Chapter 7
Transportation of Radioactive Material

Radioactive material that is possessed by UIC must be transported in a safe and legal manner. This chapter explains the requirements for transportation of radioactive material on campus, transportation of radioactive material by UIC personnel to other institutions, and radionuclide shipments using common carriers such as FedEx. The procedures in this chapter are based on regulatory requirements that are intended to protect shippers, carriers, recipients, the public, and the environment from exposure and contamination while facilitating such shipments.

7.1 Regulatory Background

The United States Department of Transportation (DOT) regulates the transportation of hazardous materials in intrastate, interstate, and international commerce. Their regulations, found in 49 CFR, apply to shippers, carriers, and container manufacturers. In addition to general regulations that apply to all shippers and carriers, there are specific regulations for each regulated mode of transportation (rail car, aircraft, vessel, and motor vehicle). In addition to the materials that are specifically identified by the DOT as hazardous, all EPA hazardous wastes, and most OSHA hazardous chemicals are also regulated. Failure to comply with the DOT hazardous materials transportation regulations can subject individuals to both civil and criminal penalties of at least $250 and not more than $27,500 per day per violation.

Transportation within the State of Illinois is also regulated by the Illinois Department of Transportation (IDOT), and enforcement is carried out by the Illinois State Police. Their regulations are virtually identical to those of DOT.

7.1.1 Definition of Radioactive Material for Transportation Purposes

DOT regulations state that radioactive material means any material having a specific activity greater than 0.002 microcurie (70 Bq) per gram. Specific activity of a radionuclide means the activity of the radionuclide per unit mass of that nuclide. The specific activity of a material in which the radionuclide is essentially uniformly distributed is the activity per unit mass of the material.

The Illinois Emergency Management Agency (IEMA) also regulates transportation of licensed radioactive material. Section 341.50 of their regulations state that “no licensee may transport licensed materials outside the confines of his plant or other place of use, or deliver licensed material to a carrier for transport unless:

1) such transport and delivery is in compliance with DOT regulations, and;
2) any special instructions needed to safely open the package have been made available to the individual or institution receiving the package”.

They also exempt radioactive material from DOT compliance if its specific activity is 0.002 microcurie per gram or less.

7.2 Transporting Radioactive Material on Campus

If radioactive material is carried on foot, it is not being transported by mode of transportation that is regulated by DOT and their regulations do not apply. However, all licensed radioactive material in
the possession of UIC is subject to IEMA regulations. IEMA regulations that apply include compliance with maximum permissible radiation levels in unrestricted areas, security of radioactive material, and maintenance of personnel exposures to levels that are as low as reasonably achievable (ALARA).

Many situations arise that require radioactive material to be transported from place to place on the UIC campus. Several situations are considered in this section. Further advice is available from Radiation Safety Section (RSS).

### 7.2.1 Transportation Using Motorized Vehicles

Transportation of radioactive material by motor vehicle is regulated by DOT. Requirements include proper classification of the material, selection of authorized packaging, marking, labeling, placarding, preparation of hazardous material shipping papers, and documented training of all personnel involved with the shipment. Under some circumstances, drivers must possess a commercial driver’s license and vehicles used to transport the material must have commercial insurance. Project personnel generally cannot satisfy these strict requirements; therefore, they are prohibited from transporting radioactive material using motor vehicles except when specifically authorized in advance by the RSS.

If it is necessary to transport radioactive material from one location to another using a motorized vehicle, such as when relocating a radionuclide laboratory, contact RSS. The RSS will assess the situation and determine the best option which may include transportation by RSS personnel, trained Motor Pool drivers (movers), or a common carrier.

### 7.2.2 Incoming Radionuclide Shipments

Almost all incoming shipments of radioactive material must be delivered to the Environmental Health and Safety Offices, 1129 S Hermitage Ave. Chicago, IL. See Chapter 4 for additional information. After receipt, packages are delivered to the RSS where they are inspected for external radiation level and contamination. Information about the shipment is entered into the database and project personnel are notified of the receipt. Packages are not opened by the RSS.

Project personnel who pick up radioactive material shipments must adhere to the following rules when transporting them to the use location:

- Do not open the package until it is in an authorized use location.
- Do not leave the package unattended at any time. Take the package directly to the authorized use location.
- If the shipment bears a Yellow II or Yellow III label, a cart should be used to transport the material so that personnel exposure is minimized.
- Avoid transporting radioactive material on public streets and sidewalks. If possible, transport the material through the tunnel system, over pedestrian overpasses, and via other building connections.
7.2.2 Transporting Radioactive Material after Receipt

After receipt of radioactive material, it is frequently necessary to move it from one authorized location to another. The following rules are based on IEMA requirements:

· Reasonable precautions must be taken to prevent the accidental release of radioactive material. This applies whether the material is being transported across the hall or to a laboratory in another building. Hallways and elevators are used by other university employees, visitors, and members of the public. A minor incident in a public area could have significant repercussions.

· Radioactive material must be transported in closed containers that will not open or leak during transport. Glass containers must be protected against breakage. The external surfaces of all containers must be free from radioactive contamination.

· Containers or container holders (e.g., trays that hold scintillation vials, test tube racks, etc.) must be properly marked with the radiation symbol and the wording Caution, Radioactive Material in magenta or purple on a yellow background. The radionuclide, activity, and date must be listed on the label.

· Containers of liquids must be placed in secondary containers with at least enough absorbent material to absorb all of the liquid in the event of a spill.

· Material that could emit an external radiation field must be surveyed and provided with appropriate shielding. The maximum accessible exposure rate on the surface of the container should be as low as reasonably achievable and the exposure rate at a distance of 1 foot from the surface of the outside container must not exceed 10 mR/h, as measured through the thin end window of a Geiger counter survey meter. Carts should be used when transporting material with significant external radiation fields to minimize personnel exposure.

· Radioactive material in transit may not be left unattended at any time. Take the material directly to the authorized use location.

· Avoid transporting radioactive material on public streets and sidewalks. If possible use UIC tunnels, pedestrian bridges, and other building connections. If the use of public streets and sidewalks is necessary, the containers of radioactive material must be packed in a sturdy box that will remain tightly closed under normal conditions.

7.3 Transporting Radioactive Material to and from other Local Institutions

The West Side VA Hospital, John H. Stroger, Jr. Hospital of Cook County, and Rush Presbyterian St. Luke’s Medical Center are within walking distance of UIC. The UIC license does not permit use of radioactive material at their facilities, however each of these institutions has its own license. Radioactive material transferred to UIC must be done so in accordance with Chapter 4, Section 4.6.

If radioactive material is transferred from UIC to one of these institutions, the following rules apply:

· The rules regarding the transfer of radioactive material to another institution found in Chapter 4, Section 4.11 must be followed. Refer to that section before continuing with this procedure.
· DOT regulations do not apply if hand carried on foot, however the material must be packaged as described above in Section 7.2.2. A list identifying the radionuclide, activity, and chemical form of each compound being transferred should also be provided as a courtesy to the recipient.

· A motor vehicle may not be used to transport the material. These rules apply to material carried on foot only.

· Radioactive material in transit may not be left unattended at any time. The material must be brought directly to the designated delivery point for the receiving licensee.

### 7.4 Preparing Radioactive Material for Shipment

Any person who prepares radioactive material for transportation by a regulated mode of transportation (rail car, aircraft, vessel, or motor vehicle) is a *hazmat employee* as defined by DOT regulations. All hazmat employees must be provided with general awareness training, function specific training, and safety training at a minimum frequency of once every 3 years. For this reason, all radioactive material shipments must be reviewed and approved by a trained RSS Health Physicist. The Health Physicist will:

· Select the hazard class and the proper shipping name of the material.
· Determine what packaging is authorized for the shipment.
· Directly supervise the packaging of the material.
· Properly label and mark the package.
· Prepare the specified shipping papers.
· Ensure that the requirements for transfers outlined in Chapter 4, Section 4.11 are satisfied.

Authorized Projects are expected to pay for any special shipping containers that are needed and all applicable shipping charges.

### 7.4.1 Limited Quantity Shipments

Shipment of small quantities of radioactive material that do not emit a significant external radiation from the packaging may qualify as a limited quantity as defined in 49 CFR 173.421. Limited quantity shipments must meet general shipping requirements, but are excepted from specification packaging, marking, labeling, and shipping paper requirements. The following conditions must be met before packages may be sent as a limited quantity.

· The activity to be shipped must not exceed the values in Table 7.1, *Limits for Limited Quantity Shipments of Radioactive Material*.

· The surface of the inner packaging or container must bear the marking *Radioactive*.

· The inner container or packaging must be packaged in a strong, tight outer package that will not leak any of the radioactive material during conditions normally incident to transportation.
· The non-fixed (removable) radioactive surface contamination on the external surface of the package must not exceed 0.001 μCi/100 square centimeters (2,200 dpm/100 cm²) for beta-gamma emitting material or 0.0001 μCi/100 square centimeters (220 dpm/100 cm²) for alpha emitting material. This shall be tested by wiping a cotton swab or piece of filter paper on 100 square centimeters of the outside surface of the package. The wipe must be counted using a liquid scintillation counter, auto-gamma counter, or other instrument set to detect the material being shipped that has been approved by an RSS Health Physicist.

· The radiation level at any point on the external surface of the package must not exceed 0.5 millirem per hour, as measured with a Geiger counter or ion chamber survey meter.

· A notice must be enclosed in or on the package, included with the packing list or otherwise forwarded with the package that states your name and university address and that states:

"This package conforms to the conditions and limitations specified in 49 CFR 173.421 for radioactive material, excepted package - limited quantity of material, UN 2910."

If the package contains dry-ice, the following must also be done:

· The outside of the package must be marked "Dry Ice, _____ Kg (or ____ lb), Frozen Medical Specimens"

· If the package is to be sent by aircraft or water (vessel), the packaging must allow the release of the carbon dioxide gas to prevent an increase of pressure that could rupture the package; and

· If more than 5 lbs of dry ice is used for a shipment by air, advance arrangements must be made between the shipper and each carrier.

· If the package will be sent on board an ocean vessel it must be marked “CARBON DIOXIDE, SOLID - - DO NOT STOW BELOW DECKS.”

If the conditions for excepted quantity shipments cannot be met, the RSS will determine the appropriate shipping regulations that must be followed.

7.4.2 Shipping Radioactive Material that does not Qualify as a Limited Quantity

Radioactive material that does not qualify as a limited quantity must be shipped under more restrictive methods. Contact an RSS Health Physicist for assistance if a package must be sent that does not qualify as a Limited Quantity.

7.4.3 International Shipments

Shipment of radioactive material out of the United States usually requires submission of import and export declarations, and will probably require the assistance of a forwarding agent familiar with international shipments. In addition, the U.S. Nuclear Regulatory Commission restricts or prohibits shipment of radioactive material to certain countries. Before shipping any quantity of radioactive material to another country, contact an RSS Health Physicist for assistance.
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*Solid, gas, or special form material as defined in 49 CFR 173.469.