



# UC Davis Guide to Shipping Dry Ice

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## ■ Introduction

- The regulations for compliant shipping of dry ice are enforced by the US Department of Transportation (DOT).
- These regulations are located in the Hazardous Materials Regulations(HMR), Chapter 49 of the Code of Federal Regulations (49CFR).
- Additional requirements for air transportation via FedEx or other air carriers are located in the International Civil Aviation Organization (ICAO) Dangerous Goods Regulations (DGR).
- 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., email [hazshipping@ucdavis.edu](mailto:hazshipping@ucdavis.edu) to inquire on the applicability of shipping regulations.

## ■ Training Objectives

- By the end of this training you will know how to prepare (identify, classify, package, mark, label and document) your dry ice shipment, via air, in accordance with the DOT Hazardous Materials Regulations and the IATA Dangerous Goods Regulations.



## ■ Training Requirements

- Federal regulations require that, if you are going to package dry ice for shipment or process any type of shipping documentation (such as a FedEx Air bill) for a dry ice shipment, you must meet the training requirements outlined below.
  - Each hazmat employee must be provided and tested on general awareness, security awareness, and function specific training as they relate to hazardous materials.
  - Training must be provided within 90 days of the initial hire or job reclassification and must be recurrent once every three years in accordance with 49CFR 172.704. (If you are shipping via air, such as Federal Express, recurrent training is required every two years.)
  - The employer authorizes the employee to ship hazardous materials and is responsible for ensuring employees are trained in compliance with the regulations.
- This training provides function specific training only as it relates to shipping dry ice. (If your shipment contains another hazard or if you are unsure please email [hazshipping@ucdavis.edu](mailto:hazshipping@ucdavis.edu) .)

## ■ Dry Ice Hazards

- The Department of Transportation (DOT) and the International Air Transport Association (IATA) classify dry ice as a “miscellaneous” hazard, Class 9.
- Dry ice is considered hazardous during transportation for three reasons:
  - **Explosion hazard:** Dry ice releases a large volume of carbon dioxide gas as it sublimates. If packaged in a container that does not allow for release of gases, it may explode, causing personal injury or property damage.
  - **Suffocation hazard:** A large volume of carbon dioxide gas emitted in a confined space may create an oxygen deficient atmosphere.
  - **Contact hazard:** Dry ice is a cryogenic material that causes severe frostbite upon contact with skin.

## ■ Identifying/Classifying dry ice

- Once the shipper has identified the material to be dry ice the shipper must then obtain classification, identification and other information that will be used to prepare the shipment in compliance with the regulations.
- This information is obtained via the Hazardous Materials Table in 49CFR or via the IATA Dangerous Goods Regulations.
  - The HMT in 49CFR can be accessed electronically at: [http://www.ecfr.gov/cgi-bin/text-idx?tpl=/ecfrbrowse/Title49/49cfrv2\\_02.tpl](http://www.ecfr.gov/cgi-bin/text-idx?tpl=/ecfrbrowse/Title49/49cfrv2_02.tpl) .
  - Section 4.2 of the IATA DGR is not available online. Distribution Services has the current version on hand for review or you can purchase your own copy from IATA directly at: <http://www.iata.org/publications/Pages/index.aspx> . Please email [hazshipping@ucdavis.edu](mailto:hazshipping@ucdavis.edu) for information.

# ■ Hazardous Materials Table, 49CFR

□ The HMT is broken down into 10 columns

- Column 1- The symbols A & W signify that dry ice is regulated when transported by air or water (Note: Dry ice not regulated by ground transport.)
- Column 2- reflects the proper shipping name(s) as it must be identified in markings or on shipping papers
- Column 3- identifies dry ice as a Class 9 “miscellaneous” hazard
- Column 4- reflects UN1845 as the identification number for dry ice
- Column 5- identifies dry ice as a low level of risk during transportation by assigning PG III. (PG I reflects high level risk and PG II reflects medium risk)
- Column 6- Indicates the required labels for the shipment as none for ground shipments (not FedEx Express). **Note: There are additional requirements when processing the shipment via air. Air shipments must contain a Class 9 Miscellaneous label via the IATA regulations.**

| 1    | A            | B                                                                                         | C                        | D                      | E   | F           | G                              | (8)                   |          |      | (9)                                             |                     | (10)           |                |
|------|--------------|-------------------------------------------------------------------------------------------|--------------------------|------------------------|-----|-------------|--------------------------------|-----------------------|----------|------|-------------------------------------------------|---------------------|----------------|----------------|
|      | 2<br>Symbols | Hazardous materials descriptions and proper shipping names                                | Hazard class or Division | Identification Numbers | PG  | Label Codes | Special Provisions (§ 172.102) | Packaging (§ 173.***) |          |      | Quantity Limitations (see §§ 173.27 and 175.75) |                     | Vessel Stowage |                |
|      |              |                                                                                           |                          |                        |     |             |                                | Exceptions            | Non-bulk | Bulk | Passenger aircraft/rail                         | Cargo aircraft only | Location       | Other          |
| 1249 | A            | Acetaldehyde ammonia                                                                      | 9                        | UN1841                 | III | 9           | IB8, IP3, IP7, T1, TP33        | 155                   | 204      | 240  | 200 kg                                          | 200 kg              | A              | 34             |
| 1250 |              | Ammonium dinitro-o-cresolate, solid                                                       | 6.1                      | UN1843                 | II  | 6.1         | IB8, IP2, IP4, T3, TP33        | 153                   | 212      | 242  | 25 kg                                           | 100 kg              | B              | 36, 65, 66, 77 |
| 1251 | A W          | Carbon dioxide, solid <i>or</i> Dry ice                                                   | 9                        | UN1845                 | III | None        |                                | 217                   | 217      | 240  | 200 kg                                          | 200 kg              | C              | 40             |
| 1252 |              | Carbon tetrachloride                                                                      | 6.1                      | UN1846                 | II  | 6.1         | IB2, N36, T7, TP2              | 153                   | 202      | 243  | 5 L                                             | 60 L                | A              | 40             |
| 1253 |              | Potassium sulfide, hydrated <i>with not less than 30 percent water of crystallization</i> | 8                        | UN1847                 | II  | 8           | IB8, IP2, IP4, T3, TP33        | 154                   | 212      | 240  | 15 kg                                           | 50 kg               | A              | 52             |
|      |              | Propionic acid <i>with not less than 10%</i>                                              | 8                        | UN1848                 | III | 8           | IB3, T4, TP1                   | 154                   | 203      | 241  | 5 L                                             | 60 L                | A              | 8              |



# ■ Hazardous Materials Table, 49CFR (cont'd).

- Column 7- indicates that there are no special provisions for dry ice.
- Column 8- reflects where to find the specific packaging requirements for dry ice. 8A and 8B are exceptions and Non-bulk packaging information and are found in 49CFR Section 173.217. Bulk shipments are found in 49CFR 173.240.
- Column 9- reflects quantity information when shipping dry ice by specified means, either Passenger aircraft/rail or Cargo aircraft only. In both cases each package is limited to no more than 200kg of dry ice.
- Column 10- address Overwater transport of dry ice. This training is for air transport only. If you have questions regarding Overwater please email [hazshipping@ucdavis.edu](mailto:hazshipping@ucdavis.edu) .

| 1    | A         | B                                                                                         | C                        | D                      | E   | F           | G                              | (8)                   |          |      | (9)                                             |                     | (10)           |                |
|------|-----------|-------------------------------------------------------------------------------------------|--------------------------|------------------------|-----|-------------|--------------------------------|-----------------------|----------|------|-------------------------------------------------|---------------------|----------------|----------------|
|      | 2 Symbols | Hazardous materials descriptions and proper shipping names                                | Hazard class or Division | Identification Numbers | PG  | Label Codes | Special Provisions (§ 172.102) | Packaging (§ 173.***) |          |      | Quantity Limitations (see §§ 173.27 and 175.75) |                     | Vessel Stowage |                |
|      |           |                                                                                           |                          |                        |     |             |                                | Exceptions            | Non-bulk | Bulk | Passenger aircraft/rail                         | Cargo aircraft only | Location       | Other          |
| 1249 | A         | Acetaldehyde ammonia                                                                      | 9                        | UN1841                 | III | 9           | IB8, IP3, IP7, T1, TP33        | 155                   | 204      | 240  | 200 kg                                          | 200 kg              | A              | 34             |
| 1250 |           | Ammonium dinitro-o-cresolate, solid                                                       | 6.1                      | UN1843                 | II  | 6.1         | IB8, IP2, IP4, T3, TP33        | 153                   | 212      | 242  | 25 kg                                           | 100 kg              | B              | 36, 65, 66, 77 |
| 1251 | A W       | Carbon dioxide, solid <i>or</i> Dry ice                                                   | 9                        | UN1845                 | III | None        |                                | 217                   | 217      | 240  | 200 kg                                          | 200 kg              | C              | 40             |
| 1252 |           | Carbon tetrachloride                                                                      | 6.1                      | UN1846                 | II  | 6.1         | IB2, N36, T7, TP2              | 153                   | 202      | 243  | 5 L                                             | 60 L                | A              | 40             |
| 1253 |           | Potassium sulfide, hydrated <i>with not less than 30 percent water of crystallization</i> | 8                        | UN1847                 | II  | 8           | IB8, IP2, IP4, T3, TP33        | 154                   | 212      | 240  | 15 kg                                           | 50 kg               | A              | 52             |
|      |           | Propionic acid <i>with not less than 10%</i>                                              | 8                        | UN1848                 | III | 8           | IB3, T4, TP1                   | 154                   | 203      | 241  | 5 L                                             | 60 L                | A              | 9              |

# ■ IATA Dangerous Goods Regulations Section 4.2


- Shipments of dry ice by air are also subject to the IATA regulations
- Below is an example of the DGR Section 4.2 for your reference only. To review a complete copy of the IATA DGR please contact 530-752-2077. You may also purchase a copy at: <http://www.iata.org/publications/Pages/index.aspx> .
- The IATA DGR Section 4.2 reflects the following column information:
  - A. The identification number for dry ice is UN1845
  - B. The proper shipping name is “Dry Ice”

| UN/<br>ID no. |           | Proper Shipping<br>Name/Description                                        | Class<br>or<br>Div.<br>(Sub<br>Risk) | Hazard<br>Label(s) | PG  | Passenger and<br>Cargo Aircraft |           |             |                    | Cargo<br>Aircraft Only |                    | S.P.<br>see<br>4.4 | ERG<br>Code |    |
|---------------|-----------|----------------------------------------------------------------------------|--------------------------------------|--------------------|-----|---------------------------------|-----------|-------------|--------------------|------------------------|--------------------|--------------------|-------------|----|
|               |           |                                                                            |                                      |                    |     | Ltd Qty                         |           | Pkg<br>Inst | Max Net<br>Qty/Pkg | Pkg<br>Inst            | Max Net<br>Qty/Pkg |                    |             |    |
| A             | B         | C                                                                          | D                                    | E                  | F   | G                               | H         |             |                    |                        |                    | I                  | J           | K  |
|               |           | Drugs, flammable, liquid, n.o.s., see Flammable liquid, n.o.s. * (UN 1993) |                                      |                    |     |                                 |           |             |                    |                        |                    |                    |             |    |
| 1845          | Dry ice † |                                                                            | 9                                    | Miscellaneous      | III | E0                              | Forbidden |             | 954                | 200 kg                 | 954                | 200 kg             | A48<br>A151 | 9L |

# ■ IATA Dangerous Goods Regulations Section 4.2 (cont'd).

- C. Identifies the hazard class for dry ice as Class 9, Miscellaneous
- D. Identifies the hazard label required on your package for dry ice as Class 9, Miscellaneous
- E. Identifies the packing group for dry ice as PG III
- F. Excepted packaging code, if your shipment meets specified criteria you may be able to use less restrictive shipping processes.
- G. Does not apply to dry ice
- H. Does not apply to dry ice
- I. Packaging instruction of dry ice is "PI 954" (for a copy of PI 954 please call 530-752-2077)
- J. Identifies the maximum per package for dry ice as 200kg.
- K. & L. apply to cargo aircraft only shipments.
- M. Shows special provisions (A48- Packaging tests not necessary) (A151 applies when a shipper prepares the shipment using a unit load device or pallet)
- N. The Emergency Response Guide (ERG) code used by the transport carriers.

| UN/<br>ID no. |           | Proper Shipping<br>Name/Description                                        | Class<br>or<br>Div.<br>(Sub<br>Risk) | Hazard<br>Label(s) | PG  | Passenger and<br>Cargo Aircraft |             |                    |             |                    |             | Cargo<br>Aircraft Only |             | S.P.<br>see<br>4.4 | ERG<br>Code |                    |
|---------------|-----------|----------------------------------------------------------------------------|--------------------------------------|--------------------|-----|---------------------------------|-------------|--------------------|-------------|--------------------|-------------|------------------------|-------------|--------------------|-------------|--------------------|
|               |           |                                                                            |                                      |                    |     | EQ<br>see<br>2.7                | Ltd Qty     |                    | Pkg<br>Inst | Max Net<br>Qty/Pkg | Pkg<br>Inst | Max Net<br>Qty/Pkg     | Pkg<br>Inst |                    |             | Max Net<br>Qty/Pkg |
|               |           |                                                                            |                                      |                    |     |                                 | Pkg<br>Inst | Max Net<br>Qty/Pkg |             |                    |             |                        |             |                    |             |                    |
|               |           |                                                                            |                                      |                    |     |                                 |             |                    |             |                    |             |                        |             |                    |             |                    |
| A             | B         | C                                                                          | D                                    | E                  | F   | G                               | H           | I                  | J           | K                  | L           | M                      | N           |                    |             |                    |
| 1845          | Dry ice † | Drugs, flammable, liquid, n.o.s., see Flammable liquid, n.o.s. ★ (UN 1993) | 9                                    | Miscellaneous      | III | E0                              | Forbidden   |                    | 954         | 200 kg             | 954         | 200 kg                 | A48<br>A151 | 9L                 |             |                    |



## ■ Use the Hazardous Materials Table and Dangerous Goods List to...

- Determine whether your shipment is regulated for transport
- Identify the proper shipping name and UN# (i.e. UN1845, Dry Ice)
- Classify the hazard (i.e. Class 9 Miscellaneous)
- Locate the Packing Group (i.e. PG III, low risk)
- Determine the hazard labels (i.e. Class 9, Miscellaneous)
- Locate the shipping instructions and determine type of packaging requirements (PI 954)
- Ensure you meet the volume/quantity limitations for your mode of transport.

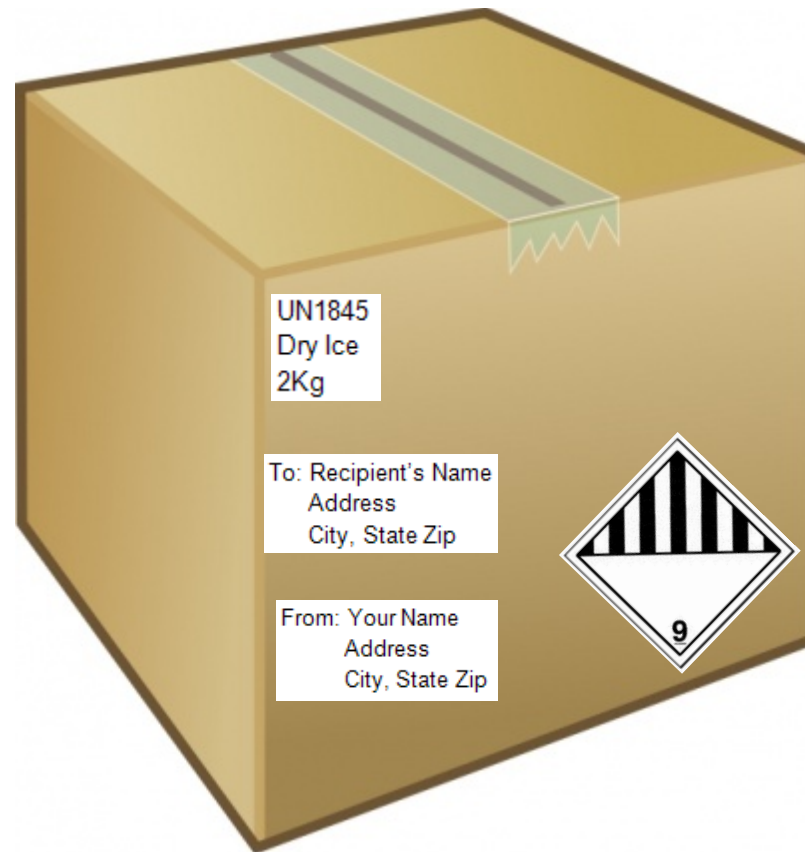
## ■ Packaging Dry Ice

- Basic requirements for packaging shipments of dry ice:
  - **Gas venting:** Packages must allow for release of carbon dioxide gas. Dry ice must never be sealed in a container with an airtight seal.
  - **Package integrity:** A package containing dry ice must be of adequate strength for its 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. (Note: Styrofoam cannot be used without sturdy outer packaging, such as a fiberboard box.)
  - **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.



## ■ Labeling and Marking

- The outermost container must be labeled with a hazard class 9 label, UN 1845, and total weight of dry ice in kilograms. The label should be affixed to a vertical side of the box (not the top or bottom) and oriented.



# ■ Documentation

- **Shipping Memo:** If your department does not have a 9-digit FedEx account number your documentation will need to be processed by the Mail Services. A shipping memo (available through UCD Buy, 71461-143 or online at [http://afs.ucdavis.edu/our\\_services/distribution-services/mail-services/ship-out-program.html](http://afs.ucdavis.edu/our_services/distribution-services/mail-services/ship-out-program.html) ) must accompany Dry Ice shipments delivered to the Mail Services for processing. In addition, your shipment will be carefully inspected for compliance. Please email [hazshipping@ucdavis.edu](mailto:hazshipping@ucdavis.edu) for more info.

UNIVERSITY OF CALIFORNIA, DAVIS

No.R- 56879

## SHIPPING MEMO

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**A** DEPARTMENT \_\_\_\_\_ DATE \_\_\_\_\_

ORIGINATOR \_\_\_\_\_ E-MAIL \_\_\_\_\_ PHONE # \_\_\_\_\_

BILLING ID OR CHART OF ACCOUNT (COA)/FULL ACCOUNTING UNIT (FAU) \_\_\_\_\_

PURCHASE ORDER NO. \_\_\_\_\_

STOREHOUSE REG. NO. (COPY OF PACKING SLIP PROGRAM) \_\_\_\_\_

---

**B** SHIP VIA:  OVERNIGHT  A.M.  SATURDAY DELIVERY  2ND DAY DELIVERY  3RD DAY DELIVERY  GROUND  YELLOW  VENDOR PICKUP  OTHER \_\_\_\_\_

INTERNATIONAL:  RED EX  OTHER \_\_\_\_\_

BILL TO:  SHIPPER (PREPAID)  RECIPIENT (COLLECT)

SHIP TO: \_\_\_\_\_

STREET ADDRESS \_\_\_\_\_

CITY \_\_\_\_\_ STATE \_\_\_\_\_ ZIP \_\_\_\_\_

---

**C** REASON FOR SHIPMENT: \_\_\_\_\_

---

**D** DANGEROUS GOODS CLASSIFICATION: (Check appropriate boxes if applicable)  YES (If YES, then Hazardous Information Sheet must be attached)  NO

DRY ICE \_\_\_\_\_ lbs.

---

**E** NO. OF CARTONS SHIPPED \_\_\_\_\_ DESCRIPTION OF CONTENTS \_\_\_\_\_

ITEM VALUE \_\_\_\_\_

CHECKED BY OTHER PERSONNEL (SPECIFY ONLY IF APPLICABLE)

---

**F** DELIVERED TO MAILMAN MANAGEMENT  \_\_\_\_\_

APPROVED SIGNATURE \_\_\_\_\_

DATE/TIME OF THIS STATE \_\_\_\_\_

DEPARTMENT USE ONLY

MAILED MANAGEMENT \_\_\_\_\_ DATE \_\_\_\_\_

1 - STORES-RECEIVING DEPT (RETENTION 3-10 YEARS)

UNIVERSITY OF CALIFORNIA 47140-100

# Documentation (cont'd).

- **Air bill:** If the department delivers the package directly to FedEx (or FedEx picks it up) a 9-digit departmental FedEx account number is required.
- The special handling section of the air bill must be filled out declaring the hazardous material (see below).

**FedEx USA Airbill** Express  
 FedEx Tracking Number: 839360283475  
 Form ID No. 0200  
 Sender's Copy

**1 From** Please print and press hard  
 Date \_\_\_\_\_ Sender's FedEx Account Number \_\_\_\_\_  
 Sender's Name \_\_\_\_\_  
 Company \_\_\_\_\_  
 Address \_\_\_\_\_  
 City \_\_\_\_\_ State \_\_\_\_\_ ZIP \_\_\_\_\_

**2 Your Internal Billing Reference** OPTIONAL  
 First 24 characters will appear on invoice.

**3 To**  
 Recipient's Name \_\_\_\_\_  
 Company \_\_\_\_\_  
 Address \_\_\_\_\_  
 City \_\_\_\_\_ State \_\_\_\_\_ ZIP \_\_\_\_\_

**4a Express Package Service** Packages up to 150 lbs.  
 FedEx Priority Overnight Next business morning  
 FedEx Standard Overnight Next business afternoon  
 FedEx First Overnight Earliest next-business morning delivery to select locations  
 FedEx 2Day Second business day  
 FedEx Express Saver Third business day  
**Express Freight Service** Packages over 150 lbs.  
 Day Freight\* no day  
 FedEx 2Day Freight Second business day  
 FedEx 3Day Freight Third business day  
 **Yes Shipper's Declaration not required**  
 **Dry Ice** Dry Ice, 9, UN 1845 1 x 6 kg  
 Cargo Aircraft Only

**6 Special Handling** Includes FedEx address in Section 3.  
 SATURDAY Delivery Available ONLY for FedEx Priority Overnight and FedEx 2Day to select ZIP codes  
 HOLD Weekday at FedEx Location NOT Available for FedEx Priority Overnight and FedEx 2Day to select locations  
 HOLD Saturday at FedEx Location Available ONLY for FedEx Priority Overnight and FedEx 2Day to select locations  
 Does this shipment contain dangerous goods?  
 No  Yes As per attached Shipper's Declaration  
 **Yes Shipper's Declaration not required**  
 **Dry Ice** Dry Ice, 9, UN 1845 1 x 6 kg  
 Cargo Aircraft Only

**7 Payment Bill to:** Enter FedEx Acct. No. or Credit Card No. below.  
 Sender Acct. No. in Section 1 will be billed  
 Recipient  Third Party  Credit Card  Cash/Check

Total Packages \_\_\_\_\_ Total Weight \_\_\_\_\_ Total Declared Value\* \$ \_\_\_\_\_  
 \*Our liability is limited to \$100 unless you declare a higher value. See back for details. FedEx Use Only

**8 Release Signature** Sign to authorize delivery without obtaining signature.  
 By signing you authorize us to deliver this shipment without obtaining a signature and agree to indemnify and hold us harmless from any resulting claims. 446

Try online shipping at [fedex.com](http://fedex.com)  
 By using this Airbill you agree to the service conditions on the back of this Airbill and in our current Service Guide, including terms that limit our liability.  
 Questions? Visit our Web site at [fedex.com](http://fedex.com) or call 1.800.Go.FedEx® 800.463.3339.



# ■ Recommendations

- Do not write “specimens” or “Biological specimens” on the box. Biological specimens are subject to specific packaging requirements. Biological specimens, in shipping terminology, are materials that may be infectious to humans or animals. If you think your samples might be infectious or have questions, please [hazshipping@ucdavis.edu](mailto:hazshipping@ucdavis.edu) for guidance regarding Hazardous Biological Materials.
- If you choose to reuse a box, completely obliterate all unnecessary marking such as hazard labels, addresses, FedEx (or other courier) labels and barcodes. 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 (vaporizes), 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 and absorbent 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 crumpled paper.
- 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. Also, remember Priority Overnight shipments that enter the mail stream on Friday will not be delivered till Monday. You must choose the “Saturday Delivery” option and make sure your recipient will be on hand to receive the package.



# Questions?

Email

[hazshipping@ucdavis.edu](mailto:hazshipping@ucdavis.edu)