water); LC50 Pimephales promelas (fathead minnow) 1730 mg/l/96 hr (95% confidence limit 1630-1840 mg/l); age 33 days old, water hardness 47.7 mg/l (CaCO3), temp 24.7 °C, pH 7.64, dissolved oxygen 6.3 mg/l, alkalinity 45.5 mg/l (CaCO3) Static bioassay; EC50 Pimephales promelas (fathead minnow) 1510 mg/l/96 hr; age 33 days old, water hardness 47.7 mg/l (CaCO3), temp 24.7 °C, pH 7.64, dissolved oxygen 6.3 mg/l, alkalinity 45.5 mg/l (CaCO3) Static bioassay; Toxicity Threshold (Cell Multiplication Inhibition Test): Uronema parduczi Chatton-Lwoff (protozoa) 8.0 mg/l; EC50 Daphnia magna (daphnid) 1983 mg/l/48 hr, toxic effect: lost ability to swim; Toxicity Threshold (Cell Multiplication Inhibition Test) Microcystis aeruginosa (algae) 100 mg/l.

- Henry's Law Constant: 5.57×10^{-6}.

- BCF: little expected.

- Biochemical Oxygen Demand (BOD): 1.1 to 1.92 lb/lb, 5 days.

- Octanol/Water Partition Coefficient: $\log K_{ow} = 0.88$.

- Soil Sorption Partition Coefficient: K_{oc} = estimated at 71.6.

13. CONSIDERATIONS ABOUT TREATMENT AND DISPOSAL

- Treatment and disposal methods, wastes and used packages:
  Any waste treatment should be in accordance with local and national regulations.

14. TRANSPORTATION INFORMATION

- Road transportation (Brazil/MERCOSUL):
  Proper Shipping Name**: BUTANOIS.**
  Hazard Class**: 3 (flammable liquid)**
  Hazard Number: 30
  UN: 1120.
  Packing group: III

- US DOT- 49 CFR 172.101
  Proper Shipping Name: BUTANOLS
  Hazard Class: 3
  ID Nº: UN 1120
  Packing Group: III
  Label: flammable liquid [3].

- IMO – IMDG
Proper Shipping Name: BUTANOLS
Hazard Class: 3
ID Nº: UN 1120
Packing Group: III
Label: flammable liquid.

- IATA-DGR
Proper Shipping Name: BUTANOLS
Hazard Class: 3
ID Nº: UN 1120
Packing Group: III
Label: flammable liquid [3].

15. REGULATION

EPA Regulation:
RCRA 40 CFR: Listed U031 Ignitable Waste
CERCLA 40 CFR 302.4: Listed per RCRA Section 3001 5000 lb (2268 kg)
SARA 40 CFR 372.65: Listed
SARA EHS 40 CFR 355: Not listed
TSCA: Listed

EPA – Environmental Protection Agency
SARA - Superfund Amendments and Reauthorization Act
RCRA - Resource Conservation and Recovery Act
CERCLA - Comprehensive Environmental Response, Compensation, and Liability Act
TSCA - Toxic Substances Control Act

16. OTHER INFORMATION

References:

-MSDS - GENIUM PUBLISHING CORP. (sheet n.º BUT2120).

-ACGIH book, portuguese version, 2006 (translation: ABHO).

-Elekeiroz specification

- IATA 2007

- IMO 2006

Observation:

The information contained in this MSDS are offered in good faith and, as an orientation instrument, without incurring in explicit or implicit liability. If additional information or explanations are needed, consult the supplier.