Introduction

Welcome to the **Shipping with Dry Ice (OHS_BIO200)** training course. This course is **REQUIRED** for anyone that who is mailing shipments refrigerated with solid Carbon Dioxide (Dry Ice).

If you choose to ship a package using Dry Ice, International and Federal requirements dictate that you **MUST** be trained to do so every two years, or if regulations change. Additional training may be required, depending on the samples/materials that are being shipped with Dry Ice.

UAB **REQUIRES** additional shipping training for anyone that will be packing:

- Infectious Substances, Category A (BIO202)
- Biological Substances, Category B (BIO201)

Failure to properly pack and ship materials is a **VIOLATION** of the law and is punishable with fines and/or imprisonment.

Objectives

At the conclusion, participants should be able to:

1. Identify and use the United Nations (UN) Classification and Proper Shipping Names (PSN) for Dry Ice.
2. Pack any primary, secondary containment, or overpack boxes correctly.
3. Mark and Label any shipping packages correctly.
4. Complete a Shipper's Declaration properly.
5. Follow all safety guidelines to avoid any accidents or injuries.

Overview

Dry Ice is a commonly used refrigerant for shipping biological samples and is classified as a Class 9 Miscellaneous Dangerous Good. The United States Department of Transportation (US DOT) and the International Air Transportation Association (IATA) regulate Dry Ice shipments and dictate the specific procedures to follow when shipping with Dry Ice. Dry Ice refrigerated packages are normally shipped by air.

Therefore, the following guide summarizes the regulatory requirements of Dry Ice-containing shipments by air. The requirements for shipping with Dry Ice as a refrigerant are combined with the shipping requirements that apply to the actual samples/materials you intend to refrigerate. Contact OH&S to discuss regulations that may apply for alternative means of transport.

If you need to send shipments that are refrigerated, you may choose to use gel packs or solid carbon dioxide (Dry Ice). Gel packs are **NOT REGULATED**. They are not capable of the cooling to the temperature and duration achieved by Dry Ice. Wet ice, or ice made from water, is not allowed by most shippers due to the likelihood of leaks.

Dry Ice Blocks

Gel Pack

Wet Ice in an Ice Machine

Shipper Responsibilities

Packaging

UN and PSN

Proper identification requires both a UN number **AND** the Proper Shipping Name (PSN) for Dry Ice. The UN Number is UN 1845. Dry Ice has two Proper Shipping Names: "Dry Ice" **OR** "Carbon Dioxide, Solid." So the proper identification would look like this

"UN 1845 Dry Ice" **OR** "UN 1845 Carbon Dioxide, Solid."

Selecting the Proper Packaging

Packaging components must pass testing requirements as a system, so mixing and matching packaging components from different manufacturer's is **NOT ALLOWED**.

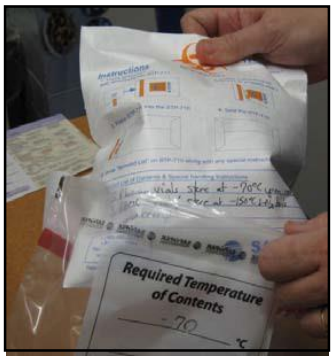
NEVER place Dry Ice is a sealed container.

All packaging intended for shipment with Dry Ice must be designed/ constructed to allow release of carbon dioxide gas, preventing the build-up of pressure. Shippers must make arrangements with the carrier before Dry Ice may be transported.

Outside Packaging

The outside packaging is typically a fiberboard box or container used to hold the gas-permeable insulated cooler preferable Styrofoam containing the Dry Ice. The box also serves as a surface for displaying clear marks, labels, and other important information.

Inside Packaging



Effects of Dry Ice on Cardboard When Packed without Proper Insulation

- Properly **CLASSIFY** and **IDENTIFY** the samples or materials you are shipping with the Dry Ice.
- Please refer to the interactive **Classification Flowchart** if you are unsure of the proper classification and to determine if any additional training will be required.
- Once the sample or material is packed with the appropriate packaging material and according to the appropriate packing instructions, you can then begin the process of packing it according to Dry Ice regulations (Packing Instructions 945).

All packaging components for Infectious Substances, Category A, or Biological Substances, Category B must be assembled per the manufacturers closing instructions specific to the packaging system purchased. If you will be packing any Category A or B substances, you need to complete the **REQUIRED** training.

Sealed Containers

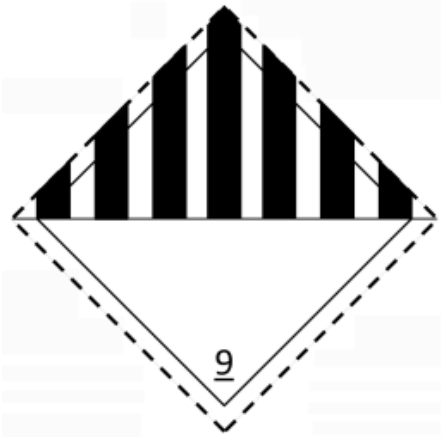
Sealed containers and Dry Ice **DO NOT** mix. Dry Ice is frozen carbon dioxide gas and expands exponentially as it sublimates. Many people have played with Dry Ice Fireworks. This consists of putting Dry Ice in a plastic container with or without water and sealing it.

This man almost lost an eye. Others have had far more serious injuries form these Dry Ice experiments. Some cities have even outlawed this type of experiment.

Please watch this **video** to see another example on how dangerous Dry Ice in a sealed container can be. This experiment was done by a professional. UAB Police were present, and all safety precautions were followed.

Marking and Labeling

Dry Ice shipments require the labels described below:



- A Class 9 Miscellaneous hazard black & white diamond-on-point label
- Proper Shipping Name and UN Number (which is either "UN 1845 Dry Ice" **OR** "UN 1845 Carbon Dioxide, Solid")
- The weight of the Dry Ice must be included adjacent to the black & white on-point label or the Proper Shipping Name.
- Any additional substance-specific marks and labels required of the material being refrigerated by the Dry Ice.
- Vendors provide Marks and Labels with the appropriate packaging components. These labels must meet minimal font and dimension requirements.

If you have any questions about the appropriate required Markings and Labels, contact OH&S at 205-934-2487.

This is an example of a **pre-printed label** available on the OH&S website that you can complete and affix on the outside of packages that do not contain Category A or B substances. If you are **NOT** shipping Category A or B substances but are shipping with Dry Ice, you **MUST** use a label (like this one found on the OH&S website) **OR** mark on the outside of box **CONTENTS BEING COOLED** along with specifying the exact content inside.

CONTENTS BEING COOLED:

Diagnostic or Treatment Purposes

Exempt Animal Specimen

Exempt Human Specimen

Non-Regulated

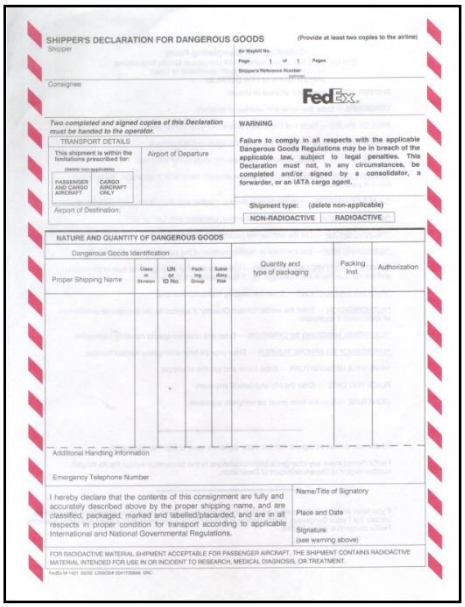
If you choose **NOT** to use this label, then you **MUST** mark: **CONTENTS BEING COOLED** and specify the contents on the outside of the package.

Documentation

Shipper's Declaration

Some substances require a Shipper's Declaration. A Shipper's Declaration is **REQUIRED** for UN 1845 Dry Ice **ONLY** when it is used as a refrigerant for dangerous goods. Infectious Substances, Category A requires a Shipper's Declaration. If it contains Dry Ice as the packing refrigerant, then the Dry Ice **MUST** also be listed on the Shipper's Declaration.

Refer to **49 CFR 173.127** to confirm that all requirements have been met.


SHIPPER'S DECLARATION FOR DANGEROUS GOODS

(Provide at least two copies to the airline)

Shipper

Consignee

FedEx

Two completed and signed copies of this Declaration must be handed to the operator.

TRANSPORT DETAILS

This shipment is within the limitations prescribed for:

PASSENGER AND CARGO AIRCRAFT

CARGO AIRCRAFT ONLY

Airport of Departure

Airport of Destination:

WARNING

Failure to comply in all respects with the applicable Dangerous Goods Regulations may be in breach of the applicable law, subject to legal penalties. This Declaration must not, in any circumstances, be completed and/or signed by a consolidator, a forwarder, or an IATA cargo agent.

Shipment type: (delete non-applicable)

NON-RADIOACTIVE | RADIOACTIVE

NATURE AND QUANTITY OF DANGEROUS GOODS

Dangerous Goods Identification

Proper Shipping Name | Class or Division | UN or ID No. | Packing Group | Subsidiary Risk | Quantity and type of packaging | Packing Inst. | Authorization

Additional Handling Information

Emergency Telephone Number

I hereby declare that the contents of this consignment are fully and accurately described above by the proper shipping name, and are classified, packaged, marked and labelled/placarded, and are in all respects in proper condition for transport according to applicable International and National Governmental Regulations.

Name/Title of Signatory

Place and Date

Signature (see warning above)

FOR RADIOACTIVE MATERIAL SHIPMENT ACCEPTABLE FOR PASSENGER AIRCRAFT, THE SHIPMENT CONTAINS RADIOACTIVE MATERIAL INTENDED FOR USE IN OR INCIDENT TO RESEARCH, MEDICAL DIAGNOSIS, OR TREATMENT.

If the items you are shipping **DO NOT** require a Shipper's Declaration (non-dangerous goods, "Biological Substance, Category B," and exempt human or animal specimens) then the following information must be included on the waybill on the "Nature and Quantity of Good" section:

- UN Number: UN1845
- Proper Shipping Name: "Carbon Dioxide, Solid" or "Dry Ice"
- The Class or Division Number: 9
- The number of packages
- The Net Weight of the Dry Ice in each package
- "UN3373, Biological Substances, Category B," if appropriate.

Waybill

Some shipments do not require a Shipper's Declaration; however, there is some required information needed on the Waybill. The required information is:

- UN Number – UN 1845
- Proper Shipping Name – Dry Ice
- Class or Division Number – 9
- Number of packages
- Net quantity of Dry Ice per package

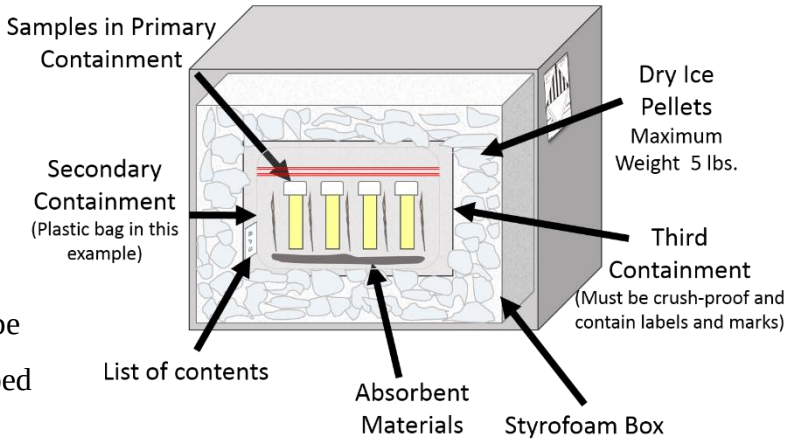
Example

The picture on the next page demonstrates how to properly pack a Category A or B substance package using Dry Ice. If the manufacturer's closure instructions are not printed directly on the box, the shipper is required to maintain a copy of the instructions for 90 days from the time the shipment was offered for transport.

You should pack using the ICAO/IATA Packing Instructions:

- 954 for Dry Ice shipments
- 650 for Biological Substance, Category B

- 620 for Infectious Substances, Category A affecting humans or Infectious Substances, affecting animals



A. The primary container is the white-capped tube. Multiple fragile primary containers must be wrapped individually. It is also recommended that the closures of primary containers be secured by positive means (e.g., lids taped closed).
B. The secondary container must be an airtight, leak-proof container. Specialized screw-capped plastic or metal jars, or sealable plastic bags, are commonly used as necessary containers in vendor-supplied systems.
C. This secondary container must also have enough absorbent material to absorb the entire contents, should the primary container fail. For infectious substances, the package must be designed to secure the secondary packaging in the original orientation even after the Dry Ice has dissipated.
D. An itemized list of contents goes between the secondary container and the outer packaging.
E. The third container must be crush-proof to protect the items. This typically consists of Styrofoam container, surrounded by a fiberboard box that facilitates labeling. If the contents are classified as Category A or B, the packaging system used must also pass designated testing specifications.
F. The Styrofoam box fits securely inside the fiberboard box and is then filled with Dry Ice pellets. The Styrofoam lid should fit securely, but not too tight.
G. Marks and Labels are placed on the outer container.

Things You Need to Remember

There are several things you should remember when shipping items that need to be refrigerated:

- Using "wet ice," or ice made from water, is **NOT ALLOWED** by most shippers due to the likelihood of leaks. You should use Dry Ice or gel packs.
- When using Dry Ice, read and pack according to PI 954 (Changed in 2011 from 904).
- Use a Styrofoam box when packing with Dry Ice.
- **NEVER** place Dry Ice within a sealed container due to the possibility of an explosion.
- If you are shipping a package containing an Infectious Substances, Category A and Dry Ice, the Shipper's Declarations **MUST** include the nature and quantity information for Dry Ice as well as the Infectious Substance, Category A.
- If your shipment does not require a Shipper's Declaration, you must use a waybill.

Operator (or Carrier) Responsibilities

Exemptions

Overpacks

If multiple fully-compliant dangerous goods packages are placed within a fiberboard box, it is considered an overpack. All Marks and Labels on the inner packages must be reproduced on the overpack. The word "overpack" must also be placed on the outside of the overpack.

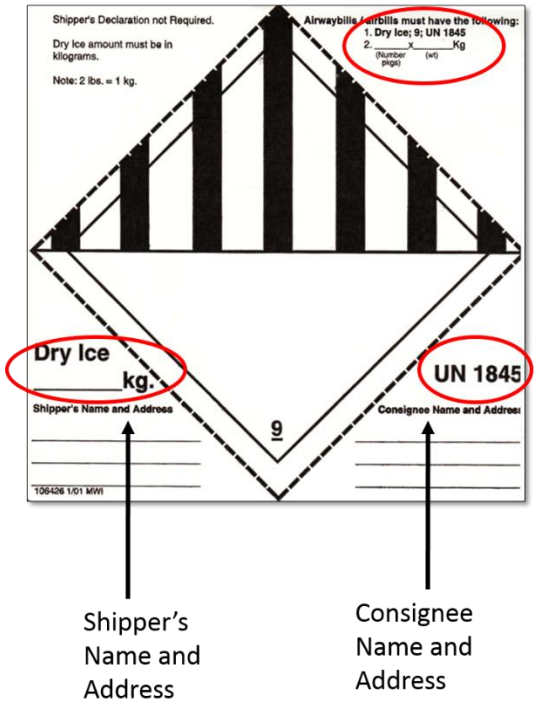
Non-Dangerous Goods

There are exceptions in the regulations for non-dangerous goods shipments by air within the U.S. when using less than 2.5Kg (5.5 pounds) of Dry Ice. The packages must allow for the release of the CO_2 gas, be marked. "Dry Ice", list the quantity of Dry Ice and the contents of the package.

In addition to the substance specific marks and labels, packages containing Dry Ice should also have:

- A Class 9 Miscellaneous hazard black and white diamond-on-point label.
- Proper Shipping Name (which is either UN 1845 or UN 1845 Carbon Dioxide, Solid)

- The weight of the Dry Ice



If you are shipping **NON-REGULATED** materials with Dry Ice, you **MUST** mark the package with the name of the contents being cooled.

Security

After preparing the package for shipment, the package must remain under the direct control of trained personnel until it is handed over to the carrier. This reduces the chances of tampering, theft, destruction, or invalidating the shipper's signature that signifies the package has been prepared in accordance with 49 CFR/IATA regulations.

If you suspect a package has been tampered with notify UAB OH&S immediately!

Receiver (or Consignee) Responsibilities

The **Receiver (or Consignee)** is the person(s) the material was sent to at the final destination. Responsibilities are to:

1. Provide assistance with import permits
2. Inspect received packages for damage or leaks
3. Verify itemized list of contents
4. Report receipt to the shipper
5. Report leaking packages to the appropriate authority

Conclusion

This concludes the **Shipping with Dry Ice (OHS_BIO200)** training course. You should now take the assessment. 85% or higher is considered passing. You have three chances to successfully complete the assessment. Failing all three attempts means that you fail the course and must start over.

Want to Learn More?

OH&S has many training courses available to all UAB active employees and students. This includes topics such as in depth radiation training, biosafety, bloodborne pathogens, chemical safety, Controlled Substances, building life safety, hazardous and medical waste, universal waste, PPE, Hazard Communication, etc.

We have a **decision tree** to assist you in choosing the right course to match the knowledge/skills you may need at work every day as well.

If you have any questions or comments, please feel free to contact OH&S at 205-934-2487.