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I. Introduction

The U.S. Department of Transportation (DOT) and the International Air Transport Association (IATA) regulate shipments of dry ice because it is a hazardous material. As a result, specific procedures must be followed when packaging and shipping materials refrigerated with dry ice and a record of training must be kept.

Follow procedures outlined in this guide when your shipment includes no hazardous materials other than dry ice. If you are not sure if the material you are sending is considered hazardous, contact EHS at 862-5038. When shipping hazardous biological materials, refer to the UNH Shipment of Biological Materials Manual. When shipping any other hazardous materials, refer to the UNH Shipment of Hazardous Materials Manual.

Packages refrigerated with dry ice are normally shipped by air in order to reach their destinations rapidly. Therefore, information in this guide pertains to air shipments of dry ice only. If you intend to ship your package by other means such as ground, freight, vessel, etc., contact EHS to discuss applicability of shipping regulations.

II. Training Requirements

Federal rules require that anyone wishing to ship dry ice must first have shipping training. If you are going to package dry ice for shipment or sign any type of shipping documentation (such as a FedEx Airbill) for a dry ice shipment, you must follow the training certification requirements outlined below.

1. **Read this guide.** This guide will explain the general provisions relating to the regulations and detailed training in the requirements applicable to dry ice.

2. **Submit to EHS an Intent to Ship Dry Ice form (Appendix A).** EHS will review this form with you and, upon successful completion, will certify you to ship dry ice.

Shipping regulations change frequently, so it is necessary to renew your certification every two years. Training sessions reviewing the material in this manual are available from EHS. Call 862-5038 to schedule training or to ask questions regarding the shipment of dry ice.

III. Hazard Identification

Dry ice is classified by DOT and IATA as a “miscellaneous” hazard, class 9. Dry ice is considered hazardous during transportation for three reasons:

1. **Explosion hazard:** dry ice releases a large volume of carbon dioxide gas as it sublimes. If packaged in a container that does not allow for release of the gas, it may explode, causing personal injury or property damage.

2. **Suffocation hazard:** a large volume of carbon dioxide gas emitted in a confined space may create an oxygen deficient atmosphere.

3. **Contact hazard:** dry ice is a cryogenic material that causes severe frostbite upon contact with skin.
Packaging dry ice properly will minimize the risk to personnel transporting the material. The explosion hazard will be eliminated with a package designed to vent gaseous carbon dioxide. Suffocation and contact hazards will be greatly reduced by labeling the package correctly, so those who come in contact with it will be aware of the contents.

IV. Packaging Dry Ice

A. Requirements

There are five basic requirements for shipments of dry ice:

1. **Gas venting**: packages must allow for release of carbon dioxide gas. Dry ice must never be sealed in a container with an airtight seal such as a jar with a threaded lid or a plastic cooler.

2. **Package integrity**: a package containing dry ice must be of adequate strength for intended use. It must be strong enough to withstand the loading and unloading normally encountered in transport. It must also be constructed and closed in order to prevent any loss of contents that might be caused by vibration or by changes in temperature, humidity, or altitude.

3. **Package materials**: do not use plastics that can be rendered brittle or permeable by the temperature of dry ice. This problem can be avoided by using commercially available packages intended to contain dry ice, see Appendix B, Manufacturers of Dry Ice Shipping Containers.

4. **Airbill**: the airbill (also referred to as the air waybill) must include the statement “Dry ice, 9, UN1845, number of packages X net weight in kilograms.” FedEx has a check box on their airbill to satisfy this requirement; see Figure 2. Airborne Express requires a slightly different format; see Figure 3. Check with your courier to make sure you have made the proper notation on their paperwork.

5. **Labeling**: the outermost container must be labeled with a hazard class 9 label, UN 1845, and net weight of dry ice in kilograms. See Figure 1. A printable version is included in Appendix C. The label should be affixed to a vertical side of the box (not the top or bottom) and oriented as in Figure 1. The maximum allowable net quantity of dry ice allowed per package is 200 kg.

Figure 1. Dry ice label.
Figure 2. FedEx Airbill. Highlighted area properly documents 1 box containing 6 kg of dry ice.

Figure 3. Airborne Express Airbill. Highlighted area shows format required for 1 box containing 5 kg of dry ice.
B. Recommendations

Note the following recommendations when packaging and labeling dry ice shipments:

- Do not write “specimens” or “diagnostic specimens” on the box. Diagnostic specimens are subject to specific packaging requirements and there should not be any misunderstanding about your shipment. Diagnostic specimens, in shipping terminology, are materials that may be infectious to humans or animals. If you think your samples might be infectious, refer to the UNH Shipment of Biological Materials Manual.

- Reusing a dry ice box is a good use of resources. If you choose to reuse a box, completely obliterate all unnecessary marking such as hazard labels, addresses, FedEx (or other courier) labels and barcodes. Use caution if reusing a box that has been used to ship infectious material or diagnostic specimens. Only reuse a box if you can personally verify it is not contaminated and its integrity is intact. A box should not be reused if it is torn, cut, stained, or if the insulation is cracked or broken.

- Secure your samples in such a way that when the dry ice sublimates, they will not move freely inside of the insulated box. This can be accomplished by wedging your samples in place with cardboard or styrofoam. Fragile containers such as glass tubes or vials should be wrapped with cushioning material.

- Minimize the volume of air to which the dry ice is exposed in order to slow the rate of sublimation. If there is any air space after you fill your package with dry ice, fill it with packing peanuts or other material to reduce the volume of air space.

- Shipments are generally recommended to contain 5-10 pounds (2.27-4.54 kg) of dry ice per 24 hours. Refer to your package manufacturer’s recommendations. Make arrangements with your consignee to make sure your package will be received on its intended delivery date. Take into account local holidays or closings that might delay package receipt.

- Dry ice shipments can be made with FedEx and DHL. UPS and the U.S. Postal Service have extremely restrictive policies concerning shipments of hazardous materials; do not ship dry ice with UPS or the U.S. Postal Service.
Appendix A. Intent to Ship Dry Ice

After reading the UNH Guide to Shipping with Dry Ice, fill out this form to qualify to ship dry ice at UNH. EHS will review the completed form with you and, upon successful completion, will certify you to ship dry ice. The certification will expire after two years.

1) Why is dry ice considered a hazardous material?

2) Which of the following labels/markings must appear on a package containing dry ice? Check all that apply.
   - Class 9 hazard label
   - Net weight of dry ice
   - Class 8 hazard label
   - “UN1845, Dry ice”
   - “Inner packages comply with prescribed specifications”
   - Biohazard symbol
   - “Diagnostic specimens”

3) I have to put a class 9 label on the box only when there are other hazardous materials in the box.
   a) True
   b) False

4) It is acceptable to put a class 9 label on the top or bottom of the box.
   a) True
   b) False

5) The only consideration when reusing a dry ice shipping box is labeling it with the correct address.
   a) True
   b) False

6) If you are shipping non-hazardous plant tissue samples to a lab for diagnostic analysis, it is okay to write on the shipping box, “Diagnostic specimens enclosed.”
   a) True
   b) False

I understand the hazards associated with dry ice and the shipping requirements for dry ice, as outlined in this manual.

| Print Name: |  |
| Signature: |  |
| Department: |  |
| Date: | Phone: |

Please return in campus mail to EHS, 11 Leavitt Lane.
Appendix B. Manufacturers of Dry Ice Shipping Containers

Air Sea Atlanta
1234 Logan Circle
Atlanta, GA 30318
(880) 351-8600
http://www.airseaatlanta.com

DG Supplies, Inc.
5 Boxal Drive
Cranbury, NJ 08512
(800) 347-7879
http://www.dgsupplies.com

Polyfoam Packers Corporation
2320 S. Foster Avenue
Wheeling, IL 60090
(888) 765-9362
http://www.polyfoam.com

All-Pak, Inc.
Corporate One West
1195 Washington Pike
Bridgeville, PA 15017
(800) 245-2283
http://www.all-pak.com

HAZMATPAC, Inc.
5301 Polk St., Bldg. 18
Houston, TX 77023
(800) 923-9123
http://www.hazmatpac.com

SAF-T-PAK, Inc.
10807-182 Street, Edmonton
Alberta, Canada, T5S 1J5
(800) 814-7484
http://www.saftpak.com

CARGOpak Corporation
3215-A Wellington Court
Raleigh, NC 27615
(800) 266-0652
http://www.cargopak.com

Inmark, Inc.
220 Fisk Drive S.W.
Atlanta, GA 30336-0309
(800) 646-6275
http://www.inmarkinc.com

Source Packaging of New England, Inc.
405 Kilvert Street
Warwick, RI 02886
(800) 200-0366
http://www.sourcepak.com
Appendix C. Dry Ice Shipping Label

The label below should print with the proper dimensions of a class 9 hazard label (minimum dimensions: 100 mm on a side). Cut around the outside border of the label and affix it a vertical side of the box (not the top or bottom), oriented as shown below. Many printer inks run when exposed to even small amounts of water, such as rain or snow. Therefore, when using this label, cover with clear plastic tape after filling in the weight of dry ice.