

Western Michigan University

Radiation Safety

Transportation of Radioactive Material/Waste Program

NOTE: Transporting radioactive material/waste over public roadways is an infrequent task. Therefore, the current requirements of 10CFR71 and 49CFR must be reviewed to ensure compliance prior to authorizing the transport of a shipment.

NOTE: Contracting a vendor to assist in the preparation and transport of radioactive material/waste has been used in the past and should be considered for future shipments.

Purpose

- A. To provide reminders and references for the Radiation Safety Officer and those authorized by the RSO of the requirements for transporting radioactive material over the public roadways for the sole purpose of performing tasks for WMU.
- B. To provide reminders and references for the Radiation Safety Officer of the requirements for transporting radioactive waste over public roadways.
- C. To provide the requirements for transporting the CPN Hydroprobe and Troxler Moisture gauges over public roadways for the sole purpose of performing tasks for WMU.

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I. Responsibilities

A. Radiation Safety Officer (RSO)

1. Ensure all packages offered for shipment along public roadways are in compliance with the rules and regulation governing material transportation.
2. Perform and evaluate survey data.
3. Provide guidance to the shipper of the gauges and packages containing licensed material.
4. Liaison with a carrier concerning shipments of WMU radioactive material or waste.
5. Ensure the 24-Hour emergency response operator is aware of the material being shipped and can provide the needed information to requesting authorities.
6. Provide specific instructions with the shipping papers for an exclusive use shipment.
7. Maintain the documentation in accordance with the Administrative Controls Program.

B. Division of Environmental, Health, and Safety (EHS)

1. Assist the RSO in the preparations and shipping of Radioactive Material/Waste.
2. Provide the 24-Hour emergency response operator.

C. Shippers for gauges and packages containing licensed material.

1. Complete the shipping paperwork.
2. Instruct the drivers of their responsibilities.
3. Assist the RSO in maintaining compliance with the rules and regulations governing material transportation.
4. Maintain the transport packaging and vehicle in proper condition.
5. Maintain the documentation required by this program in accordance with the Administrative Control Program.

II. Definitions

A1	The maximum activity of special form radioactivity permitted in a Type-A package. [49 CFR 173.435; 10CFR71 APP A]
A2	The maximum activity of other than special form radioactivity (normal form), LSA, or Surface Contaminated Objects (SCO) permitted in a Type-A package. [49 CFR 173.435; 10CFR71 APP A]
Carrier	A person engaged in the transportation of property in a common, contract, or private vehicle.
Exempted	To release from a requirement to which others are subjected.
Excepted	To leave out or omit.
Exclusive Use	The sole use of a conveyance by a single shipper in which all initial, intermediate, and final loading and unloading are carried out in accordance with the direction of the shipper or receiver.
Hazardous Material	A material that has been determined by the Secretary of Transportation capable of posing an unreasonable risk to the health, safety, and property when transported in commerce that includes radioactive material and waste if the specific activity is > 70 Bq/g.

Hazardous Substance	A material, including mixtures and solutions, that : (1) is listed in the Appendix to 49 CFR 172.101, or (2) Is in a quantity, in one package, which equals or exceeds the reportable quantity (RQ) listed in the Appendix to 49 CFR 172.101. Radioactive material and waste can be hazardous substances.
Hazardous Waste	Any material that is subject to the hazardous waste manifest requirements of the Environmental Protection Agency, 40 CFR 262. Radioactive Material and Waste ARE NOT hazardous waste, unless mixed with a hazardous waste.
Low Specific Activity (LSA)	Refers to a radioactive material with a specific activity governed by a set criteria in 49 CFR 173.427
Labels	4" x 4" diamond shape stickers affixed to packages prior to shipping or moving to make individuals aware of potential radiation exposures and to minimize exposures.
Marking	Information placed conspicuously on items to make individuals aware of potential radiation exposures and to minimize exposures.
Package	The packaging together with its radioactive contents as presented for transport.
Packaging	The container or receptacle that makes up the containment system for radioactive transport. This includes any absorbent materials, shielding, etc.
Placards	10.8" x 10.8" diamond shape stickers or plaques affixed to transport vehicles to indicate the hazards associated with the different package contents aboard the vehicle.
Shipping Papers	The documentation required by the Department of Transportation to identify and manifest a shipment.
Specification Communication	Specific information placed in or on a package or vehicle required by the Department of Transportation in order to communicate the hazard associated with the materials transported. The specification communications include Markings, Labels, Placards, and Shipping papers. Each item must comply with set standards as to size, shape, color, and placement.
Special Form	A radioactive material that would present a direct radiation hazard, but little internal hazard or contamination if released from its package; a solid piece or sealed encapsulated item with no single dimension < 5 mm.
Transport Index (TI)	A dimensionless number placed on the label of a package to designate the degree of control to be exercised by the carrier during transportation. (Dose rate (in mR/hr) at one meter from the external surface of the package and rounded up to the first decimal place is the TI.)

III. Requirements

A. References

- 10 CFR 20 - Standards for Protection Against Radiation
- 10 CFR 71 - Packaging and transportation of Radioactive Material
- 49 CFR 171 - General information, Regulation, and Definitions
- 49 CFR 172 - Hazardous Materials table, Special Provisions, Hazardous Material Communications, Emergency Response, and Training Requirements
- 49 CFR 173 - Shipper's - General Requirements for Shipments and Packaging

B. Standard requirements for all packaging and packages [49CFR173.24 and 410 / 10CFR71.43]

1. No identifiable release to the environment without the use of instruments.
2. Maintain the effectiveness of the package - impact resistance, strength, gas containment or relief.
3. No chemical or galvanic corrosion.
4. Adequate closures to prevent leakage under normal conditions of transport.
5. Must be able to withstand friction and vibration while in transport.
6. Metallic devices shall not protrude in a manner likely to cause failure.
7. Must have a copy of the Certification of Compliance and supporting documents.
8. Must comply with the conditions and restrictions of the Certificate of Compliance.

C. General design requirements for packaging for radioactive material [49CFR173.410 / 10CFR71.43-77]

1. Easily handled and secured during transport.
2. Lifting attachment designed for a safety factor of 3.
3. Easy to decontaminate.
4. Compatible with the contents.
5. Must have a copy of the Certification of Compliance and supporting documents.
6. Must comply with the conditions and restrictions of the Certificate of Compliance.

D. Specification communication requirements

1. Shipping paperwork [49CFR172.200, 201, 202, and 203]

a. Bill of Lading always requires these entries.

1. The basic description, in the following order:
 - a. X or RQ for hazardous material or substances
 - b. Proper Shipping Name
 - c. Hazard Class (7)
 - d. U.N. Identification Number
2. 24-hour emergency response telephone number.
3. Name of the Shipper.
4. Proper page numbering (i.e. 1 of 4).
5. The total quantity (mass or volume) in appropriate units, except for empty packages.
6. The Chemical and Physical Form, if not special form.
7. The name of each radionuclide and total package activity.

- d. Excepted from marking.
 - 1. Empty and Radioactive Instrument and Articles are excepted.
 - 2. Limited Quantity packages must bear the marking "radioactive" on the outside of the inner package or the outer package itself.
 - 3. Packages must have the UN number on the outside.
- 3. Labeling Packages [49CFR172.400]
 - a. Radioactive White-I
 - 1. Surface radiation levels < 0.5 mR/hr.
 - 2. TI = 0 (the one meter reading is < 0.05 mR/hr).
 - b. Radioactive Yellow-II
 - 1. Surface radiation levels between 0.5 mR/hr and 50 mR/hr.
 - 2. TI less than or equal to 1 (≤ 1).
 - c. Radioactive Yellow-III
 - 1. Surface radiation levels between 50 mR/hr and 200 mR/hr.
 - 2. For exclusive use closed vehicles the surface radiation levels may be as high as 1000 mR/hr.
 - 3. TI less than or equal to 10 (≤ 10), unless exclusive use then no package TI limit.
 - d. Empty
 - 1. Required for shipment of empty radioactive packages.
 - 2. Must cover any previous labels.
 - e. Content of labels.
 - 1. Using symbols, list the radioisotopes in the package.
 - 2. The activity in SI units.
 - 3. The Transport Index (TI) in the appropriate box.
 - f. Labels must be:
 - 1. Placed on two (2) sides opposite of each other, one of which must be placed near the proper shipping name.
 - 2. Printed or affixed to the package surface, not the bottom.
 - 3. Be in contrast to with the background.
 - 4. Unobscured by markings or attachments.
 - 5. Within color, design, and size tolerances.
 - 6. Represent the hazmat contents of the package.
- 4. Placarding the Transport Vehicle [49CFR172.500]
 - a. Required
 - 1. All shipments containing Radioactive Yellow-III packages.
 - 2. Exclusive use shipments of LSA or SCO.
 - 3. Any shipment that contains a Highway Route Controlled Quantity.
 - b. Placards must be:
 - 1. Displayed on all four sides of the vehicle.
 - 2. Visible from the direction they face.
 - 3. Clear of appurtenances and other devices.
 - 4. At least three inches from any markings that may reduce its ability to communicate the hazard.
 - 5. Upright and on-point such that the words read horizontally.

6. In contrast with the background or have a lined border to distinguish from the background.

7. Placed such that dirt and water from the vehicle will not cover them.

8. Securely attached to the vehicle or in a holder.

5. Emergency Response Information [49CFR172.600]

a. 24-hour emergency telephone number.

b. Immediately available to any authority responding to an incident.

c. Not required when a shipment is excepted from the shipping paper requirements.

d. Minimum information:

1. Basic description and technical name of the hazardous material.

2. Immediate hazards to health.

3. Risks of Fire or Explosions.

4. Immediate precautions to be taken.

5. Immediate methods for handling fires.

6. Initial methods for handling spills and leaks.

7. Preliminary first aid.

e. Emergency response information must be:

1. Printed legibly and in English.

2. Available away from the package.

3. Presented on a shipping paper, separate document, or a dangerous cargo manifest.

4. Maintained with the same requirements for the shipping papers.

E. DOT radioactive material category criteria and transportation requirements

NOTE: Refer to the tables for the respective CFR (49CFRXXX.XXX).

1. Excepted Quantities

a. Limited Quantity

Activity	173.425
Package (173.421)	Excepted quantity package
Radiation levels	173.421
Contamination levels	173.443
Specification Communications	173.421
Non- Specification Communications	173.422

b. Instruments and Articles

Activity	173.425
Packaging (173.424)	Excepted quantity package
Radiation levels	173.424
Contamination levels	173.443
Specification Communications	173.421
Non- Specification Communications	173.422

2. Type A

Activity	≤ A1 or A2, 173.435
Packaging	Type A
Radiation levels	173.441
Contamination levels	173.443
Specification Communications	172
Non- Specification Communications	None

3. Type B

Activity	> A1 or A2, 173.435
Packaging	Type B
Radiation levels	173.441
Contamination levels	173.443
Specification Communications	172
Non- Specification Communications	None

4. Low Specific Activity (LSA-I, LSA-II, LSA-III), Exclusive Use Domestic

Activity	173.403
Packaging	173.427
Radiation levels	173.441,e
Contamination levels	173.443
Specification Communications	Placards and Shipping papers
Non- Specification Communications	Radioactive - LSA Driver Instructions RQ if required

5. Surface Contaminated Object (SCO-I, SCO-II)

Activity	173.403
Packaging	173.427
Radiation levels	173.441
Contamination levels	173.443
Specification Communications	Placards and Shipping papers
Non- Specification Communications	Radioactive - SCO Driver Instructions RQ if required

IV. Final Conditions

A. Radioactive material/waste is transported in compliance with all rules and regulations.

B. Copies of paperwork documenting the transportation of radioactive material, waste, gauges, etc. are filed in accordance with the Administrative Controls Program.

Appendix A

Process for Shipping Radioactive Material or Waste

I. The following steps are to be conducted by the RSO:

- A. Preparation for shipping a dry material or waste
1. Determine the proper packaging to be used for the shipment of material or waste and package the material or waste.
 2. Determine if notifications must be made before transporting.
 3. Arrange for a carrier and a trained driver if required.

NOTE: Shipping of liquids should be avoided if possible.

- B. Preparation for shipping a liquid or damp material or waste
1. Determine the proper packaging to be used for the shipment of material or waste and package the material or waste.
 2. Place sufficient suitable absorbent material to absorb twice the volume of the liquid contents, or use the method prescribed in B.3 below.
 - a. The absorbent material must be compatible with the package contents, and
 - b. Suitably positioned to contact the liquid in the event of leakage
 3. Place the primary container in a secondary containment container that was designed to assure retention of the liquid contents within it.
 4. Determine if notifications must be made before transporting.
 5. Arrange for a carrier and a trained driver if required.

- C. Shipping the Material or Waste
1. Survey the package to verify the Specification Communications are correct.
 2. Attach the required markings and labeling.
 3. Complete the Shipping papers in legible English [49CFR172.201].
 - a. Cover sheet.
 - b. Bill of Lading.
 - c. Emergency Response Information.
 - d. Radioactive Material Shipping Manifest, if required.
 - e. Exclusive use instructions, if necessary.
 4. Inspect the transport vehicle.
 - a. Integrity of the vehicle.
 - b. Locks and seals intact.
 - c. Complete a radiation and contamination survey prior to loading if required.
 - d. Verify all exterior indicator lights are functioning properly.
 - e. Verify head and tail lights are functioning properly.
 5. Inspect the package.
 - a. Integrity is intact.
 - b. Surfaces dry and clean enough to allow integrity checks.

- c. Seals and gaskets intact.
- d. Closure devices intact and properly functioning.
- e. Tamper seals in place, if required.
- f. Specification Communications are displayed properly.
5. Load the package on the vehicle.
6. Survey the vehicle.
 - a. Determine the vehicle Specification Communications required.
 - b. Affix the required communications to the vehicle.
7. Sign the shipping paperwork.
8. Obtain the driver's signature.
9. Make copies of the paperwork.
 - a. Shipper's Copy
 - b. Carrier's Copy
 - c. Campus' Copy
10. Give the Carrier Copy to the driver and instruct to keep the shipping paperwork in the left door pocket or within sight and arm reach.
11. File the documentation.

Appendix B Transportation of Portable Nuclear Gauges

NOTE: The CPN Hydroprobe contains a 50 mCi AM-241/Be source in special form. As such, all users must satisfactorily complete radiation safety training prior to using or transporting this piece of equipment.

NOTE: The Troxler Moisture gauge contains a 40 mCi AM-241/Be source in special form. As such, all users must satisfactorily complete radiation safety training prior to using or transporting this piece of equipment.

I. The following steps are to be conducted by the shipper:

- A. Determine the Hydroprobe or Troxler needs to be used.

- B. Complete the shipping papers for the gauge.

NOTE: These gauges may NOT be transported in the bed of a pick-up truck unless the bed contains a primary and secondary security enclosure that meets the intent of 10CFR30.34 requirement to have two independent physical barriers to deter theft.

C. Inspect the enclosed transport vehicle:

- 1. Integrity of the vehicle, specifically the area where the gauge will be stored.
- 2. Exterior door locks are intact and working.
- 3. Interior locking devices are intact and working.
- 4. All exterior indicator lights are functioning properly.
- 5. Headlights and taillights are functioning properly.

D. Inspect the package:

- 1. Integrity is intact.
- 2. Seals or locks are in place.
- 3. Specification Communications are displayed.
 - a. Markings
 - 1. Proper Shipping name
 - 2. U.N. identification Number
 - 3. Name and Address of Consignor
 - 4. RQ
 - 5. Type-A package
 - b. Labels
 - 1. Radioactive Yellow II
 - 2. Affix one label to the side of the package near the Proper Shipping Name.
 - 3. Affix a second label to the opposite side from the first.

- E. Load and secure the package within the vehicle using two independent physical controls to deter theft. [10CFR30.34 / NUREG 1556, Vol 1]
- F. Sign the Shipping Paper.
- G. Obtain the Driver's signature.
- H. Make copies of the Shipping paperwork.
 - 1. Shipper's copy
 - 2. Driver's copy
- I. Scan and email a copy of the shipping paper to the RSO at james.center@wmich.edu.
 - 1. Provides the RSO with the necessary information in the event of an accident or other emergency.
 - 2. This serves as the Campus copy of the shipping paperwork.
- J. Give the driver a copy of the shipping paper.
- K. Instruct the driver to keep the shipping paperwork in the left door pocket or within sight and in reach of an arm.

II. The following steps are to be conducted by the RSO:

- A. File the documentation.

Appendix C Transportation of a GC-ECD

NOTE: The GC-ECDs contain an excepted quantity of material.

I. The following steps are to be conducted by the shipper:

- A. Shipment preparation
 - 1. Determine the GC-ECD needs to be shipped or transported to another location.
 - 2. Notify the RSO of the need to ship the instrument.
 - 3. Notify the vendor holding the General License of the need to transport the material.
 - a. The instrument serial number
 - b. The GL reference number if available
 - c. The location to which the instrument is going
 - d. The name of the person that will be responsible for the instrument.
 - 4. Obtain approval from the RSO, vendor, and recipient to ship them the item.
 - 5. Initiate the Shipper's Certification.

II. The following steps are to be conducted by the RSO:

- A. Shipment preparation
 - 1. Survey the instrument.
 - a. Complete a leak test
 - b. $< 1,000 \text{ dpm}/100 \text{ cm}^2$ averaged over 300 cm^2 β - γ
 - c. $< 20 \text{ dpm}/100 \text{ cm}^2$ averaged over 300 cm^2 α , if suspected of alpha contamination.
 - d. $< 90 \text{ mR/hr}$ 10 cm from any surface of the instrument.
 - e. $< 0.05 \text{ mR/hr}$ at one meter from any surface of the instrument.
 - 2. Inform the shipper if the outside of the package will have to be surveyed.
 - 3. Complete the survey information on the Shipper's Certification.
 - 4. Return the Shipper's Certification to the shipper.

III. The following steps are to be conducted by the shipper:

- A. Shipment and shipping paperwork finalization.
 - 1. Complete the Shipper's Certificate.
 - 2. Obtain the shipping packaging - Strong, Tight Container; in most instances, a corrugated cardboard box is a sufficient container.
 - 3. Place the item into the container.
 - a. Ensure the item will be protected from normal transportation wear.
 - b. Notify the RSO for additional surveys.
 - 4. Make and distribute the copies of the Shipper's Certification.
 - a. The original goes into the package.
 - b. A copy goes to the RSO.
 - c. A copy is for the shipper's records.
 - 5. Seal the package.
 - 6. Place a shipping label on the package.

7. Ensure the consignee's information is clear and legible.

IV. The following steps are to be conducted by the RSO:

- A. Verify the shipment and shipping paperwork is complete.
 - 1. Return to shipper if incomplete or incorrect.
 - 2. Assist the shipper in correcting errors.

- B. Ship the package.

- C. Complete the shipment record.
 - 1. Contact the recipient if a signed copy of the Shipper's Certification is not returned.
 - 2. Provide the shipper with a copy of the receipt.
 - 3. File the documents.
 - 4. Update the records.