Cryogenic Liquid Hazards and Controls

Brief

<table>
<thead>
<tr>
<th>Title:</th>
<th>Cryogenic Liquid Hazards and Controls</th>
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<tbody>
<tr>
<td>Publication date:</td>
<td>9/10/2013</td>
</tr>
<tr>
<td>Effective date:</td>
<td>1/29/2010</td>
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**BRIEF**

**Policy Summary**

This policy describes the restrictions and conditions for persons who handle cryogens or who operate cryogenic-liquid-handling systems at Berkeley Lab.

Cryogenic liquids include, but are not limited to, liquid nitrogen, liquid helium, and liquid argon.

**Who Should Read This Policy**

Berkeley Lab employees, visitors, affiliates, and subcontractors who handle cryogens or who operate cryogenic-liquid-handling systems at Berkeley Lab

**To Read the Full Policy, Go To:**

The POLICY tab on this wiki page

**To Read the EH&S Program Details, Go To:**

http://www.lbl.gov/ehs/pub3000/CH29/CH29.html

**Contact Information**

For assistance on cryogenic-liquid applications, including safety engineering and industrial hygiene, contact:

EH&S Division
Subject Matter Expert for Cryogens
Joe Dionne
(510) 486-7586
JEDionne@lbl.gov

For assistance with cryogenic system repairs, maintenance, and modifications, contact:

Facilities Division
Mike Botello
(510) 486-7941
MLBotello@lbl.gov

**Policy**

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POLICY

A. Purpose

This policy describes the restrictions and conditions for persons who handle cryogens or who operate cryogenic-liquid-handling systems at Lawrence Berkeley National Laboratory (Berkeley Lab).

Cryogenic liquids include, but are not limited to, liquid nitrogen, liquid helium, and liquid argon.

B. Persons Affected

Berkeley Lab employees, visitors, affiliates, and subcontractors who handle cryogens or who operate cryogenic-liquid-handling systems at the Laboratory

C. Exceptions

None

D. Policy Statement

1. The primary hazards associated with cryogenic liquids are:
   a. Thermal hazards due to extremely low temperatures
   b. Pressurization hazards due to inadequate venting
   c. Oxygen deficiency due to oxygen displacement (for inert cryogens)

   There are additional hazards including any hazardous characteristics associated with the cryogenic liquid (e.g., flammability of hydrogen). See Work Processes A and F for more details on hazards.

2. Cryogenic liquids are obtained by:
   a. The Principal Investigator placing an order for a portable cryogenic liquid dewar through a request to the on-site chemical supplier or
   b. The Principal Investigator making a request to the Facilities Division to connect to a cryogenics liquid tank (the Facilities Division has responsibility for the Laboratory's bulk cryogenic systems and for their safe design, operation, and maintenance.)

3. Orders and Facilities Requests should be followed with a note or call to the Cryogenic Liquids Subject Matter Expert (SME) to start assessment processes.

4. Before work with cryogenic liquids is undertaken, an oxygen-deficiency risk assessment must be conducted (Work Process A).

5. Prior to use, persons who handle cryogens or who operate cryogenic-liquid-handling systems at Berkeley Lab must complete training that covers:
   • Awareness of hazards related to the equipment
   • Methods for controlling those hazards
   • Proper operating procedures applicable to the equipment (Work Process B)

6. Ensure all hazards associated with the handling of cryogenic liquids in an area are identified and controlled (Work Processes C, D, E, F, J, K, and L).

7. Line management must ensure:
   a. Only equipment intended for cryogenic service is used
   b. Equipment, commercial or otherwise, is not modified in a fashion that could defeat the designed safety features of the equipment or otherwise create an unforeseen hazard, such as inadequate venting of cryogen spaces
   c. Equipment is appropriately designed, fabricated, and used for cryogenic use (See Work Processes D, J, K, and L of Pub-3000 Chapter 29.

8. Users of cryogenic systems must follow training guidance and written procedures covering:
   b. Use of controls for cryogenic liquid handling, including personal protective equipment (PPE) (Work Processes C, D, H and I)
   c. Transportation of cryogenic liquids (Work Process N)
   d. Disposal of cryogenic materials (Work Process O)
E. Roles and Responsibilities

See Pub-3000 for roles and responsibilities related to the execution of this policy's implementation.

<table>
<thead>
<tr>
<th>Role</th>
<th>Responsibility</th>
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</thead>
<tbody>
<tr>
<td>Facilities Division</td>
<td>Oversees the Laboratory's bulk cryogenic systems and their safe design, operation, and maintenance</td>
</tr>
<tr>
<td>Industrial Hygiene SME</td>
<td>Is responsible for development, approval, revision, and administration of this policy and its implementing documents</td>
</tr>
<tr>
<td>Line Managers</td>
<td>Ensure that persons within their areas of responsibility comply with this policy and its implementing documents</td>
</tr>
<tr>
<td>Supervisors and Work Leads</td>
<td>Ensure that persons within their areas of responsibility comply with this policy and its implementing documents, and in particular have completed the required training prior to beginning work</td>
</tr>
<tr>
<td>Cryogenic Liquid Users</td>
<td>Follow all guidance provided in training and Work Processes to safety use, transport, and dispose of cryogenic liquids</td>
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</table>

F. Definitions/Acronyms

See PUB-3000 Chapter 29 for technical terms related to the details of this policy and its implementation.

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
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<tbody>
<tr>
<td>Cryogenic Liquid</td>
<td>A material whose boiling point is less than 120 degrees Kelvin. The typical cryogenic materials used at Berkeley Lab include but are not limited to liquid nitrogen, liquid helium, and liquid argon.</td>
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G. Recordkeeping Requirements

<table>
<thead>
<tr>
<th>Role</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Subject Matter Expert</td>
<td>Oxygen-Deficiency Risk Assessments</td>
</tr>
<tr>
<td>Subject Matter Expert</td>
<td>Cryogenic Safety Training Records</td>
</tr>
<tr>
<td>Subject Matter Expert</td>
<td>Activity Hazard Document</td>
</tr>
<tr>
<td>Hazardous Waste Office</td>
<td>Hazardous Waste Manifests</td>
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H. Implementing Documents

<table>
<thead>
<tr>
<th>Document Number</th>
<th>EH&amp;S Reference Numbers</th>
<th>Title</th>
<th>Type</th>
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<tbody>
<tr>
<td>07.07.009.001</td>
<td>Ch. 29</td>
<td>Cryogenic Liquids</td>
<td>Program</td>
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J. Revision History

<table>
<thead>
<tr>
<th>Date</th>
<th>Revision</th>
<th>By whom</th>
<th>Revision Description</th>
<th>Section(s) affected</th>
<th>Change Type</th>
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<tbody>
<tr>
<td>9/10/13</td>
<td>1.1</td>
<td>S. Robinson</td>
<td>Reviewed 9/6/2013, no changes</td>
<td>Publ &amp; Next Review Dates</td>
<td>Minor</td>
</tr>
<tr>
<td>1/2/2012</td>
<td>1</td>
<td>J. Dionne</td>
<td>Rewrite for wiki</td>
<td>all</td>
<td>Minor</td>
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Document Information

DOCUMENT INFORMATION

Lawrence Berkeley National Laboratory. The official or current version is located in the online LBNL Requirements and Policies Manual. Printed or exported versions are not official. Users are responsible for working with the latest approved revision.
07.07.009.011 Ch 29, Work Process J Guidance for Materials of Construction Process
07.07.009.012 Ch 29, Work Process K Continuous Oxygen-Monitoring Systems Process
07.07.009.013 Ch 29, Work Process L Cryogen Signs Process
07.07.009.014 Ch 29, Work Process M Operational Guidance Process
07.07.009.015 Ch 29, Work Process N Transporting Cryogen Dewars Process
07.07.009.016 Ch 29, Work Process O Waste Disposal Process
07.07.009.017 Ch 29, Work Process P ES&H Documentation and Reporting/Notification Process

Other References

- Compressed Gas Association, Pamphlet P-12, *Safe Handling of Cryogenic Liquids*
- Compressed Gas Association, Pamphlet P-12, *Safe Handling of Cryogenic Liquids*, 6.7
- NFPA 55, *Standard for the Storage, Use, and Handling of Compressed Gases and Cryogenic Liquids in Portable and Stationary Containers, Cylinders, and Tanks*
- Public Law 91-596, *Occupational Safety and Health Act of 1970*
- International Fire Code (IFC) Chapter 32 "Cryogenic Fluids"