STANDARD OPERATING PROCEDURE-LIQUID NITROGEN

|  |  |  |  |
| --- | --- | --- | --- |
| **CONTACT INFORMATION** | | | |
| **Location** | Building: | | Room: |
| **Street Address:** |  | | |
| **Lab Safety Contact:** | Name: | | |
| Lab Phone: | Office Phone: | |
| **Emergency Contact** | Name: | Phone: | |
| **TYPE OF STANDARD OPERATING PROCEDURE** | | | |
| Indicate which type of Standard Operating Procedure applies  Specific Process or Equipment  Specific Hazardous Chemical  Hazard Class for a Group of Chemicals | | | |
| **DESCRIBE PROCESS/EQUIPMENT, HAZARDOUS CHEMICAL or HAZARD CLASS** | | | |
| **Liquid Nitrogen**  **Formula: N2**  **CAS Number: 7727-37-9**  **Other Names: LN2** | | | |
| **HAZARD SUMMARY** | | | |
| Liquid nitrogen is a colorless, odorless liquid with a boiling point of -196oC. At low temperatures the gas / vapor is heavier than air. Small amounts of liquid vaporize rapidly to produce large volumes of gas (1 liter of liquid nitrogen will produce 0.7m3 of gas). Nitrogen gas is invisible - the cloudy vapor which appears when liquid nitrogen is exposed to air is condensed moisture, not the gas itself.  Asphyxiation  One of the main dangers associated with liquid nitrogen is the risk of asphyxiation when used or stored in poorly ventilated or tightly enclosed areas. Liquid nitrogen involves nitrogen gas which is inert and non-toxic but there is a risk of asphyxiation in situations where high concentrations may accumulate and subsequently displace air from the room. Short exposures to cold gas vapor lead to discomfort in breathing with prolonged inhalation can produce serious effects on the lungs and could possibly provoke an asthma attack.  Cryogenic burns  Liquid nitrogen can cause cryogenic burns if the substance itself, or surfaces which are or have been in contact with the substance (e.g. metal transfer hoses), come into contact with the skin. Local pain may be felt as the skin cools, though intense pain can occur when cold burns thaw and, if the area affected is large enough, the person may go into shock.  Frostbite  Continued exposure of unprotected flesh to cold atmospheres can result in frostbite. There is usually sufficient warning by local pain while the freezing action is taking place.  Hypothermia  Low air temperatures arising from the proximity of liquefied gases can cause hypothermia. Susceptibility is dependent upon temperature, exposure time and the individual concerned (older people are more likely to succumb). | | | |
| **SPECIAL HANDLING AND STORAGE REQUIREMENTS** | | | |
| Liquid nitrogen cylinders have pressure release valves that release gas at intervals. A slight hiss is a normal characteristic of a properly functioning cylinder. Unexpected leaking may be a faulty o-ring or valve. Contact the vendor for service.  Make sure that there is good ventilation. Open a door if you are in a small room.  Never work alone when handling liquid Nitrogen  Do not leave vessels unattended when filling  Use only proper transfer equipment and dewars rated for liquid nitrogen.  Do not overfill vessels.  Never use a dewar that does not have a pressure relief valve or pressure venting lid/stopper  Never use dewars with makeshift or homemade lids/stoppers. Use only pressure venting lids/stoppers supplied by the dewar manufacturer  Do not use a funnel to transfer LN2.  Do not transport liquid nitrogen in open container  If you are carrying a Dewar containing Liquid Nitrogen. Make sure the dewar is your ONLY load (no books, coffee, other items).  Carry transport dewar as far away from your face and body as possible. Stay clear of groups of people and watch for other people who may run into or bump you.  Do not use brittle plastics which may shatter on contact with the cold liquid.  Do not use hollow dipsticks - use solid metal or wood. If a warm hollow tube is inserted into liquid nitrogen, liquid will sprout from the tube due to rapid expansion of liquid inside the tube and gasification. | | | |
| **ENGINEERING AND VENTILATION CONTROLS** | | | |
| Nitrogen is the main component of air and is present at approximately 78% by volume (oxygen is approximately 21% and argon 1%). Any alterations in the concentrations of these gases, especially oxygen, have an effect on life. In the case of liquid nitrogen, there is a risk of hypoxia/asphyxiation where ventilation is inadequate and the nitrogen gas evolved can build up and displace oxygen from the local atmosphere. An atmosphere containing less than 18% oxygen is potentially hazardous and entry into atmospheres containing less than 20% should be avoided.  The room where the chemical is being used should be equipped with proper exhaust ventilation to keep the airborne concentration below the allowable exposure limit. Emergency eye wash fountains and safety showers should be available in the immediate vicinity of any potential exposure. | | | |
| **PERSONAL PROTECTIVE EQUIPMENT** | | | |
| **PPE Requirements:**  Long pants or clothing that covers all skin below the waist  Shoes that cover the entire foot  Gloves; indicate type: Click here to enter text.  Inspect gloves before use. Use proper glove removal technique to avoid skin contact with outer surface of glove. Wash hands after removing gloves.  Safety goggles  Safety glasses  Face shield  Lab coat  Flame-resistant lab coat  Other: A non-absorbent cryogenic apron must be worn where splashing or spraying may occur. Open pockets and turn-ups where liquid could collect should be avoided. Trouser bottoms should overlap boots or shoes for the same reason.  If the use of an N95, half mask, or full face respirator is requested, the individual and/or their supervisor must first contact Environmental Health & Safety for a consultation to determine if respirator use is necessary. If EH&S determines the use of a respirator is necessary, the individual must participate in the University’s respirator program. This includes a medical evaluation; respirator fit test, and training. | | | |
| **EMERGENCY PROCEDURES** | | | |
| **In case of fire or large and/or extremely hazardous chemical releases pull the fire alarm and evacuate the area**  Small leaks should vaporize in a few seconds. In the event of a large spillage or accidental release, the following procedures should be followed:  -Evacuate the area. Deploy warning signs if necessary.  -Ventilate the area. Open doors and windows or activate forced ventilation to allow any spilt liquid to evaporate and the resultant gas to disperse.  -Try to stop the release if at all possible e.g. turn off valves, but only if it is safe to do so - always wear protective clothing.  -Do not re-enter area unless it is proved safe to do so. The presence of oxygen deficiency monitors (if available) will indicate the oxygen levels in the vicinity.  -Prevent liquid nitrogen from entering drains, basements, pits or any confined space where accumulation may be dangerous.  **If someone is seriously injured or unconscious:**  Where inhalation has occurred, the victim (who may be unconscious) should be removed to a well ventilated area. Rescuers should not put themselves at risk - a contaminated area should not be entered unless considered safe. Breathing apparatus may be required but should only be used by trained personnel. The person should be kept warm and rested whilst medical attention is obtained.  If breathing has stopped then resuscitation should be commenced by a trained first aider. Where contact has occurred, the aim should be to slowly raise the temperature of the affected area back to normal. For minor injuries, clothing should be loosened and the person made comfortable. Clothing should not be pulled away from burned or frozen skin. The affected area should be doused with copious quantities of tepid water (40oC) for at least 15 minutes and a sterile burn dressing applied to protect the injury until the person can be taken to receive hospital treatment. Do not:  -use a direct source of heat such as a radiator  -permit smoking or alcohol consumption  -give analgesics (e.g. Paracetamol, aspirin)  For major injuries apply first aid as far as is practicable and arrange for the victim to receive medical attention.  **CALL 911 or CAMPUS POLICE AT <enter your campus PD #>**  From a safe place, provide as much information as possible to the emergency responders including chemical name, volume, hazards, injuries, and location.  **Chemical Exposure**: Remove any contaminated clothing, and IMMEDIATELY flush contaminated skin with water for at least 15 minutes following any skin contact. For eye exposures, IMMEDIATELY flush eyes with water for at least 15 minutes. Consult SDS for guidance on appropriate first aid. Where medical attention is required, bring the SDS(s) of chemical(s) to aid medical staff in proper diagnosis and treatment.  **Evacuation Procedure**   * Immediately evacuate the building via the nearest exit when the fire alarm is activated. * If unable to evacuate due to a disability, shelter in the area of rescue / refuge, typically a stairwell landing, and wait for assistance from drill volunteers or emergency responders. * Instruct visitors and students to evacuate and assist them in locating the nearest exit. * Do not use elevators to exit the building during an evacuation as they may become inoperable. * Carry only those personal belongings that are within the immediate vicinity. * Close doors to limit the potential spread of smoke and fire. * Terminate all hazardous operations and power off equipment. * Close all hazardous materials containers. * Remain outside of the building until the building is released for reentry. * Do not restrict or impede the evacuation. * Convene in the designated grassy gathering area and await instruction from emergency responders or drill volunteers. Avoid parking lots. * Report fire alarm deficiencies, (e.g., trouble hearing the alarm) to facilities personnel for repair. * Notify evacuation drill volunteers or emergency responders of persons sheltering in the areas of rescue/ refuge. * **Never assume that an alarm is a “false alarm”. Treat all fire alarm activations as emergencies. Get out of the building!**   **Incident and Near Miss Reporting**: Report any incident that occurs in any University of South Florida affiliated teaching or research laboratory/studio or field research project. An incident means any unplanned event within the scope of a procedure that causes, or has the potential to cause, an injury or illness and/or damage to equipment, buildings, or the natural environment. Due to medical privacy concerns, no personal identifying information of the person involved in the incident shall be entered or submitted with the form.  <http://www.usf.edu/administrative-services/environmental-health-safety/reporting/index.aspx>  **Workers’ Compensation Procedure:** Call AmeriSys at 800-455-2079 to report a work-related injury or illness. Complete the Supervisor’s Accident Investigation Report available at the link above and send it to EH&S within 24 hours. | | | |
| **WASTE DISPOSAL** | | | |
| Describe how to dispose of the chemical waste produced from this activity.  All chemical waste generated within USF System laboratories is considered hazardous waste and must be disposed of as hazardous waste in accordance with the USF Hazardous Waste Management Procedure, the U.S. EPA, and the FDEP. The USF Hazardous Waste Management Procedure can be found using the following link, <https://www.usf.edu/administrative-services/environmental-health-safety/documents/hazwaste-managementprocedure.pdf> | | | |
| **TRAINING REQUIREMENTS** | | | |
| All individuals working with chemicals in USF laboratories must take EH&S’s Laboratory & Research Safety Training. To register for Laboratory & Research Training, please use the following link, <https://www.usf.edu/administrative-services/environmental-health-safety/training/course-descriptions.aspx#labsafety>  This procedure may warrant additional safety training per the PI, EH&S, or an authorizing unit such as the Biosafety or Radiation Safety programs. Check training requirements for this activity below:  Research Specific Training from the PI/Lab Supervisor or their designee  EH&S Laboratory & Research Safety Training  EH&S Safety and Compliance in the Arts  EH&S Respirator Fit Test  EH&S Biomedical Waste  EH&S Universal Pharmaceutical Waste Testing  EH&S Fire Prevention Safety  EH&S Slips, Trips, and Falls  RIC Biosafety Core Course  RIC Shipping Biohazardous Materials  RIC BSL 3  RIC Radiation Safety  RIC Laser Safety  RIC Boating Safety  RIC Scientific Diving  Other:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | | | |
| **PRIOR APPROVALS** | | | |
| This activity requires prior approval from the PI/designee.  If this box is checked, working alone is not allowed. | | | |

By signing and dating here the Principal Investigator/ or a designee certifies that the Standard Operating Procedure (SOP) for ***Liquid Nitrogen*** is accurate and effectively provides safe standard operating procedures for employees and students in this lab who will handle this hazardous chemical.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Signature Printed Name Date

I affirm that I have read and understand the Standard Operating Procedure for***Liquid NItrogen*** and have undergone the EH&S Laboratory & Research training and any lab specific training regarding this SOP.

|  |  |  |
| --- | --- | --- |
| Printed Name | Signature | Date |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |