T-Hydro Tert-Butyl Hydroperoxide (TBHP)

Product Safety Bulletin
Foreword

Lyondell Chemical Company (“Lyondell”), a LyondellBasell company, is dedicated to continuous improvement in product health, safety and environmental performance. Included in this effort is a commitment to support our customers by providing guidance and information on the safe use of our products. For Lyondell, environmentally sound operations, like environmentally sound products, make good business sense.

Lyondell Product Safety Bulletins are prepared by our Environmental, Health and Safety Department with the help of experts from our manufacturing and research facilities. The data reflect the best information available from public and industry sources. This document is provided to support the safe handling, use, storage, transportation and ultimate disposal of our chemical products.

This Product Safety Bulletin should be evaluated to determine applicability to your specific requirements. Please make sure you review the government regulations, industry standards and guidelines cited in this bulletin that might have an impact on your operations.

Lyondell is ready to support our customers’ safe use of our products. For additional information and assistance, please contact your LyondellBasell customer representative.

LyondellBasell is a member of SPI’s Organic Peroxide Producers Safety Division (OPPSD).

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1.1 Product Identification
This document refers to the product as T-Hydro or TBHP-70 and the pure compound as tertiary butyl hydroperoxide, t-buty1 hydroperoxide or TBHP.

T-Hydro TBHP is a clear, colorless, stable and aqueous solution of approximately 70 wt% t-buty1 hydroperoxide and 30 wt% water. The active oxygen content is about 12%. It has a characteristic odor.

Chemical Name: 1,1-Dimethyl ethyl hydroperoxide
Chemical Family: Alkyl hydroperoxide
Common Names: Tertiary butyl hydroperoxide, t-buty1 hydroperoxide

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Chemical Family: Alkyl hydroperoxide
Common Names: Tertiary butyl hydroperoxide, t-buty1 hydroperoxide

Lyondell is the largest producer of TBHP worldwide. Lyondell produces T-Hydro TBHP by autoxidation of isobutane at high temperature in the presence of oxygen suitable for diverse oxidation technologies. Lyondell’s epoxidation of propylene to propylene oxide accounts for the largest commercial application for TBHP. Producers of initiators use TBHP solution to synthesize many peroxide, dialkyl peroxide and perketal derivatives. The product itself serves as a free radical initiator for polymerizations, copolymerizations, graft polymerizations and curing of polymers.

1.2 Applications
T-Hydro TBHP provides a readily available and convenient source of active oxygen suitable for diverse oxidation technologies. Lyondell’s epoxidation of propylene to propylene oxide accounts for the largest commercial application for TBHP. Producers of initiators use TBHP solution to synthesize many peroxide, dialkyl peroxide and perketal derivatives. The product itself serves as a free radical initiator for polymerizations, copolymerizations, graft polymerizations and curing of polymers.
1.4 Physical Properties

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical State</td>
<td>Liquid</td>
</tr>
<tr>
<td>Color</td>
<td>Colorless</td>
</tr>
<tr>
<td>Boiling Point (°C)</td>
<td>96°C (205°F)</td>
</tr>
<tr>
<td>Molecular Weight</td>
<td>90.12</td>
</tr>
<tr>
<td>Freezing Point (°C)</td>
<td>-2.8°C (27°F)</td>
</tr>
<tr>
<td>Density @ 25°C (77°F)</td>
<td>0.933 g/cc</td>
</tr>
<tr>
<td>Density of Saturated Liquid</td>
<td>See Figure 1-1</td>
</tr>
<tr>
<td>Vapor Density</td>
<td>See Figure 1-2</td>
</tr>
<tr>
<td>Vapor Pressure</td>
<td>See Figure 1-3</td>
</tr>
<tr>
<td>Critical Temperature</td>
<td>351.4°C (664.6°F)</td>
</tr>
<tr>
<td>Critical Pressure (MPa)</td>
<td>16.4 (2382 psi)</td>
</tr>
<tr>
<td>Critical Volume</td>
<td>3.18 cm³ (cc)</td>
</tr>
<tr>
<td>Heat of Combustion (Kcal/mol)</td>
<td>-654 Kcal/mol</td>
</tr>
<tr>
<td>Heat of Vaporization (Kcal/mol)</td>
<td>See Figure 1-5</td>
</tr>
<tr>
<td>Heat Capacity of Saturated Liquid (Kcal/mol)</td>
<td>See Figure 1-6</td>
</tr>
<tr>
<td>Enthalpy of Saturated Liquid (Kcal/mol)</td>
<td>See Figure 1-7</td>
</tr>
<tr>
<td>Heat Capacity of Vapor (Kcal/mol)</td>
<td>See Figure 1-8</td>
</tr>
<tr>
<td>Enthalpy of Saturated Vapor (Kcal/mol)</td>
<td>See Figure 1-9</td>
</tr>
<tr>
<td>Surface Tension</td>
<td>See Figure 1-10</td>
</tr>
<tr>
<td>Thermal Conductivity of Saturated Liquid</td>
<td>See Figure 1-11</td>
</tr>
<tr>
<td>Flash Point (ASTM D7094)</td>
<td>38°C (100°F)</td>
</tr>
<tr>
<td>Auto Ignition (°C)</td>
<td>237.8°C (460°F)</td>
</tr>
<tr>
<td>Upper Flammable Limit (°C)</td>
<td>121°C (250°F)</td>
</tr>
<tr>
<td>Lower Flammable Limit (°C)</td>
<td>5.75 vol%</td>
</tr>
<tr>
<td>SADT (55-gal. drum)</td>
<td>77°C (171°F)</td>
</tr>
<tr>
<td>Phased Diagram</td>
<td>See Figure 1-12</td>
</tr>
<tr>
<td>Half Life (days)</td>
<td>See Figure 1-13</td>
</tr>
</tbody>
</table>

*1 Refers to pure tertiary butyl hydroperoxide.
*2 ASPEN estimate for T-Hydro Solution.
*3 Measured for T-Hydro Solution.
*4 Estimated from accelerating rate calorimeter data.
1. General Information

**Figure 1-7**  Enthalpy of Saturated Liquid as a Function of Temperature

**Figure 1-8**  Heat Capacity of Vapor (Ideal Gas) as a Function of Temperature

**Figure 1-9**  Enthalpy of Saturated Vapor as a Function of Temperature

**Figure 1-10**  Surface Tension as a Function of Temperature

**Figure 1-11**  Thermal Conductivity of Saturated Liquid as a Function of Temperature

**Figure 1-12**  Phase Diagram for Aqueous Tertiary Butyl Hydroperoxide

**Figure 1-13**  Half Life vs. Temperature TBHP-70 Decomposition in ARC™

**Figure 1-14**  Enthalpy of Saturated Liquid as a Function of Temperature
2. Occupational Health

2.1 Toxicity

See Safety Data Sheet for Toxicity information.

2.2 Occupational Exposure Limits

See Safety Data Sheet for Toxicity information.

2.3 First Aid

TBHP-70 is a respiratory, mucous membrane, skin and eye irritant. When an emergency arises, approach the incident with caution. Know emergency procedures, the location of rescue equipment and emergency contact numbers before the need arises. Persons who have been acutely exposed to TBHP and have received initial first aid procedures may require additional emergency medical treatment.

Employers are required by OSHA's Medical Services and First Aid Standard, 29 CFR 1910.151 to provide for medical personnel in cases of medical emergency and/or employee illness. In the absence of a clinic or local hospital, the employer may have first aid trained staff on site. If no medical personnel are located at the facility, prior medical emergency arrangements should be made with area hospitals or similar services. Employers should also provide copies of the MSDS and this Product Safety Bulletin and review these documents with appropriate medical personnel.

2.3.1 First Aid for Inhalation

If someone is overcome by exposure, assisting personnel should remove him or her to fresh air immediately. As needed, personnel trained in cardiopulmonary resuscitation (CPR) should give oxygen or artificial respiration. Once the person revives, assisting personnel should keep him or her warm and calm.

Medical personnel should monitor the patient for respiratory distress. If the person develops a cough or has difficulty breathing, medical personnel should evaluate him or her for respiratory tract irritation. If required, they may want to consider administering 100% humidified, supplementary oxygen.

2.3.2 First Aid for Eye Contact

Upon even minor eye contact, immediately flush eyes with clean lukewarm water for 20-30 minutes periodically holding eyelids open. Seek prompt medical attention.

2.3.3 First Aid for Skin

Upon skin contact of TBHP-70, flush skin with copious amounts of lukewarm water for at least 15 minutes preferably in a deluge shower. Remove clothing to minimize continued skin contact. Personnel providing assistance should remove the victim's clothing if he or she cannot. Finally, wash skin thoroughly with mild soap and water. Seek medical attention in the event of pain, reddening or irritation.

2.3.4 First Aid for Ingestion

If someone swallows even a minor quantity of TBHP-70, do not induce vomiting. Seek prompt medical attention or contact Poison Control Center.

2.4 Medical Management

2.4.1 Pre-Placement Medical Screen

Wearing personal protective equipment, such as respiratory protection and chemical protective clothing (see Sections 3.3 and 3.4), can potentially cause a significant increase in the work of the cardiorespiratory systems. Employees required to wear respiratory protection should be evaluated and approved for work by a medical professional as stated in 29 CFR 1910.134. The medical decision is based upon the practitioner's judgment, but commonly involves a targeted medical history and physical with particular reference to the cardiorespiratory system; pulmonary function studies and an assessment of cardiorespiratory fitness.

A new employee or one transferred to TBHP-70 service should be screened for any prior history of medical conditions that could place him or her at increased risk because of potential exposures to TBHP-70. In persons with impaired pulmonary function, particularly obstructive airway disease, the irritant properties of TBHP-70 can potentially exacerbate symptoms. Also, persons with existing eye diseases may be at increased risk of harm from exposure. Persons with existing skin disorders may be more susceptible to dermal irritant effects of TBHP-70.

2.4.2 Periodic Screening

For comparative purposes, provide periodic medical evaluations that essentially duplicate the pre-placement evaluation.
3. Personal Safety and Health

3.1 Site Facilities
If workers may potentially contact T-Hydro TBHP in storage and handling areas, work locations should contain:

- quick-drenching equipment such as deluge showers and eyewash stations
- washing facilities for cleaning before consuming food or beverages and before using tobacco or cosmetics
- properly ventilated areas for breaks or meals

Install, test and maintain the quick-drenching equipment according to the American National Standards Institute, Inc. (ANSI) Z358.1 (see Appendix B). Workers should know the location and operation of this safety equipment. Keep washing facilities and break or lunch rooms separate from those places in which workers handle chemicals.

3.2 Hygiene Practices
Workers should use proper personal hygiene and good work practices while working with and around T-Hydro TBHP. After working with or around the product, they should wash their hands with lukewarm water and mild soap or detergent. Wash used protective clothing and equipment. Keep washing facilities and break or lunch rooms separate from those places in which workers handle chemicals.

3.3 Site Facilities

Good industrial hygiene practices require that engineering and work practice controls be considered before implementing a respiratory program. Table 3-1 provides guidance for respirator selection.

3.4 Chemical Protective Clothing
Provide chemical protective clothing (CPC) to workers when there is potential for contact with T-Hydro TBHP during routine and non-routine operations. Select CPC according to the working conditions and the potential for contact with liquid or vapor. Choose CPC materials based on TBHP-70 chemical properties and the material’s chemical resistance, durability, flexibility, thermal limits and cleanliness.

3.4.1 Eye Protection
Because of T-Hydro TBHP corrosive properties, whenever a worker can have potential exposure to vapor or liquid, he or she should wear chemical safety goggles, cup-type plastic or gas-tight design, equipped with impact-resistant lenses. A face shield (8-inch minimum) may provide added splash protection. These eye-protective measures should meet ANSI Z87.1 specifications.

3.4.2 Head Protection
When there is danger from overhead leaks or spills, wear a hard hat that meets ANSI Z89.1 specifications.

3.4.3 Foot Protection
Wear rubber over-boots on top of leather shoes or boots to protect the feet from contamination and under pant legs to prevent the product from entering the boot.

3.4.4 Skin Protection
Options for protecting skin range from gloves and an apron to a full-containment suit and selection depends on the particular work activity. T-Hydro TBHP has not been tested against most CPC materials. Protective clothing made of nitrile rubber does not degrade upon contact with the product and, therefore, may be adequate. However, since the quality and thickness of the CPC may vary according to the manufacturer, evaluate product-specific permeation data before selection.

Where the potential for exposure to T-Hydro liquid exists, as in a spill cleanup or containment, workers should wear chemical resistant suits with non-wicking seams. Routinely inspect all suits to identify any damage that may compromise worker safety.

3.5 Direct Reading Instruments

Many direct reading instruments can readily analyze TBHP. The advantage of using direct reading instruments is providing real-time analysis and instantaneous air concentrations. Combustible gas indicators, infrared spectrophotometers, flame ionization detectors, photoionization detectors and portable gas chromatographs have successfully measured TBHP. The detection capabilities and calibration requirements vary between these instruments. Appendix I contains a partial list of product vendors. The proper selection, calibration, use and interpretation of the instruments require a trained professional.

<table>
<thead>
<tr>
<th>Condition (Vapor Concentration)</th>
<th>Respiratory Protection* (see Section 3.3) Recommended Above 1 ppm</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-10 ppm</td>
<td>A chemical-cartridge respirator with a half faceseal and organic/ vapor cartridge</td>
</tr>
<tr>
<td>11-50 ppm</td>
<td>A chemical cartridge respirator with a full faceseal and an organic/vapor cartridge</td>
</tr>
<tr>
<td>51-1,000 ppm</td>
<td>Any supplied-air respirator with a full faceseal, helmet or hood operated in a pressure-demand mode</td>
</tr>
<tr>
<td>Greater than 1,000 ppm or entry into unknown concentrations</td>
<td>SCBA with a full faceseal operated in pressure-demand mode</td>
</tr>
<tr>
<td></td>
<td>A combination respirator that includes a Type C supplied-air respirator with a full faceseal operated in pressure demand or other positive pressure or continuous flow mode and an auxiliary (5-minute) SCBA operated in pressure demand or other positive pressure mode</td>
</tr>
<tr>
<td>Fire Fighting</td>
<td>Any SCBA with a full faceseal operated in pressure-demand mode</td>
</tr>
<tr>
<td>Escape</td>
<td>Any escape SCBA</td>
</tr>
<tr>
<td></td>
<td>A chemical cartridge respirator with full face and an organic-vapor cartridge</td>
</tr>
</tbody>
</table>

* Only NIOSH-approved and NIOSH-certified equipment should be used.

3.6 Air Sampling and Analysis

Assessing worker exposure to T-Hydro TBHP requires an extended sampling period. An accepted method of air sampling is collection of the material on a silica gel tube. Appendix II documents the hydant method. A qualified professional should develop a monitoring program to include sampling strategy, quality assurance and statistical analysis of results.

Table 3-1: T-Hydro TBHP Respiratory Protection Selection Guide

3.9 Personal Safety and Health

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4. Engineering

This section provides guidelines for T-Hydro TBHP and is not a design handbook. Additional requirements are imposed by the Process Safety Management of Highly Hazardous Chemicals (29 CFR 1910.119). Facilities should review this standard. Mixtures of TBHP with other materials or compounds may significantly affect engineering practices, and require further studies to determine applicability of the following guidelines. Exercise competent chemical and engineering judgment and use qualified professionals to ensure specific requirements are met.

4.1 Bulk Storage
Lyondell storage tanks are constructed of 304 stainless steel (SS). Refer to Section 8.2 for information on diluent systems, nitrogen padding and relevant safety guidelines and standards. Design and construct tanks as atmospheric or low pressure vessels according to API 620 and 650 or a pressurized storage per ASME Code, Section VIII, Division I.

4.2 Piping
Piping and piping components should comply with the latest edition of ASME/ANSI B31.3 and NFPA 30. Lyondell has successfully used 304 SS. Avoid using threaded connections.

4.3 Electrical Area Classification
All electrical equipment and wiring installations used where T-Hydro TBHP is stored or handled must conform to Class I, Group C.

4.4 Pump Specifications
Lyondell has successfully used single mechanical seal, centrifugal pumps. If additional safety, performance or environmental considerations require reduced fugitive emissions, multiple mechanical seals with a flush fluid compatible with T-Hydro TBHP (such as demineralized water) may be preferable. The preferred casing and impeller materials are austenitic SS or their cast equivalents.

4.5 Instrumentation
As a minimum, instrumentation generally includes pressure, liquid temperature and level indicator devices on vessels. Instruments can be pneumatic or electronic, using nitrogen or air. Instrument fluids should be compatible with T-Hydro TBHP; leaks may result in a reaction and rapid pressure build up. Oxygen service instruments are generally acceptable and should have minimum hold up and safety venting/blow out provisions.

4.6 Relief Requirements
Emergency venting should conform to the requirements in API RP-2000. Flame arresters, when required, should meet the requirements of API RP-2028 and 2210 and UL 525. Pressure relieving systems for pressure vessels should follow API RP-520 parts 1 and 2. Design an overpressure relief system adequate for a possible cool flame combustion (see Section 8.2.1).

4.7 Leak Detection Devices
In areas where potential leaks are not immediately obvious, instrumentation able to detect TBHP vapors in air (see Section 3.5) can be used.

4.8 Material Guidelines
Use only dry, moisture free nitrogen for T-Hydro TBHP service.

<table>
<thead>
<tr>
<th>Part</th>
<th>Material</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gaskets</td>
<td>Spiral wound: Teflon filled, type 316 SS windings and inner ring, carbon steel outer ring per API 601</td>
</tr>
<tr>
<td>O-rings</td>
<td>Teflon, Kalrez or Chemraz 505 subject to process temperature limitations</td>
</tr>
<tr>
<td>Pipe Thread</td>
<td>Teflon tape when threaded connections are unavoidable</td>
</tr>
<tr>
<td>Pump Seals</td>
<td>For mechanical seals stationary faces: tungsten carbide, silicon carbide</td>
</tr>
<tr>
<td>Valve Packing</td>
<td>Die-formed rings: Teflon</td>
</tr>
<tr>
<td>Hoses</td>
<td>316 SS double braided, bellows type with 316 SS two-way automatic shut off, quick disconnects. All hoses must have suitable pressure and temperature ratings</td>
</tr>
</tbody>
</table>

4.9 Chemical Compatibility
T-Hydro TBHP is compatible with glass, austenitic SS and their cast equivalents, polyethylene and Teflon material. T-Hydro TBHP should not contact mild steel, copper and its alloys (e.g., brass or bronze), zinc and galvanized steel or other zinc plated metals, aluminum, cast iron, wood or other carbonaceous materials such as composition gaskets due to contamination hazards (see Section 1.3.3).
5. Fire Safety

5.1 Fire and Explosion Properties

The flash point for T-Hydro TBHP is 38°C (100°F) and the boiling point is 96°C (205°F). Based on these properties along with many others shown in Section 1, various U.S. organizations have classified T-Hydro TBHP fire and explosive properties. The following table provides the hazard classifications:

<table>
<thead>
<tr>
<th>Organization</th>
<th>Hazard Classification</th>
</tr>
</thead>
<tbody>
<tr>
<td>NFPA Code 30</td>
<td>flammability: Class II, combustible liquid</td>
</tr>
<tr>
<td>NFPA Code 43B</td>
<td>reactivity: Class I, organic peroxide*</td>
</tr>
<tr>
<td>NFPA Code 70</td>
<td>flammability: Class I, Group C</td>
</tr>
</tbody>
</table>

If T-Hydro TBHP is concentrated, explosions are possible. Dilution with water to a 65% solution (maximum) may be used to prevent potentially hazardous concentrations during a fire.

5.2 Fire Fighting Measures

Fire fighters must protect themselves against TBHP vapor or liquid as well as carbon monoxide and isobutylene released from incomplete combustion. Fire fighters should use full protective clothing and equipment, including self-contained breathing apparatus (see Section 3).

If a leak or spill has not ignited, blanket with fire fighting foam. Prevent flow to sewers and public waters. Cool with water fog or spray any stored flammables that are exposed to an external fire so the containers do not explode and add to the fire hazard.

A qualified fire safety professional should decide whether a fire should be extinguished or allowed to burn. The basis for this decision should be:

- the fire's proximity to T-Hydro TBHP storage vessels
- the degree to which the product container is protected from the heat of the fire
- the potential for explosion
- the degree of containment of the burning material

In addition, weigh the hazards from exposure to combustion products against those from exposure to unburned vapor.

Apply water from a safe distance upward of the fire. Evacuate all personnel not directly involved with controlling the fire to a safe location.

If T-Hydro solution spills on the ground, contain it as quickly as possible, as TBHP runoff may be an environmental hazard (see Section 7). Follow design criteria, handling procedures and training to prevent leakage or vapor releases.

5.3 Fire Prevention

Follow design criteria, handling procedures and training to prevent the concentration of T-Hydro TBHP. Prevent steam purging of systems until they are properly flushed with a suitable solvent such as mineral oil, kerosene, tertiary butyl alcohol or water, as steam may concentrate residual TBHP to unstable levels. In the selection of solvents, consider the contamination hazards in Section 1.3.3. Keep storage and handling areas free of ignition sources including heat, sparks, flames and static electricity. Design such areas to prevent ignition or exposure to fire (see Section 8).

Adopt a comprehensive program for fire prevention. The following management systems contribute to such a program:

- electrical equipment and wiring installations used where T-Hydro TBHP is stored or handled should conform to Class I, Group C as specified in NFPA 70
- maintenance of effective bonding and grounding of metallic storage or receiving containers
- use of trained, qualified operating and mechanical personnel
- periodical inspection, testing and maintenance of all safety-critical items; e.g., sensors, alarms, controls and flame arresters
- inspection and maintenance of elastomeric parts
- enforcement of a “No Smoking” policy in TBHP storage or handling areas
- stringent use of welding, cutting and burning (hot work) permit systems

5.4 Fire Fighting Planning

Facilities using internal fire brigades should follow the OSHA Fire Brigade Standard (29 CFR 1910.156). This standard includes information on organization, personnel qualifications, fire-fighting equipment and training requirements.

Facilities using community fire companies should provide them with information on T-Hydro TBHP operations and storage, including an illustration of storage locations and quantities of TBHP present. Periodically, conduct drills with the fire company and regularly update facility information.

Any facility using T-Hydro TBHP should plan to deal with emergencies, including the potential for serious fires and community evacuation. Preplanning, drills and effective communication with local fire and police departments contribute to effective emergency responses.

After fire has been extinguished, any residual TBHP should be cleaned up to prevent another fire or environmental contamination. Individuals involved in this work should be thoroughly trained in proper techniques, be correctly protected and use appropriate equipment (see Section 3). Water runoff from TBHP fires may be subject to operating permit and local/national regulations covering environmental releases and ignitable hazardous waste (see Section 7).
6. Hazard Communication

6.1 OSHA Hazard Communication
Under Hazard Communication and Right-to-Know Laws, workers and communities should be informed of the potential hazards of T-Hydro TBHP. At the federal level, the OSHA Hazard Communication Standard 29 CFR 1910.1200 requires that employers using hazardous chemicals in their workplace develop written programs and train workers on potential hazards.

6.2 Worker Training
The OSHA Standard 29 CFR 1910.1200 requires employers to provide information and train employees on its hazards, methods for detecting releases and methods of protection from exposure. This bulletin, and in particular, Sections 1, 2, 3 and 5 provide much of the primary information which should be used to develop your compliance program. The Lyondell MID is another important primary and concise source of information and contains a label information page. You must supplement this bulletin and the MID with information on other potential hazards arising from specific circumstances related to your facility and intended use of the product.

6.3 Labeling
Labeling is an important communication tool. Containers of T-Hydro TBHP or mixtures containing greater than or equal to one percent T-Hydro TBHP must be labeled according to the OSHA Hazards Communication Standard. Section 11.2 presents the DOT (Department of Transportation) labeling requirements.

6.4 Emergency Planning
The Emergency Planning and Community Right-To-Know Act of 1986 (also referred to as the Superfund Amendments and Reauthorization Act or SARA Title III) does not list TBHP as a hazardous substance and therefore does not have a reportable quantity (RQ) under this law. Facilities which use or store TBHP must notify their local emergency response authorities and work with them to develop emergency response plans. Companies within the EU should comply with the requirements of Directives 82/501/EEC and 88/100/EC relating to major accident hazards of certain industrial activities including production and storage sites, covering emergency planning and information communication to the public. Companies outside the EU may have equivalent regulations. Companies should check their local and national regulations and ensure they comply with the requirements.

6.5 National and State Regulations
National regulations may have different or more stringent requirements regarding hazard communication. Countries within the EU will have legislation complying with the requirements of Directive 89/391/EEC, while others will have equivalent legislation, protecting workers from the hazards of exposure to chemicals. National regulations should be reviewed in order to assess the applicability of these regulations to the use of TBHP. States also have adopted Right-to-Know Laws. To assist your compliance with these and other laws, Appendix IV contains a partial listing of the relevant regulations.

T-Hydro Solution Label Information

Manufacturer: Lyondell Chemical Company
1221 McKinney Street
Houston, Texas 77010

Telephone Numbers
Emergency: +1-800-424-9180 Chemtrec
+1-800-245-4532 North America
+31-0-10-275-57-77 Europe

User Statement: For industrial use only. Keep out of the reach of children

Signal Word: Danger

Physical Hazards: Combustible, reactive

Health Hazards:
Inhalation hazard
Corrosive to skin
Corrosive to eyes
Ingestion hazard
Mucous membrane irritant
Skin contact hazard

Precautionary Measures:
Do not handle near heat, sparks or open flame
Do not get in eyes
Avoid prolonged or repeated breathing of vapor
Avoid contact with skin
Use only with adequate ventilation/personal protection
No contact with oxidizable materials

Prevent contact with food, chewing or smoking materials

DOT Information
ID Number: UN 3109 Packing Group-II
Hazard Class: 5.2 (8) (3)

Proper Shipping: Organic Peroxide type F, Liquid
Contains 70% tert-butyl hydroperoxide in water

Component Name: tert-Butyl hydroperoxide
CAS Number: 75-91-2
CAS Number: 7732-18-5

In case of fire:
Water spray, water fog, alcohol type foam or dry chemical.

In case of spill:
Reactive material. Release can cause fire, explosion, health and/or environmental hazards. Extinguish all ignition sources. Use foam or water spray. Impound/recover large land spill. Soak up small spill. Report per regulatory requirements.

First Aid
Inhalation:
If overcome by exposure, remove victim to fresh air immediately. Give oxygen or artificial respiration as needed. Obtain emergency medical attention. Prompt action is essential.

Eye Contact:
For even minor eye contact, immediately rinse with clean water for 20-30 minutes. Retract eyelids often. Obtain emergency medical attention. Prompt action is essential.

Skin Contact:
For even minor contact, immediately remove contaminated clothing and flush with lukewarm water for 15 minutes. Wash skin thoroughly with mild soap/water. Seek medical attention in the event of pain, reddening or irritation.

Ingestion:
If swallowed, do not induce vomiting. Seek prompt medical attention.

Protective Equipment
Respiratory:
Use NIOSH/MSHA approved full face air-purifying or supplied air respirator as appropriate.

Eye:
Both chemical splash goggles and face shield.

Skin:
Impervious protective suit plus impervious gloves, boots and full head/face protection.
The primary pathways for TBHP removal from soils probably are biodegradation and transport to groundwater. TBHP has a calculated log Kow value of -1.30, which indicates that TBHP is not biodegradable and toxic to aquatic organisms. TBHP is not listed as a priority pollutant under the Clean Water Act. TBHP is not a Hazardous Air Pollutant (HAP) under the Clean Air Act (CAA) of 1990. It is not a Hazardous Liquid Organic Compound (VOC) under the Resource Conservation and Recovery Act. TBHP is subject to the new regulations for ozone non-attainment areas. These regulations, which vary by area depending on the severity of non-attainment, require emission controls on industrial sources of VOCs. Any facility with the potential to emit TBHP may be subject to emission control requirements.

These regulations, which vary by area depending on the severity of non-attainment, require emission controls on industrial sources of VOCs. Any facility with the potential to emit TBHP may be subject to emission control requirements. TBHP is not specifically regulated under the EPA pretreatment standards. TBHP may be subject to case-by-case determination of NPDES permit limits.

The discharge of wastewater containing TBHP (as with most pollutants) to waters of the United States is regulated under the National Pollutant Discharge Elimination System (NPDES) permit program of the Clean Water Act. TBHP is not listed as a priority pollutant under this Act, and Federal Water Quality Criteria for the protection of human health and/or aquatic organisms have not been developed for this material.

TBHP is not specifically regulated under the EPA pretreatment standards. TBHP may be subject to case-by-case determination of NPDES permit limits.

7.2 Waste Management
7.2.1 Waste Classification
Wastes containing TBHP, which are defined as solid wastes (see 40 CFR Part 261), may be classified as characteristically hazardous if the flash point is below 60°C (140°F) or characteristically reactive. Solid wastes containing TBHP may include, but are not limited to, contaminated water, soil and debris, process wastes and empty containers. TBHP wastes may be defined as ignitable (D001) and/or reactive (D003) hazardous wastes based on the TBHP concentration. State regulations may have more restrictive definitions and should be reviewed.

7.2.2 Spill Prevention and Response
Facilities using T-Hydro TBHP (as with other organic liquids) should have a comprehensive spill prevention and emergency response plan developed and implemented. This plan should address spill detection methods, emergency notification procedures, community contacts for notification and advice on evacuation needs, fire prevention and protection, provisions for spill containment and cleanup, environmental protection and compliance with applicable national, state and local regulations.

Design facilities involved in the storage and/or handling of T-Hydro TBHP to contain and/or control spills from process areas and transfer operations. Minimize soil, surface water and groundwater contamination from an accidental spill by installing curbs, sumps and impervious containment areas. Appropriate materials of construction for containment areas include concrete, compatible synthetic liners or compacted clay. A dual liner system may be desirable in environmentally sensitive areas.

Pumps, piping and equipment designed to operate within potential spill areas should be compatible with T-Hydro TBHP (see Section 4) and free of potential ignition sources. If possible, all pumps and ancillary equipment should be located outside the primary containment area and should be provided with curbing to collect drips, leaks and minor spills. In the event of a T-Hydro TBHP spill, evacuate all non-essential personnel and extinguish all ignition sources immediately (see VZ-STEL in Section 5.2). Prevent flow to sewers or public waters and contain spill. The spill can be covered with fire fighting foam to minimize evaporation and potential fire hazards.

In the event of a secondary spill, spill the contents into a lined waste pit and注明出处 away from any potential fire hazards. The pit contents are disposed of according to applicable regulations.

In the event of a release to the environment of 100 pounds or more of a characteristic hazardous waste containing TBHP in the United States (see Section 7.2.1), notify the National Response Center at 1-800-424-8802. Other national, state and/or local reporting requirements may also apply.

7.3 Waste Handling, Storage and Disposal
Users must comply with National regulations on the handling, storage and disposal of hazardous waste. In the United States, EPA regulations at 40 CFR Parts 262-272 apply to the storage, handling, treatment and disposal of hazardous wastes. OSHA regulation 29 CFR Part 1910.120 (Hazardous Waste Operations and Emergency Response or HazWoper) applies to personnel engaged in hazardous material activities such as spill response under CERCLA, cleanup operations under RCRA, hazardous waste storage operations and emergency response. Training and management requirements are also given under RCRA. Shipment of waste is governed by Department of Transportation (DOT) rules. In the EU, Directives 91/156/EEC and 91/689/EEC cover waste management, waste disposal and environmental protection. Countries outside the United States and the EU may have similar regulations. Users of T-Hydro TBHP who generate, store, reclaim or tender for transportation and dispose any hazardous waste should review these regulations for applicability. Hazardous waste may be held on site for up to 90 days without a RCRA permit, provided that the waste is placed in approved containers and stored in clearly identified areas. Design hazardous waste storage areas to collect any spillage in a separate section. Clearly label, date and inspect containers stored in such facilities. Prevent stored wastes from contacting incompatible materials and causing an uncontrollable decomposition or reaction in the storage container. Inspect hazardous waste areas regularly. State regulations may specify additional design requirements for hazardous and non-hazardous waste accumulation areas.

Aqueous waste streams with higher concentrations of TBHP or contaminated soil or debris may be incinerated. Avoid contacting TBHP waste streams with incompatible materials (see Section 4.9) that could cause an uncontrollable decomposition or reaction. Concentrated liquid waste may be reacted harmlessly by combining with dilute (less than 10%) sodium bisulfite (reducing agent) and alkaline solution, mixing thoroughly until reaction heat dissipates. Resulting solution may be biologically treatable. Assure efficient compliance with applicable regulations.

Characteristic hazardous wastes require disposal at permitted facilities and are subject to land disposal restrictions under RCRA requirements (40 CFR 268). The disposal of non-hazardous wastes on land may also be regulated under this program.

Containers used to hold T-Hydro TBHP must be drained and then thoroughly rinsed with water. Collect and properly dispose of rinse water generated by this washing. It may be desirable to complete a certificate of cleaning for documentation that the containers were appropriately cleaned and can be reused. Any container which has not been completely washed should be considered a potential fire or explosion risk and should not be cut, burned, soldered or welded.
8. Product Storage

Considerations in the design and construction of organic peroxide storage facilities include physical hazards and potential environmental, health and safety effects. Specific design requirements for facilities receiving, storing and handling T-Hydro TBHP depend on the following:

- types of containers used (drums or bulk)
- mode of delivery
- processing methods
- quantities of T-Hydro solution stored and handled
- characteristics of materials stored and handled nearby
- the character of the adjacent community
- risks posed by adjacent facilities

8.1 Drum Storage

Lyondell currently uses a packaging code UN1H1/Y1.8/100 polyethylene drum (see Section 11.3.2). The three classifications of drum storage facilities are: segregated, cut-off and detached. Segregated storage areas are in the same interior area, separated by distance from incompatible materials. Cut-off storage is an interior area separated by walls. Detached storage areas are in an exterior area, separated by distance from incompatible materials. Cut-off areas that meet the requirements of NFPA 13 and 15 and have automatic sprinkler protection, storage capacities are unlimited.

Cut-off storage areas should be one-story construction without basements or crawl spaces and should have automatic sprinklers and vents to discharge decomposition gases. All storage areas of noncombustible construction require automatic sprinkler protection when quantities of T-Hydro TBHP or a combination of Class IV peroxides exceed 200,000 pounds. Discharge densities and design requirements are the same as those specified for segregated storage areas. Walls common with other buildings should have two-hour fire resistance ratings.

Detached storage buildings should be single-story construction without basements or crawl spaces. Provide buildings with vents to discharge decomposition gases. Detached storage areas with a minimum 50 foot separation from normally occupied buildings and property lines require automatic sprinkler protection when quantities of T-Hydro TBHP or a combination of Class IV peroxides exceed 300,000 pounds. Discharge densities and design requirements are the same as those specified for segregated storage areas.

Lyondell discourages outside, unprotected drum storage of T-Hydro TBHP.

8.2 Storage Tanks

Considerations in site selection and tank spacing include:

- their proximity to other flammable material storage facilities
- nearby ignition sources
- fire fighting accessibility
- potential consequences of a release beyond the plant boundaries
- spill containment
- product segregation
- environmental compliance

Installations should comply with NFPA 30, 43B and 70.

Figure 8-1 Typical Atmospheric Storage Tank Configuration

Design and construct T-Hydro TBHP tanks as low pressure or atmospheric vessels according to API 620 and 650 or as pressurized storage per ASME/ANSI Section VIII, Division 1. If the vessel is cladded, caution should be used to ensure the cladding does not crack or separate from the shell, providing a site for decomposition to occur. Thermal protection and relief valves should be installed on long pipe runs. Figures 8-1 and 8-2 illustrate typical TBHP tank designs.

The EPA has issued Standards of Performance (40 CFR 60.110) that regulate the storage of volatile organic liquids (VOLs). These regulations specify certain storage tank roof construction as well as emission-control and monitoring devices. Because T-Hydro TBHP vapor pressure exceeds 0.75 psia at the recommended maximum storage temperature of 38°C (100°F), vessels with a capacity greater than or equal to 40,000 gallons are subject to 40 CFR 60.110. Because the vapor pressure is below 4.0 psia, storage vessels with less than 40,000 gallons are exempt from special roof construction and closed vent requirements.

Floors with open space located below the T-Hydro TBHP storage area should be water tight and equipped with drainage away from the storage area. Provide segregated areas storing more than 100,000 pounds of TBHP with automatic sprinkler protection designed to provide 0.25 gpm per square foot over a 3,000 square foot area for wet pipe sprinkler systems or a 3,900 square foot area for dry pipe sprinkler systems. For segregated areas that meet the requirements of NFPA 13 and 15 and have automatic sprinkler protection, storage capacities are unlimited.

Installations should comply with NFPA 30, 43B and 70.
In spite of the safety of T-Hydro solution relative to other peroxides, testing has shown that under conditions where TBHP is concentrated in the liquid, explosions are possible. Lyondell recommends taking one of these two precautions to lower this risk: 1) provide for water dilution or 2) add a combustion modifier. Water injection acts as a diluent to prevent TBHP from concentrating during a fire. To allow for safe dilution without overfilling, the liquid level should be limited to approximately 70-80% of the tank volume. Water dilution or combustion modifiers do not prevent flammability in the vapor phase.

Addition of a combustion modifier entails installing polyethyleneroatix saddles which capture free radicals. These saddles are three inch, low density polyethylene having a melt index (ASTM D 1238-82 Condition E) above 0.2 grams per 10 minutes. The quantity of PE saddles to T-Hydro TBHP ratio should be greater than 0.0123 by weight. Visually inspect and check the melt index of the saddles on a regular basis, at a minimum of once every year. Replace them when discoloration, fracture, severe deformation, low melt index or other indication of change is noticed.

8.2.1 Venting
Normal venting allows the tank to breathe due to liquid withdrawal or addition and thermal changes. Conservation venting reduces evaporative losses. Typical venting systems for T-Hydro TBHP include vapor collection and containment.

The vapor-air mixture above T-Hydro liquid is not flammable when the temperature is below 38°C (100°F). However, as decomposition occurs, oxygen is formed above the liquid. Sweeping the tank with nitrogen will increase the flammable temperature in the vapor-nitrogen mixture to 74°C (165°F) and should provide a safe condition in the vapor space. (Refer to Figure 8-1 and Figure 8-2). Because decompositions is low the absence of contaminants, the oxygen is small. A water scrubber can recover residual TBHP from the vent gases if a containment system is not in place. Although the tank is provided with nitrogen sweep, a vacuum relief system is also important.

Use over-pressure relief systems that provide adequate protection. Exposing a tank to an external fire can cause high pressures resulting in a boiling liquid expanding vapor explosion (BLEVE). To prevent these explosions, provide adequate pressure relief which allows the vapors to escape and burn at the vents and thereby prevents tank rupture. Pressure relief can entail additional self-closing breather valves, loose manhole covers that lift under pressure, gauge hatches, hinged manhole covers, rupture discs or commonly used emergency relief valves. The roof-to-shell seam of a vertical cone roofed tank should be more weakly constructed than the bottom-to-shell seam. This design prevents failure at the tank bottom and the resulting release of a liquid flood. Refer to NFPA 1910.106 for the emergency management. Lyondell uses an emergency relief valve and a lifting-type manhole cover.

8.2.2 Draining and Diking
Situate tanks within containment systems that can detect and control releases from any tank connection or from piping to and from the tank. Consult API-2350 for proper design considerations for overfill prevention.

Dikes should have a capacity as large as the worst credible accidental release plus 10 percent volume for flush and rain water. Dike walls should be not less than these feet high inside or more than six feet high above the interior grade. The six-foot limit prevents vapor accumulation in stagnant areas and avoids possible asphyxiation or explosions. Include drain valves in the design. During normal operations, all drain valves should be in a closed position with fire walls to prevent the spread of fire. If possible, locate all pumps and ancillary equipment outside the primary containment area and provide with curbing to collect drips, leaks and minor spills. Materials within the same diked tank area should be compatible. Slope drainage surfaces around tanks towards collection basins or sumps. Ensure that all materials and compositions collecting in basin or sumps are compatible under all possible spill scenarios. Incorporate tanks bottom supports with a passive leak detection system. NFPA 30 contains diking requirements, such as slopes, remote impounding and construction recommendations.

If the composition of accumulated liquids is acceptable to the designated tank or disposal system, dispose of them in the presence of a trained field operator. Refer to NFPA 60, Subpart Kb, for monitoring, record-keeping and inspection requirements.

8.3 Off-Loading Stations
For fire protection, worker safety and environmental protection, instrumentation at off-loading stations to warn operators of the potential overfilling and a totally independent device to shut off flow whenever overfill is imminent should be installed. Neither device should replace regular operating tools for determining tank level.

As part of the off-loading procedure, test the shutoff device prior to each use. Locate loading racks at least 150 feet from all equipment and tanks. Electrical wiring and devices should comply with the requirements of NFPA 70. Piping should comply with NFPA 30 and the latest version of ASME/ ANSI B31.3.

Curb the unloading area to divert spillage into the drainage system and prevent runoff into surrounding areas. Locate unloading stations at elevations lower than surrounding areas to avoid releasing liquid into adjacent areas. Make provisions to protect surface and ground waters from release contamination. Segregate adjacent unloading areas by curbing. Construct the unloading area surface (both under and around the bulk transport vessel) with an impermeable membrane or bulk installed over an impermeable barrier suitable for T-Hydro TBHP retention. Pitch drainage surfaces towards a collection basin or sump.
9. Transfer Operations

Detailed site specific procedures and checklists should be written by persons who understand both T-Hydro TBHP hazards and proper operating procedures. Only properly trained workers should perform unloading and transfer operations.

9.1 Work Preparation

When unloading vessels or containers, workers should have the following equipment and supplies available:

- Non-sparking tools
- Unloading block valve
- Grounding system

Before unloading, check and inspect the appropriate safety equipment (see Sections 3.3, 3.4 and 5.3). Place appropriate barriers and warning signs. Determine that sufficient tank capacity (ullage) is available to accept the shipment. Ensure that all high-level warning devices are activated and functioning. Verify that the material is T-Hydro TBHP by confirming that the identification number on the tank car is UN 3109 and by review of the shipping manifest or sample verification.

Visually inspect containers for structural damage or tampering in transit. Wet spots may be an indication of leaks. Look for evidence of discharge from pressure relief valves.

9.2 Drums

Properly bond and ground the line, pump and equipment. Figure 9-1 shows a typical drum unloading configuration. Exposures can be reduced by using local exhaust ventilation connected to a vapor collection or scrubber system. Nitrogen supply with pressure regulator and check valve will reduce flammability hazards. Use a “wand” or dip tube to empty from the bottom of the container. When moving the wand to the next drum, use care to prevent drips. Use a bucket of water to catch the drips. For disposal of collected waste, see Section 7. Do not pressurize any drum. When a drum has been emptied, replace its bung as soon as possible.

9.2.1 Unloading Procedures

To safely off-load a drum, the following procedure should be considered (see Figure 9-1).

1. Gather all additional necessary equipment. For drum unloading:
   a. An air-operated drum pump or Class I Group C electric motor pump should be used (see Section 4.4).
   b. Stainless steel double-braided accordion type hose with two-way shutoff quick disconnect couplings should be used if possible.
2. Purge all lines and connections with nitrogen before transfer of T-Hydro TBHP.
3. Visually inspect hoses and fittings prior to use.
4. Set drum on its end with the bungs at the top. Save all bungs for resealing the drum when empty.
5. Check that drums and equipment are properly grounded and bonded. Specifically design such systems to maintain continuity to earth ground.
6. Loosen the 0.75-inch bung cautiously to reduce pressure in the drum.
7. Carefully remove the two-inch top bung.
8. Connect the nitrogen line to the 0.75-inch bung. Place the unloading pump into the two-inch opening with the flexible hose connected to the pump and the unloading valve. Do not make any mechanical connections between the drum and pump to prevent pressurization of drum.
9. Open unloading valve and start nitrogen flow.
10. Engage pump to start transfer of material. Periodically check pump for leakage during use.
11. When the drum is empty, close the unloading valve and shut off the nitrogen source.
12. Disconnect unloading and nitrogen lines. Replace bungs.
13. Dispose of drum in compliance with existing federal, state and local regulations (see Section 7.2).
9. Transfer Operations

9.3 Tank Trucks

Lyondell ships T-Hydor TBHP in Department of Transportation specified (DOT 412) cargo tank motor vehicles with a nitrogen pad (see Figure 9-2). The nitrogen pressure should be low enough so total pressure does not exceed the relief valve setpoint of 25 psig. The specification prohibits bottom outlets. The tank trucks contain AYALCOY polyethylene saddles as a combustion modifier. If possible, locate the loading facility in a relatively remote, level location, distant from general activity. Refer to 49 CFR 177 Subpart B for information on unloading regulations.

The following procedures are comparable to those used by Lyondell for unloading tank trucks and can be used as a basis for developing site-specific procedures. A suggested unloading checklist is provided in Figure 9-3.

9.3.1 Unloading Preparation

The following procedures prepare the tank truck for unloading:

1. Gather all necessary equipment. For tank truck unloading, also include road barriers, warning lights and/or wheel chocks (this should be checked).
2. Instruct driver to position tank truck for unloading at designated station, then set brakes, shut off engine and leave cab. The driver should remain in a designated area.
3. Safeguard truck from nearby traffic by putting up road barriers or warning lights.
4. Check both sides of one tank truck wheel.
5. Connect ground cable and check for electrical continuity.
6. Remove and read the label attached to the tank truck’s outlet valve to confirm that its contents are T-Hydor TBHP.
7. Visually inspect hoses and fittings prior to use.
8. Determine that the receiving storage tank has sufficient capacity (ullage) to hold the entire contents of the tank truck.
9. Identify all pipelines so that proper valve alignment can be made.
10. Determine that the unloading station’s spill-collection sump drain is closed and substantially free of accumulated liquid.

9.3.2 Unloading Procedures

The unloading procedures for tank trucks are:

1. Connect liquid transfer line to unloading valve and nitrogen line to vapor valve. Stainless steel double-braided accordion-type hoses with two-way shutoff, quick-connect couplings are preferred. If these couplings are not used, purge all lines and connections with nitrogen before transferring.
2. Open nitrogen supply valve and the tank truck vapor valve. Adjust nitrogen pressure to no more than 20 psig on tank truck. Nitrogen pressure and/or a pump may be used to unload.
3. Verify seal number on truck matches seal number on BOL. Open the unloading valve and, if used, the pump intake valve, allowing liquid to fill the pump. The unloading valve must be opened slowly to avoid activating the excess now valve. Start pump and begin pumping into the storage tank. Maintain positive pressure of at least 10 psig on the tank truck to keep from pulling a vacuum. Closely monitor this operation.
4. Immediately make a visual check for leaks, especially at places where seals and O-rings are present. If leaks are observed, shut down immediately and take remedial action.
5. Check to determine that the receiving tank level is rising at the expected rate for the transfer system.
6. Monitor the transfer. When the tank truck is empty, close pump discharge valve and immediately shut off pump.
7. Blow the transfer lines clear. Close all valves and vents. Vent pressure from transfer lines. Disconnect liquid transfer and nitrogen lines.
8. Pad with slight nitrogen pressure (3–5 PSIG).
9. Ressal valve with wire cable seal and record seal number on paperwork.

9.3.3 Release of Empty Truck

The following steps complete the process of unloading tank trucks:

1. Disconnect the ground cable. Remove the wheel chocks and traffic control devices.
2. Ensure that tank truck placards meet DOT requirements for the return trip.
3. Release the vehicle to the driver.
4. If there were any mechanical problems with the tank truck, advise LyondellBasell Customer Service North America +1-888-777-0232 or Europe +33-3-4424-8035.

Figure 9-2 Typical Tank Truck Configuration

Figure 9-3 TBP70 Solution Unloading Checklist

<table>
<thead>
<tr>
<th>Tank Truck Number</th>
<th>Date:</th>
<th>Time:</th>
</tr>
</thead>
</table>

Prior to Unloading Tank Truck

<table>
<thead>
<tr>
<th>Wheels checked and parking brakes engaged</th>
<th>Ground cable to truck connected and checked for continuity</th>
<th>Check bill of lading &amp; labels to confirm contents</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Eyebath and safety shower flushed and ready</th>
<th>Inspected for leakage around valves and fittings</th>
<th>Storage tank capacity and tank truck liquid level determined before filling</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Liquid unload and vapor return lines connected, pumped and tested for leaks</th>
<th>Proper piping alignment made and checked</th>
<th>Someone in attendance during transfer</th>
</tr>
</thead>
</table>

After Unloading Tank Truck

<table>
<thead>
<tr>
<th>When tank truck is empty, shut down the pump</th>
<th>Transfer line blased clear</th>
<th>Unloading line valve closed to the storage tank</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Nitrogen pad pressure on truck</th>
<th>Tank truck vapor valve and liquid unload valve closed</th>
<th>Transfer line vented of pressure</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Transfer and nitrogen lines disconnected</th>
<th>Inspected for leakage around valves and fittings</th>
<th>Ground cable disconnected, labels checked</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Wheel chocks removed</th>
<th>Wheel chocks removed</th>
<th>Wheel chocks removed</th>
</tr>
</thead>
</table>
9. Transfer Operations

9.4 ISO Tanks

Lyondell ships T-Hydro TBHP in intermodal bulk transport tanks meeting the T2.3 portable tank specifications. The relief valve setting is 10.9 psig as required by DOT and UN regulations. Portable tanks contain INTELEOX polyethylene saddles as a combustion modifier. The unloading valve is located at the top of the tank (see Figure 9-4). International Organization for Standardization (ISO) tank work preparation and unloading procedures are essentially the same as those in Section 9.3.

Figure 9-4 Typical IMO Tank Configuration

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10. Tank Cleaning and Equipment Repair

10.1 Work Preparation

Proper preparation for cleaning or maintaining T-Hydro TBHP storage vessels and equipment by fully trained workers can help prevent fire or harm to workers or the environment. Establish a hazardous-work permit system before performing any maintenance or inspection activities involving hot work (29 CFR 1910.119, lockout/tagout (29 CFR 1910.146 see Appendix B for citations). The permit should identify all job-related hazards and include a work plan to address them. For information on precautions during hot work, cutting and welding in organic peroxide storage areas, refer to NFPA 30, 43B and 51B. Use engineering controls and appropriate PPE (see Section 3).

Experienced, trained workers should conduct T-Hydro TBHP equipment cleaning in compliance with a written, approved procedure. Review of the procedure should include a hazards analysis, such as a job safety analysis (JSA), to identify hazards and necessary protective measures. The emptying of T-Hydro TBHP vessels or storage tanks can present danger of ignition, toxic vapors and improper disposal of the drained solution. Before opening tanks and equipment that contain T-Hydro solution, empty all liquid. Blow down lines with nitrogen and then rinse with water or suitable solvent to clear out any residual T-Hydro solution. Because steam may concentrate residual T-Hydro TBHP to unsafe levels, do not use it to clean or purge lines or vessels unless they have been properly flushed with a suitable solvent such as mineral oil, kerosene, tertiary butyl alcohol or water. In the selection of solvents, consider the proper preparation for cleaning or maintaining T-Hydro TBHP to unsafe levels, never use it to clean or purge lines or vessels unless they have been properly flushed with a suitable solvent such as mineral oil, kerosene, tertiary butyl alcohol or water. In the selection of solvents, consider the contamination hazards. Never use acetone or other ketones to clean TBHP to unsafe levels, never use it to clean or purge lines or vessels unless they have been properly flushed with a suitable solvent such as mineral oil, kerosene, tertiary butyl alcohol or water. In the selection of solvents, consider the contamination hazards. Never use acetone or other ketones to clean TBHP to unsafe levels.

Before opening tanks and equipment that contain T-Hydro solution, empty all liquid. Blow down lines with nitrogen and then rinse with water or suitable solvent to clear out any residual T-Hydro solution. Because steam may concentrate residual T-Hydro TBHP to unsafe levels, do not use it to clean or purge lines or vessels unless they have been properly flushed with a suitable solvent such as mineral oil, kerosene, tertiary butyl alcohol or water. In the selection of solvents, consider the contamination hazards. Never use acetone or other ketones to clean TBHP to unsafe levels.

10.2 Control of Hazardous Energy

A facility must have procedures for controlling hazardous energy sources that comply with the requirements of 29 CFR 1910.147. The procedures protect workers in areas where T-Hydro TBHP vessels or equipment are cleaned, maintained or entered. After a system is purged, ensure that all potential sources of T-Hydro TBHP or hazardous energy are physically tagged and/or locked out and affected persons notified.

10.3 Confined Space Entry

OSHA (29 CFR 1910.146) establishes requirements for entry into confined spaces. For confined spaces that typically contain T-Hydro solution, a lower Flammability limit of 5.75 vol% should be used to determine permit requirements. Appropriate respiratory protection for T-Hydro vapor exposures (see Section 3.5) may also be required.

10.4 Maintenance and Inspection

Follow regular inspection, testing and preventive maintenance schedules for safety critical equipment (29 CFR 1910.119). The inspection program should include periodic visual inspection of equipment and storage areas for signs of deterioration, leaks or malfunctions. Base the inspection frequency upon experience. Inspect visible parts in transfer systems each time they are used. Visual inspection can be augmented by using instruments that detect T-Hydro vapors (see Section 3.5).
9. Transfer Operations

9.4 ISO Tanks
Lyondell ships T-Hydro TBHP in intermodal bulk transport tanks meeting the T23 portable tank specifications. The relief valve setting is 10.9 psig as required by DOT and UN regulations. Portable tanks contain INTALOX polyethylene saddles as a combustion modifier. The unloading valve is located at the top of the tank (see Figure 9-4). International Organization for Standardization (ISO) tank work preparation and unloading procedures are essentially the same as those in Section 9.3.

Figure 9-4 Typical IMO Tank Configuration

10. Tank Cleaning and Equipment Repair

10.1 Work Preparation
Proper preparation for cleaning or maintaining T-Hydro TBHP storage vessels and equipment by fully trained workers can help prevent fire or harm to workers or the environment. Establish a hazardous-work permit system before performing any maintenance or inspection activities involving hot work (29 CFR 1910.119), lockout/tagout (29 CFR 1910.146) or confined-space entry (29 CFR 1910.148 see Appendix B for citations). The permit should identify all job-related hazards and include a work plan to address them. For information on precautions during hot work, cutting and welding in organic peroxide storage areas, refer to NFPA 30, 43B and 51B. Use engineering controls and appropriate PPE (see Section 3). Experienced, trained workers should conduct T-Hydro TBHP equipment cleaning in compliance with a written, approved procedure. Review of the procedure should include a hazards analysis, such as a job safety analysis (JSA), to identify hazards and necessary protective measures. The emptying of T-Hydro TBHP vessels or storage tanks can present danger of ignition, toxic vapors and improper disposal of the drained solution.

10.2 Control of Hazardous Energy
A facility must have procedures for controlling hazardous energy sources that comply with the requirements of 29 CFR 1910.147. The procedures protect workers in areas where T-Hydro TBHP vessels or equipment are cleaned, maintained or entered. After a system is purged, ensure that all potential sources of T-Hydro TBHP or hazardous energy are physically tagged and/or locked out and affected persons notified.

10.3 Confined Space Entry
OSHA (29 CFR 1910.146) establishes requirements for entry into confined spaces. For confined spaces that typically contain T-Hydro solution, a lower Flammability limit of 5.75 vol% should be used to determine permit requirements. Appropriate respiratory protection for TBHP vapor exposures (see Section 3.3) may also be required.

10.4 Maintenance and Inspection
Follow regular inspection, testing and preventive maintenance schedules for safety critical equipment (29 CFR 1910.119). The inspection program should include periodic visual inspection of equipment and storage areas for signs of deterioration, leaks or malfunctions. Base the inspection frequency upon experience. Inspect visible parts in transfer systems each time they are used. Visual inspection can be augmented by using instruments that detect T-Hydro vapors (see Section 3.5).
**Appendix I. Names and Addresses of Manufacturers**

**Chemical Protective Clothing**
- Gloves: Ansell Healthcare
  - 200 Schub Drive
  - Red Bank, NJ 07701
  - (+1) 888-800-0444
- Ansell Healthcare Europe
  - Boulevard International 55
  - 1070 Brussels
  - Belgium
  - (+32) (0) 25 28 74 00

**Combustible Gas Detectors**
- Tsu' Sniffer: Bacharach, Inc.
  - 621 Hutt Valley Circle
  - New Kensington, PA 15068-7074
  - (+1) 724-334-5051

**Explosimeter**
- MSA Fire
  - P.O. Box 426
  - Pittsburgh, PA 15230
  - (+1) 800-MSAFIRE
- MSA Alair GmbH
  - Thierenanstr. 1
  - 12059 Berlin
  - (+49) (0) 30 68-861305

**Appendix II. Lyondell Sampling and Analytical Method**

**Tertiary Butyl Hydroperoxide**

**Issued**: 10/13/92  
**Formula**: C₃H₅O₂, 70% in H₂O  
**M.W.**: 90.12  
**OSHA**: No exposure limit established  
**ACGIH**: No exposure limit established  
**Properties**: See Section 1. General Information, Table 1-1  
**Synonyms**: TBBP, CAS #75-91-2, Synonyms: TBHP

**Sampling**
- **Sampler**: Silica Gel Sorbent Tube (2605/520 mg)  
- **Flow Rate**: 0.05 to 0.2 L/min  
- **Vol Min**: 6L  
- **Max**: 48L  
- **Shipment**: Routine  
- **Sample Stability**: Stable for 7 days at ambient temperature  
- **Field Blanks**: 10% of samples

**Accuracy**
- **Range Studied**: 0.301 to 11.61 ppm  
- **Bias**: Not significant  
- **Overall Precision (S)**: 0.081

**Measurement**
- **Technique**: GC-FID  
- **Analyte**: tert butyl hydroperoxide  
- **Description**: 1 mL methanol, 30 min  
- **Injection Volume**: 1 µL  
- **Temperature-Detector**: 250°C  
- **Temperature-COLUMN**: Initial Oven Temp.: 45°C  
- **Initial Time**: 3 min  
- **Rise**: 8°C/min  
- **Final Temp**: 75°C  
- **Final Time**: 3 min  
- **Injection**: Ambient (on-column)  
- **Column**: Restek Rtx-5, 5% methylpolysiloxane, 30 m x 0.53 mm i.d., 1.0 film thickness  
- **Calibration**: Standard concentration of TBHP in methanol with 0.1% isobutyl acetate  
- **Range**: 0.065 mg to 0.093 mg  
- **Estimated LOD**: 0.050 mg  
- **Precision (S)**: 0.050 @ 0.065 to 0.973 mg per sample

**Interferences**
- **To avoid breakthrough, sample at 0.05 L/min for 4-hour sessions if large concentrations of tert-Butyl hydroperoxide are expected.**

**Reagents**
- **1. Eluent**: methanol, chromatographic quality, containing 0.1% isobutyl acetate as the internal standard  
- **2. Hydrogen**  
- **3. Hydrogen**  
- **4. Air**

**Equipment**
- **1. Sampler**: silica gel sorbent tube (2605/520 mg)  
- **SKC Catalog No. 226-15**  
- **2. Personal sampling pump**: 0.05 to 0.2 L/min, with flexible connecting tubing  
- **3. Gas chromatograph, FID, integrator or data system**  
- **4. Vials**: 2-mL PTFE-lined caps  
- **5. Syringes**: 10 µL and other convenient sizes for preparing standards, readable to 0.1 µL  
- **6. Volumetric flasks**  
- **7. Pipets**

**Sampling**
- **1. Calibrate each personal sampling pump with a representative sampler in line.**
- **2. Break the ends of the sampler immediately before sampling, attach sampler to personal sampling pump with flexible tubing.**
- **3. Sample at an approximately known flow rate between 0.05 and 0.2 L/min for 4 hours.**
- **4. Cap the sampler, Pack securely for shipment.**
- **Sample Preparation:**
  - **5. Place the front and back sorbent sections of the sampler tube in separate vials. Discard the glass wool and foam plugs.**
  - **6. Add 1.0 ml eluent to each vial. Attach cap to each vial.**
  - **7. Allow to stand 30 min with occasional agitation.**

**Evaluation Method**

TBHP was issued on October 13, 1992 and was validated using a generated atmosphere of TBHP over the range of 0.301 to 11.61 ppm in a 48-L sample. Overall precision S = 0.081 with an average recovery of 102.7%, representing an insignificant bias.
Appendices

Appendix III. References (T-Hydro TBHP)

ACOIH American Conference of Governmental Industrial Hygienists
6500 Glenway Avenue, Bldg. D-7
Cincinnati, OH 45211-4438
USA
AGIH, Threshold Limit Values and Biological Exposure Indices

ANSI American National Standards Institute
11 West 42nd Street
New York, New York 10036
USA
ANSI B16.2; Non-metallic Flat Gasket for Pipe Flanges
ASME/ANSI B31; American National Standard Code For Pressure Piping
ASME/ANSI B31.1; Safety Footwear
ANSI Z87; Occupational and Educational Eye and Face Protection
ANSI Z88.2; Practices for Respiratory Protection
ANSI Z89.1; Protective Headwear for Industrial Workers
ANSI Z535.1; Emergency Eye Wash and Shower Equipment

API American Petroleum Institute
1220 L Street, NW
Washington, DC 20005
USA
API-RP-520; Recommended Practices for the Design and Installation of Pressure-Relieving System in Refineries. Part I – Design
API-RP-520; Sizing, Selection and Installation of Pressure-Relieving Devices in Refineries. Part II – Installation
API-1601; Metallic Gaskets for Raisied-Face Pipe Flanges and Flanged Connections (Double-Jacketed Corrugated and Spiral-Wound)
API-1602; Recommended Rules for the Design and Construction of Large Welded, Low-Pressure Storage Tanks
API-1650; Welded Steel Tanks for Oil Storage
API-RP-2002; Venting Atmospheric and Low-Pressure Storage Tanks
API-RP-2003; Protection Against Ignitions Arising Out of Static, Lightning and Stir Currents
API-RP-2028; Flame Arrestors in Piping System
API-RP-2210; Flame Arrestors for Vents of Tanks Storing Petroleum Product
API-RP-2350; Overfill Protection for Petroleum Storage Tanks

ASME American Society of Mechanical Engineers
Uniting Engineering Center
345 East 4th Street
New York, New York 10017
USA
ASME Code, Section VIII, Division 1; Boiler and Pressure Vessel Code
ASME/ANSI B31; American National Standard Code For Pressure Piping

ASTM American Society for Testing and Materials
1916 Race Street
Philadelphia, PA 19103
USA
ASTM E 162; Test Method for Internal Pressure Limit of Overflow Flow of Piping Systems

CEFC European Chemical Industry Council
Avenue E. van Nieuwenhuyis, 4 box 1
B-1160 Brussels
Belgium

DOT Department of Transportation
400 Seventh Street, S.W.
Washington, DC 20590
USA
49 CFR 171; General Information, Regulations and Definitions
49 CFR 173, Shippers - General Requirements for Shipments and Packaging
49 CFR 174, Carriage by Rail
49 CFR 175, Carriage by Aircraft
49 CFR 176, Carriage by Vessels
49 CFR 177, Carriage by Public Highway
49 CFR 178, Shipping Containers Specifications
49 CFR 179, Specifications for Tank Cars
49 CFR 180, Qualifications and Maintenance of Cargo Tanks

EPA United States Environmental Protection Agency
401 M Street, S.W.
Washington, DC 20460
USA
40 CFR 60; Standards of Performance
40 CFR 260; Hazardous Waste Management System: General
40 CFR 261; Identification and Listing of Hazardous Waste
40 CFR 262; Standards Applicable to Generators of Hazardous Waste
40 CFR 263; Standards Applicable to Transporters of Hazardous Waste
40 CFR 264; Standards for Owners and Operators of Hazardous Waste Treatment, Storage and Disposal Facilities
40 CFR 265; Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage and Disposal Facilities
40 CFR 266; Standards for the Management of Specific Hazardous Wastes and Specific Types of Hazardous Waste Management Facilities
40 CFR 267; Interim Standards for Owners and Operators of New Hazardous Waste Land Disposal Facilities
40 CFR 268; Land Disposal Restrictions
40 CFR 270; EPA Administered Permit Programs: The Hazardous Waste Permit Program
40 CFR 271; Requirements for Authorization of State Hazardous Waste Programs
40 CFR 272; Approved State Hazardous Waste Management Programs
40 CFR 372; Toxic Chemical Release Reporting: Community Right-to-Know

IARC International Agency for Research on Cancer
49 Sheridan Street
Albany, New York 12210
USA

IATA International Air Transport Association
1155 Mansfield Street
Montreal 113, PQ, Canada
IATA, Dangerous Goods Regulations

ICAO International Civil Aviation Organization
100 Sherbrooke Street West
Suite 400
Montreal, Quebec, Canada H3A 2B2
ICAO, Technical Instructions for Safe Transport of Dangerous Goods, By Air

IMO International Maritime Organization
Albert Embankment
London SE1 England
IMO, International Maritime Dangerous Goods Codes, Volumes I through V
IMO, International Code for the Construction and Equipment of Ships Carrying Dangerous Chemicals in Bulk

NFP A National Fire Protection Association
Batterymarch Park
Quincy, Massachusetts 02269
USA
NFP A 10; Portable Fire Extinguishers
NFP A 11; Foam Extinguishing Systems, Low Expansion and Combined Agent
NFP A 19; Installation of Sprinkler Systems
NFP A 14; Installation of Standpipe and Hose Systems
NFP A 15; Water Spray Fixed Systems for Fire Protection
NFP A 39; Flammable and Combustible Liquids Code
NFP A 438; Storage of Organic Peroxide Formulations
NFP A 70; National Electrical Code Article 500 - Hazardous (Classified) Locations
NFP A 80; Fire Doors and Fire Windows
NFP A 704; Standard for the Identification of the Fire Hazards of Materials

NIOSH National Institute for Occupational Safety and Health
US Department of Health, Education and Welfare
4676 Columbia Parkway
Cincinnati, Ohio 45226
USA

NTP National Toxicology Program
P.O. Box 12233
Research Triangle Park, North Carolina 27709
USA

OPP SD Organic Peroxide Producers Safety Division
Society of Plastics Industry (SPI)
1667 K Street, NW, Suite 1000
Washington, DC 20006
USA

OSHA Occupational Safety and Health Administration
200 Constitution Avenue, N.W.
Washington, DC 20210
USA
29 CFR 1910.106; Flammable and Combustible Liquids
29 CFR 1910.119; Process Safety Management of Highly Hazardous Chemicals
29 CFR 1910.120; Hazardous Waste Operations and Emergency Response (HAZWOPER)
29 CFR 1910.134; Respiratory Protection
29 CFR 1910.146; Permit-Required Confined Space
29 CFR 1910.147; Sources of Standards
29 CFR 1910.151; Medical Services and First Aid
29 CFR 1910.156; Fire Brigades
29 CFR 1910.1010; Air Contaminants
29 CFR 1910.1200; Hazard Communication

UL Underwriter’s Laboratories
333 Prington Road
Northbrook, IL 60062
USA
UL 525, Flame Arrestors for Use on Vents of Storage Tanks for Petroleum Oil and Gasoline

UN United Nations
First Avenue and 42nd Street
New York, NY 10017
USA
Recommendations on the Transport of Dangerous Goods

US COAST GUARD
US Coast Guard, Headquarters
2100 Second Street, S.W.
Washington, DC 20593-0001
USA
46 CFR 153; Ships Carrying Bulk Liquid, Liquidfied Gas or Compressed Gas Hazardous Materials

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Appendix IV. Regulatory Summary

The following summary presents some of the federal, state and international laws and enabling regulations that require review prior to handling, storage or distribution of tertiary butyl hydroperoxide (TBHP), the main ingredient of T-Hydro solution. Where the addition of water to TBHP (as, for example, in the T-Hydro solution) would significantly change a cited regulation, this fact is noted. This overview is not and should not be construed as an all inclusive source of information. In addition, either international, federal, state and local laws and regulations may be applicable.

Federal

Clean Air Act

The Clean Air Act required the EPA to set national ambient air quality standards for pollutants determined to be injurious to health or welfare. TBHP is not listed as a potential human health hazard under Section 111. Amendments to the Clean Air Act enacted in 1990 required the EPA to establish technology standards applicable to the sources of listed pollutants. TBHP is not listed as a hazardous air pollutant in Section 112(b).

Clean Water Act

The Clean Water Act was enacted to ensure the chemical, physical and biological integrity of the nation’s waters by setting national water quality standards for publicly owned treatment works and industry and by creating the National Pollutant Discharge Elimination System (NPDES) permit program. The following sections of the law may be of interest to the user of TBHP:

Section 307 Priority Pollutants (40 CFR 116.4) – TBHP is not listed.

Section 311 (40 CFR 116.4) List of Chemicals considered hazardous if spilled in navigable waters. Regulations specify spill procedures to be followed in the event of accidental spillage. TBHP is not listed.

Comprehensive Environmental Response, Compensation, & Liability Act (CERCLA)

CERCLA, more commonly known as “Superfund,” established a list of more than 700 hazardous substances that, when released in quantities greater than 700 hazardous substances that, when released in quantities

CERCLA regulations but also to the Superfund Amendments & Reauthorization Act (SARA) Title III, Section 304, emergency notification requirements (see below).

TBHP is not a listed hazardous substance and, therefore, does not have a RQ under this law.

Resource Conservation and Recovery Act (RCRA)

The major objectives of RCRA are to protect human health and the environment while conserving valuable material and energy resources. The Act is concerned with all stages in the hazardous waste management cycle – generation, storage, transportation and disposal – and requires notification to EPA within 90 days by anyone who generates, transports, treats, stores or disposes of the specific covered waste. Process waste streams from TBHP manufacturing are not specifically identified as hazardous wastes (40 CFR 261.31 and 40 CFR 261.32). For TBHP, discarded off-specification product, spill cleanup residue and empty TBHP containers are not considered listed hazardous wastes (40 CFR 261.33). However, liquid waste material should be evaluated for the characteristic of ignitability (40 CFR 261.21) and reactivity (40 CFR 261.23). Mixtures containing TBHP and/or TBHP destined for disposal which exhibit flash points less than 140°F are also considered ignitable hazardous waste (40 CFR 261.21). Mixtures also may exhibit the characteristic of reactivity due to the peroxide content of the waste (40 CFR 261.23).

Safe Drinking Water Act (SDWA)

The 1986 amendments to the Safe Drinking Water Act required the EPA to establish a priority list of contaminants which are known or anticipated to occur in public water systems and which “may” require regulation under the SDWA.

TBHP does not appear on the priority list of contaminants established by the EPA’s 1986 SDWA study program. The EPA has established the Safe Drinking Water hotline at 1-800-426-4701; in the Washington, D.C. area, the number is 1-202-382-5533.

Department of Transportation (DOT)

The Hazardous Materials Transportation Act of 1974 gave the Department of Transportation authority to regulate the transportation of hazardous materials in interstate commerce. DOT regulates such matters as classification, packaging and hazard communication (labeling). DOT also has established spill notification requirements. Regulations governing the transport of hazardous materials can be found at 49 CFR 172 and 173.

TBHP at >2% mass concentration is classified as an Organic Peroxide, Type 5 Liquid and is listed as hazard class 5.2. The identification number is UN1309, packing group II, packing method OPBA. The hazard label required is “Organic Peroxide.”

Shipments of solutions containing TBHP “more than 90% with water” are forbidden. (The terminology in quotations is taken directly from DOT regulations 49 CFR 172.101). The authority for this list is the Illinois Rev. Statute, Chapter 48, paragraph 1407. Questions may be directed to the Illinois Department of Labor, Toxic Substances Division, #1 W. Old State Capitol Plaza, Room 300, Springfield, IL 62701 USA.

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Illinois Chemical Safety Act
Under this law, covered businesses using, storing or manufacturing defined chemical substances must have a written Chemical Safety Contingency Plan.
TBHP is not a covered substance.
The authority for these regulations is Illinois Rev. Statute, Chapter 111 1/2, Paragraph 95.1.

Louisiana
Louisiana Hazardous Materials Information, Development, Preparedness and Response Act
This law subjects covered facilities to “right-to-know” type requirements.
Covered materials include federal SARA extremely hazardous substances and any hazardous chemicals as defined under the federal OSHA standard.
TBHP is not listed.
The authority for these regulations is Louisiana Admin. Code, Title 33, Part V, Section 10101.

Louisiana Spill Reporting
Louisiana has established reportable quantities (RQs) to determine the need for notification for unauthorized discharges. The notification requirements are in addition to notification requirements established under the Louisiana right-to-know requirements.
A RQ has not been established for TBHP.
These regulations are established under Louisiana Administrative Code, Title 33, Chapter 39.

Massachusetts
Massachusetts Right-to-Know Law
This law established reporting, labeling, MSDS, recordkeeping and related regulations for certain toxic or hazardous substances.
TBHP is listed on the Massachusetts Substance List subject to the Right-to-Know law.
The authority for this listing is Massachusetts General Laws Annotated, Chapter IF and Title 105 Massachusetts Regulations Code, Section 670.000, Appendix A. Questions about the regulations can be directed to The Commonwealth of Massachusetts, Executive Office of Human Services, Department of Public Health, 150 Tremont Street, Boston, MA 02111 USA.

Massachusetts Spill Reporting
The Oil and Hazardous Materials List establishes reportable quantities (RQs) for substances which require reporting of unauthorized discharges.
TBHP is listed with a reportable quantity (RQ) of 10 pounds.
The authority for these regulations is Title 310 Massachusetts Regulations Code Sections 40.30 and 40.900 Appendix L, Department of Environmental Quality Engineering.

Michigan
Michigan Critical Materials
All Michigan businesses discharging wastewater must file required reports with the State. When wastewater discharge is required to be reported, the user or manufacturer of designated “critical materials” also is required.
TBHP has not been designated as a critical material.
Authority for these requirements is contained in Michigan Act 293, PA 1972 and 1990 Michigan Public Acts 19, Section 68; Michigan Administrative Code §323.1231.

New Jersey
New Jersey Right-to-Know Act
This law requires facilities containing, distributing or handling a hazardous substance to complete a Right-to-Know survey. The survey provides workers and the community with information pertaining to the specific hazardous substance.
TBHP is listed on the New Jersey Hazardous Substance List. The New Jersey regulation number (ID) is 11520. TBHP also is classified as a New Jersey Special Hazard subject to restriction of trade secret claims. The Hazard Code is “Mu.”

Regulations are codified in the New Jersey Administrative Code, Title 8, Department of Health Chapter 59. Additional information about the New Jersey Hazardous Substance List is available from the New Jersey Department of Environmental Protection, Division of Environmental Quality, Bureau of Hazardous Substances Information, 401 E. State Street, CN 405, Trenton, N.J. 08625-0405 USA. Information about labeling regulations is available from the State of New Jersey Department of Health, CN 360, Trenton, NJ 08625-0360 USA.

New Jersey Spill Tax
New Jersey has established a list of substances defined as hazardous according to the Spill Compensation and Control Act (N.J. Statutes, Annotated, Section 58: 10-23.1 (1h)).
TBHP is not a list substance.
The authority for the listing is N.J. Administrative Code, Section 7:1E-1.3.

New York
New York Bulk Storage Registration/Release Reporting
New York requires the registration of bulk storage tanks and notification of releases of listed hazardous substances under the Substances Hazardous or Acutely Hazardous to Public Health, Safety or the Environment Act and the Environmental Substances Bulk Storage Act.
TBHP is not listed.
The authority for this registration is New York Code §§ 500-509, 596 and 597.

Pennsylvania
Pennsylvania Worker & Community Right-to-Know Act
This law creates the state’s system for communicating information about “hazardous substances.” A hazardous substance is defined and listed by Pennsylvania through reference to a number of source lists. The state also classifies certain substances as “environmental hazards” and/or “special hazardous substances.” The law established MSDS, labeling and recordkeeping requirements and requires facilities or distributors handling hazardous substances to complete a Hazardous Substance Survey Form (HSSF) annually, before April 1, for the previous calendar year.
TBHP is listed with a threshold of 1%.
The authority for these regulations is Pennsylvania Code, Title 34, Labor and Industry, Chapter 301-323.

Rhode Island
Rhode Island Hazardous Substance Right-to-Know Act
This law requires employers who use, transport, store or in any other manner expose employees to toxic or hazardous substances, as defined by the state, to provide notice, labeling and training.
TBHP is listed with the hazard code “F” = Flammable.
The authority for these regulations is Rhode Island General Laws, Sections 28-21-1.

International

Australia
Australian Inventory of Chemical Substances
TBHP is listed.

Canada
Canadian Workplace Hazardous Materials Information System (WHMIS) 2015
WHMIS established requirements for classifying hazardous substances that will be used in the workplace and for preparing MSDSs and container warning labels. Substances are classified by the manufacturer or importer to determine whether or not they are controlled products. When a product has been evaluated and is found to be a controlled product, the ingredient disclosure list (IDL) must be consulted and any ingredient present in a concentration greater than that specified must be disclosed on the MSDS.
Lyondell has classified T-hydro solution as B3 (moderately combustible liquid); C (oxidizing material);丁 (toxic material causing immediate and serious toxic effects); and E (corrosive material). TBHP is listed on the IDL as a substance which must be disclosed if the weight-to-weight concentration in the product is 1% or greater. The WHMIS number is G74.
Canadian Domestic Substances List
TBHP is listed.

European Economic Community
European Inventory of Existing Commercial Chemical Substances (EINECS)
TBHP is listed on EINECS. The EINECS number is 200 915 7. Listing on EINECS is accepted by certain other European countries which have adopted EINECS as their base inventory, i.e., Austria, Finland, Switzerland. However, other “registration” requirements may apply in those countries.

Japan
Japanese List of Existing & New Chemical Substances (ENCI)
TBHP is listed. The ENCI number is 2-224.

Korea
Korean List of Existing Chemicals
TBHP is listed. The Korean listing number is 2-128.

Miscellaneous

National Fire Protection Association (NFPA) Hazard Rating
The NFPA ratings assign a numeric value to specific aspects of each hazard. For T-hydro solution, these ratings are as follows:
Health: 3. Materials that, on short exposure, could cause serious temporary or residual injury, including those requiring protection from all bodily contact.
Flammability: 2. Materials that must be moderately heated or exposed to relatively high ambient temperatures before ignition can occur.
Materials in this degree would not under normal conditions form hazardous atmospheres with air, but under high ambient temperatures or under moderate heating may release vapor in sufficient quantities to produce hazardous atmospheres with air.
Reactivity: 2. Materials that readily undergo violent chemical change at elevated temperatures and pressures.

Additional information on the NFPA hazard rating system can be obtained from the National Fire Protection Association, Batterymarch Park, Quincy, MA, 02269 USA, (+1-800-344-3555).

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Before using a product sold by a company of the LyondellBasell family of companies, users should make their own independent determination that the product is suitable for the intended use and can be used safely and legally. SELLER MAKES NO WARRANTY; EXPRESS OR IMPLIED (INCLUDING ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OR ANY WARRANTY) OTHER THAN AS SEPARATELY AGREED TO BY THE PARTIES IN A CONTRACT. Users should review the applicable Safety Data Sheet before handling the product.

This product(s) may not be used in the manufacture of any of the following, without prior written approval by Seller for each specific product and application:

(i) U.S. FDA Class I or II Medical Devices; Health Canada Class I, II or III Medical Devices; European Union Class I or II Medical Devices;
(ii) film, overwrap and/or product packaging that is considered a part or component of one of the aforementioned medical devices;
(iii) packaging in direct contact with a pharmaceutical active ingredient and/or dosage form that is intended for inhalation, injection, intravenous, nasal, ophthalmic (eye), digestive, or topical (skin) administration;
(iv) tobacco related products and applications, electronic cigarettes and similar devices.

The product(s) may not be used in:

(i) U.S. FDA Class III Medical Devices; Health Canada Class IV Medical Devices; European Class III Medical Devices;
(ii) applications involving permanent implantation into the body;
(iii) life-sustaining medical applications.

All references to U.S. FDA, Health Canada, and European Union regulations include another country’s equivalent regulatory classification. In addition to the above, LyondellBasell may further prohibit or restrict the use of its products in certain applications. For further information, please contact a LyondellBasell representative.

LyondellBasell (NYSE: LYB) is one of the largest plastics, chemicals and refining companies in the world. Driven by its employees around the globe, LyondellBasell produces materials and products that are key to advancing solutions to modern challenges like enhancing food safety through lightweight and flexible packaging, protecting the purity of water supplies through stronger and more versatile pipes, improving the safety, comfort and fuel efficiency of many of the cars and trucks on the road, and ensuring the safe and effective functionality in electronics and appliances. LyondellBasell sells products into more than 100 countries and is the world’s largest producer of polymer compounds and the largest licensor of polyolefin technologies. In 2018, LyondellBasell was named to Fortune magazine’s list of the “World’s Most Admired Companies.” More information about LyondellBasell can be found at www.LyondellBasell.com.