US. Department of Energy

Washington, D.C.

ORDER

DOE 5480.3

7-9-85

SUBJECT: **SAFETY REQUIREMENTS FOR THE PACKAGING AND TRANSPORTATION OF HAZARDOUS MATERIALS, HAZARDOUS SUBSTANCES, AND HAZARDOUS WASTES**

1. PURPOSE. To establish requirements for the packaging and transportation of hazardous materials, hazardous substances, and hazardous wastes.

2. CANCELLATION. Chapter III, DOE 5480.1A, ENVIRONMENTAL PROTECTION, SAFETY, AND HEALTH PROTECTION PROGRAM FOR DOE OPERATIONS, of 5-1-81.

3. SCOPE. The provisions of this Order apply to all Departmental Elements and contractors performing work for the Department as provided by law and/or contract and as implemented by the appropriate contracting officer, who are involved with the packaging and/or transportation (shipping, carrying, or receiving) of hazardous materials, hazardous substances, or hazardous wastes.

4. REFERENCES.

   a. Title 10 CFR 71, "Packaging of Radioactive Material for Transport," which promulgates Federal regulations for the packaging of radioactive material for transport.

   b. Title 46 CFR 146, "Transportation or Storage of Military Explosives On Board Vessels," which promulgates Federal regulations for the transportation or storage of military explosives on board vessels.

   c. Title 49 CFR 109-199, 'Hazardous Materials Regulations,' which promulgates Federal regulations which govern the packaging and transportation of hazardous materials, hazardous substances, and hazardous wastes.

   d. International. Atomic Energy Agency Safety Series No. 6. "Regulations for the Safe Transport of Radioactive Material," 1973 Revised Edition.

   e. International Air Transport Association safety requirements which establish carrier requirements for international shipments via air.

   f. American National Standards Institute Standard N14.5-1977, "American National Standard for Leakage Tests on Packages for Shipment of Radioactive Materials," which discusses recommendations for leak testing radioactive materials packages.

DISTRIBUTION.
All Departmental Elements

INITIATED BY:
Assistant Secretary for Policy, Safety, and Environment

g. NUREG-0360, "Qualification Criteria to Certify a Package for Air Transport of Plutonium," which discusses criteria for certification of ● package for ● ir transport of plutonium, available from NRC.

h. DOE 1540.1, MATERIALS TRANSPORTATION AND TRAFFIC MANAGEMENT, of 5-3-82, which promulgates policy for traffic management.

i. DOE 5480.1A, ENVIRONMENTAL PROTECTION, SAFETY, AND HEALTH PROTECTION PROGRAM FOR DOE OPERATIONS, of 8-13-81, which promulgates policy for the environmental, safety, and health protection program.

j. DOE 5482.1A, ENVIRONMENTAL PROTECTION, SAFETY, AND HEALTH PROTECTION APPRAISAL PROGRAM, of 8-13-81, which promulgates the environmental protection, safety, ● d health protection appraisal program.

k. DOE 5484.1, ENVIRONMENTAL PROTECTION, SAFETY, ANO HEALTH PROTECTION REPORTING REQUIREMENTS, of 2-24-81, which promulgates the environmental protection, safety, ● nd health protection reporting requirements.

l. DOE 5700.6A, QUALITY ASSURANCE, of 8-13-81, which promulgates standards to assure quality achievement In DOE programs.

m. DOE 5000.3, UNUSUAL OCCURRENCE REPORTING SYSTEM, of 11-7-84, which sets forth policy for reporting unusual occurrences.

n. DOE 5610.1, PACKAGING AND TRANSPORTING OF NUCLEAR EXPLOSIVES, NUCLEAR COMPONENTS, AND SPECIAL ASSEMBLIES, of 9-11-79, which ● stablishes standards for shipment of special items.

DEFINITIONS.

● m Carrier. Any person engaged In the transportation of passengers or property as common, contract, or private charter, or freight forwarder, ● s those terms ● m used in the Interstate Commerce Act, as emended, or by the U.S. Postal Service.

b. Close Reflection by Water. Immediate contact by water of sufficient thickness to reflect a maximum number of neutrons.

c. Containment Vessel. The receptacle in which principal reliance isplaced to retain the radioactive material during transport.

d. Fissile Classification. Classification of ● package or shipment of fissile materials ● ccording to the controls needed to provide nuclear " criticality safety during transportation ● s follows:

(1) **Fissile Class I.** Packages that may be transported in unlimited numbers and in any arrangement and that require no nuclear criticality safety controls during transportation. For purposes of nuclear criticality safety control, a transport index is not assigned to Fissile Class I packages. However, the external radiation levels may require a transport Index number.

(2) **Fissile Class II.** Packages that may be transported in any arrangement but In numbers that do not exceed a transport Index of 50. For purposes of nuclear criticality safety control, individual packages may have a transport index of not less than 0.1 and not more than 10. However, the external radiation levels may require a higher transport Index number but not to exceed 10. Such shipments require no nuclear Criticality safety control by the shipper during transportation.

(3) **Fissile Class III.** Shipments of packages that do not neat the requirements of Fissile Class I and 11 and that are controlled in transportation by special arrangements between the shipper and the carrier to provide nuclear criticality safety.

t. **Fissile Materials.** Uranium-233, uranium-235, plutonium-238, plutonium-239, plutoni=1, neptunium-237, and curium-244.

f. **Limited Quantities of Radioactive Materials** excepted from packaging, marking, and labelling are described In 49 CFR 173.421.

g. **Low Specific Activity.** Material of low radioactivity level such as ores and chemical concentrations of those ores. The low specific activity definition is in 49 CFR 173.403.

h. **Maximum Normal Operating Pressure.** The maximum gauge pressure that is expecte=levelop in the containment vessel under the normal conditions of transport.

i. **Moderator.** A material used to reduce the kinetic energy of neutrons by Scattering collisons without appreciable neutron capture.

j. **Optimum Interspersed Hydrogerous Moderation.** The occurrence of hydrogenous material between containment vessels to such an extent that the maximum nuclear reactivity results.

k. **Package.** Packaging and of radioactive contents. " . . "

1. **Packaging.** One or more receptacles and wrappers and their contents excluding fissile material and other radioactive material, but including absorbent material, spacing structures, thermal Insulation, radiation shielding, devices for cooling and for absorbing mechanical shock, external fittings, neutron moderators, nonfissile neutron absorbers, and other supplementary equipment.

. Primary Coolant. A gas, liquid, or solid, or combination of them, in contact with radioactive material, or, if the material Is in special form, in contact with its capsule, and used to remove decay heat.

n. **Special Form Radioactive Material.** To qualify as special form the radioactive material must either be in massive solid form or encapsulated. Special tests which were required of special form material were explained in 49 CFR 173.403.

o. Transport Index. The number placed on a package to designate the degree of control to be exercised by the carrier during transportation. The transport index to be assigned to a package of radioactive material shall be determined by either paragraph (1) or (2) below, whichever is larger. The number expressing the transport index shall be rounded up to the next higher tenth; e.g., 1.01 becomes 1.1.

(1) The highest radiation dose rate in millirem per hour at 1 meter from any accessible external surface of the package.

(2) The transport Index of each Fissile Class II package Is calculated by dividing the number 50 by the number of such Fissile Class II packages that may be transported together determined under the limitations of 10 CFR 71.

p. For other definitions refer to 49 CFR 173.403, 46 CFR, 10 CFR, or other sections as applicable.

RESPONSIBILITIES AND AUTHORITIES.

8. Director of Operational Safety.

(1) Conducts periodic appraisals to assure compliance with this Order (except as provided in paragraph 6d).

(2) Assists field organizations in securing exemptions for hazardous materials issued by the Department of Transportation (DOT). (Reference 49 CFR 107.)

(3) Prepares guidance criteria and procedures for application of package testing and quality assurance standards.

(4) Coordinates Department of Energy participation in the development and revision of transportation safety regulations.

(5) Provides a central point of coordination with the Nuclear Regulatory Commission (We) for developing safety standards for transporting nuclear materials.

b. Heads of Headquarters Elements provide program guidance, Instruction, and standards to assure the safe packaging of fissile and other radioactive materials, including:

(1) Directing cognizant Heads of Field Organizations to require modifications of equipment, procedures, or practices and to coordinate budget requirements.

(2) Imposing additional requirements for packaging standards.

(3) Curtailing or suspending the use of specific packages, when necessary.

(4) Participating at their option in reviewing safety analysis reports.

c. Heads of Field Organizations, consistent with guidance Instructions, standards, and criteria issued pursuant to paragraph 6b, above:

(1) Grant Department of Energy approval when required for packages that meet the standards of this Order, and that are to be used for the transportation of fissile or other radioactive materials In greater than Type A quantities, and issue Certificates of Compliance for approved designs.

(2) Perform an Independent objective review and evaluation of contractors' safety analysts reports for packaging designs.

(3) Grant Department of Energy approval for shipments made under the National Security Exemption provided to the Department Of Energy and the Department of Defense under the Code of Federal Regulations, Title 49, Part 173.7b.

(4) Grant such alternatives to the requirements set forth in this Order as will provide equivalent protection to life or property and to the common defense and security; and within 30 days after granting

alternative, provide the Director of Operational Safety, a detailed report of the reasons for granting it. The granting of such alternative is in no way to be construed as the granting of exemptions or exceptions from or to the Department of Transportation or other regulatory agency requirements.

(5) Conduct periodic appraisals to determine the adequacy of contractor performance in the implementation of this Order, except as provided in subparagraph 6d, below.

d. Deputy Assistant secretary for Naval Reactors (NE-60) is responsible for administering the program for design review and issuance of Department of Energy Certificates of Compliance for Naval Reactors packagings. The Deputy Assistant Secretary assumes the responsibility for conducting appraisals and the responsibilities of the Heads of Headquarters Elements and Heads of Field Organizations for auditing the performance in appropriate program.

REQUIREMENTS.

a. Federal Regulations. When offered to the carrier, each shipment of hazardous materials, hazardous substances, or hazardous wastes shall be in compliance with this Order and the applicable safety regulations of the Department of Transportation, and follow the explicable packaging standards of the Nuclear Regulatory Commission (10 CFR 71).

b. Special Packaging Requirements for Plutonium and Plutonium Bearing Wastes (in addition to other packaging requirements in this Order).

(1) Solid plutonium or plutonium bearing wastes in greater than A2 quantities for normal form or greater than A1 quantities for special form must be packaged in accordance with specified DOE Certificate of Compliance, an NRC Certificate of Compliance, a DOT exempt packaging system, or a DOT Specification package.

(2) Plutonium (for air transport) in greater than A2 quantities for normal form or greater than A1 quantities for special form must be in DOE or NRC certified packaging (equivalent to, or meeting the criteria of NUREG-0360), e.g., USA/0361/BF, USA/9150/B(U), or USA/9509/B(U) (DOE-A1). The packaging approval shall authorize specifically the air transport of plutonium.

(3) Plutonium packaging requirements for any surface mode of transportation.

(a) Plutonium in excess of 20 curies per package must be shipped as a solid.

(b) Plutonium In excess of 20 curies per package must be packaged in a separate inner container placed within outer packaging that meets the requirements of a Type B package for material in normal fem. In addition, the following tests must be performed on the package design:

1 If the entire package Is subjected to the design tests specified in paragraph 11, "@pi Conditions of Transport," the separate inner container must restrict the loss of plutonium to no more than 10-6 A2/hour.

2 If the entire package is subjected to the design tests specified In paragraph 12, "Hypothetical Accident Conditions," the separate inner container must restrict the loss of plutonium to not more than an A2 quantity in 1 week.

(4) Solid plutonium In excess of 20 curies per package In the following forms is not subject to the requirements of paragraph 7b(3):

(a) Reactor fuel elements;

(b) Metal or metal alloy;

(c) Special Form materials; or

(d) Other forms of plutonium-bearing materials, e.g., wastes or contaminated equipment, as approved by the Office of Operational Safety,

c, PackageStandards for Radioactive Materials In Amounts Greater Than Type A Quantities.

(1) Packages of radioactive materials shall be prepared for shipment and transported In accordance with the provisions of this Order. Department of Transportation specification containers for greater than Type A and fissile materials are considered to-t the standards of this Order and no specific Department of Energy Certificates of Compliance are required for this use when lading . meets the specification. Packaging having a current Nuclear Regulatory Commission Certificate of Compliance can be used after the DOE Is registered with the Nuclear Regulatory Commission as a user.

(2) Nuclear weapons and their components shall be packaged and transported in accordance with the standards in this Order or with

other standards such as reference n, which provide a degree of safety at least equivalent to that provided by the Department of Energy and Department of Transportation regulations.

(3) Packages shipped under the National Security Exemption, 49 CFR 173.7(b), must be in compliance with the standards in this Order and must also comply with the provisions of other pertinent Department of Energy Orders.

(4) A quality assurance program must be established and implemented to assure that packages for radioactive materials are fabricated, maintained, and used in accordance with the regulations and approved design feature. (Reference 10 CFR 71.37; 10 CFR 71.121; 10 CFR 71.137.)

d. Department of Energy Certificates of Compliance for Packages of Radioactive Materials in Excess of Type A Quantities. Upon determination that a package design meets the requirements of this Order, a Department of Energy Certificate of Compliance will be issued by the Department.

e. Department of Energy as Consigner. When a Department of Energy field organization, rather than a contractor, serves as the actual consignor, Independent internal procedures shall be established by the responsible Head of the Field Organization to assure compliance with the standards contained in this Order.

f. Exemption. Packages that do not meet the standards in the Department of Transportation Hazardous Materials Regulations and that do not qualify for shipment under the National Security Exemption may be shipped only under the provisions of an exemption issued by the Department of Transportation, or on public vehicles or aircraft if approved under the provisions of paragraph 6c, above. Applications for a DOT exemption shall be prepared in accordance with 49 CFR 107.103, and shall be forwarded through the Safety Engineering and Analysis Division to the Department of Transportation.

PACKAGE STANDARDS.

a. General Standards for All Packaging.

(1) Reference 10 CFR 71.

(2) For determination of transport indexes for packaging, see paragraph 5 of this Order.

(3) Excluded from the standards, testing requirements, packaging certification, and documentation described in this Order are low specific activity shipments consigned to exclusive use. The requirements for this type of shipment are contained In Code of Federal Regulations, Title 49, Part 173.425.

(4) Type A packaging requirements are contained in 49 CFR 173.411 and 412.

b. Structural Standards for Type B Packaging. Packaging used to ship a quantity of radioactive material larger than Type A shall be designed and constructed In compliance with the structural standards of 10 CFR 71. Standards different from those specified in this section may be approved by the Head of the Field Organization or other designed official if the controls proposed to be exercised by the shipper are demonstrated to be adequate to assure the safety of the shipment.

(1) Load Resistance. Regarded as a simple beam supported at its ends and along any major axis, packaging shall be capable of withstanding a static load, normal to and uniformly distributed along its length, equal to 5 times its fully loaded weight, without generating stress in any material of the packaging in excess of its yield strength.

(2) External Pressure. Packaging shall be adequate to assure that the containment vessel will suffer no loss of contents if subjected to external pressure of 25 pounds per square Inch gauge.

c. Criticality Standards for Fissile Material Packages.

(1) A package used for the transport of fissile material shall be so designed and constructed and Its contents so limited that it would be subcritical if it is assumed that water leaks into the containment vessel, and:

(a) Water moderation of the contents occurs to the most reactive credible extent consistent with the chemical and physical form of its contents.

(b) The containment vessel is fully reflected on all sides by water.

(2) A package used for the transport of fissile material shall be so designed and constructed and its contents sO limited that it would be subcritical if it is assumed that any contents Of the package that are liquid during normal transport leak out Of the containment vessel, and that the fissile material is then:

(a) In the most reactive credible configuration consistent with the chemical and physical form of the material.

(b) Moderated by water outside of the containment vessel to the most reactive credible extent.

(c) Fully reflected on all sides by water.

(3) The Head of the Field Organization or other designated official may approve exceptions to the requirements of this paragraph where the containment vessel incorporates special design features that would preclude leakage of liquids in spite of any single packaging error, and appropriate measures are taken *before* each shipment to verify the leak tightness of *each* containment vessel.

d. Evaluation of a Single Package.

(1) The effects of the transport environment on the safety of any single package of radioactive material shall be evaluated as follows:

(a) The ability of a package to withstand conditions likely to occur in normal transport shall be assessed by subjecting a sample package or scale model, by test or other assessment, to the normal conditions of transport as specified in paragraph 8e, below.

(b) The effect on a package of conditions likely to occur in an accident shall be assessed by subjecting a sample package or scale model, by test or other assessment, to the hypothetical accident conditions as specified in paragraph 8f, below.

(2) Taking into account controls to be exercised *by the* shipper, the Head of the Field Organization or other designated official may permit the shipment to be evaluated together with or without the transporting vehicle for the purpose of one or more tests.

(3) Normal conditions of transport and hypothetical accident conditions different from those specified in paragraphs 8e and 8f, below, may be approved by the Head of the Field Organization *or other* designated official if the controls proposed to be exercised by the shipper are demonstrated to be adequate to assure the safety of the shipment.

e. Standards for Normal Conditions of Transport for a Single Package.

(1) A package used for the shipment of fissile material or more than Type A quantity of radioactive material shall be so designed and

constructed, and its contents so limited, that under the normal conditions of transport specified in paragraph 11:

(a) There will be no release of radioactive materials from the containment vessel.

(b) The effectiveness of the packaging will not be substantially reduced.

(c) There will be no mixture of gases or vapors in the package that could, through any combination of pressure or explosion, significantly reduce the effectiveness of the package.

(d) Radioactive contamination of the liquid or gaseous primary coolant will not exceed 10-7 curies of activity or Group I radionuclides per milliliter, 5 x 10-6 curies of activity of Group II radionuclides per milliliter, and 3 x 10-4 curies of activity of Group III and Group IV radionuclides per milliliter.

(e) There will be no loss of coolant or loss of operation of any mechanical cooling *device.*

(2) A package used for the shipment of fissile material shall be designed and constructed, and its contents so limited, that under normal conditions of transport specified in paragraph 11, considered individually:

(a) The package will be subcritical.

(b) The geometric form of the package contents would not be substantially altered.

(c) There will be no leakage of water into the containment vessel. This requirement need not be met If, In the evaluation Of undamaged packages under paragraphs 8h, 8i, or 8j below, it has been assumed that moderation is present to such extent as to cause maximum reactivity consistent with the chemical and physical form of the material.

(d) There will be no substantial reduction in the effectiveness of the packaging, including:

1. Reduction by more than 5 percent In the total effectfve volume of the packaging on which nuclear safety is assessed.

2 Reduction by more than 5 percent In the effective spacing on which nuclear safety is assessed between the center of the containment vessel and the outer surface of the packaging.

3 Occurrence of any aperture in the outer surface of the packaging large enough to permit the entry of a 4-inch cube.

(3) A package used for the shipment of more than Type A quantity of radioactive material shall be so designed and constructed, and its contents so limited, that under normal conditions of transport specified in paragraph 11, considered individually, the containment vessel would not be vented directly to the atmosphere.

f. Standards for Hypothetical Accident Conditions for a Single Package.

(1) A package used for the shipment of more than Type A quantity of radioactive material shall be so designed and constructed and its contents so limited that if subjected to the sequence of the hypothetical accident conditions specified in paragraph 12, It will meet the following conditions:

(a) The reduction of shielding would not be sufficient to increase the external radiation dose rate to more than 1 rem per hour at one meter from the external surface of the package.

(b) No radioactive material would be released from the package except for gases and contaminated coolant containing total radioactivity exceeding a total amount of A2 in 1 week.

(2) A package used for the shipment of fissile material shall be so designed and constructed, and its contents so limited, that if subjected to the sequence of the hypothetical accident conditions specified in paragraph 12, the package would be subcritical. In determining whether this standard is satisfied, it shall be assumed that:

(a) The fissile material is in the most reactive credible configuration consistent with the damaged condition of the package and the chemical and physical form of the contents.

(b) Water moderation occurs to the most reactive credible extent Consistent with the damaged condition of the package and the chemical and physical form of the contents.

(c) There is reflection by water on all sides and as close as is consistent with the damaged condition of the package.

g. Criticality Standards for Packaging Fissile Materials. The fissile characteristics of each package and array of packages shall be evaluated for criticality and the assignment of the proper fissile Class I, II, or III (10 CFR 71).

9. QUALITY ASSURANCE PROCEDURES FOR THE FABRICATION, ASSEMBLY, AND TESTING OF OFFSITE SHIPPING CONTAINERS.

a. Establishment and Maintenace of Procedures. Each field organization shall require its contractors to establish and to maintain a quality assurance program to:

(1) Assure that the requisite standards of quality are met in the fabrication, assembly, and testing of each package.

(2) Assure that packages In use continue to meet the requisite standards of quality.

b. Elements of a Quality Assurance Program. For guidance in developing a comprehensive quality assurance program, see 10 CFR 71, Appendix H, "Quality Assurance." The contractor's programs shall consist of a formal system of procedural and organizational arrangements that:

(1) Require that specific responsibilities be assigned to designated units (Including those of the vendor, the fabricator, and the contractor) for assuring specified quality at all stages of construct ion.

(2) Designate codes, standards, and specifications for materials, equipment, methods of fabrication, testing, and performance.

(3) Provide for quality control of materials, equipment, and services in instances where these have net al ready been established by existing standards and speci fi cati ons.

(4) Provide that quality assurance records are ma intained In an audt table file duri ng the servi ce 11 fe of the container.

(5) Provide for a quality control method of determining that packages procured for use from other sources, Including contractors and subcontractors or from Nuclear Regulatory Commission licensees, meet the requirements of this Order.

(6) Establish acceptance criteria in terms of measurable characteristics and the effects of appropriate tests prescribed in paragraph 11, 12, 14, and required in paragraph 8(c).

(7) Provide for a program of routine maintenance inspection and, where necessary, retesting to assure that all reusable containers used by DOE continue to meet the applicable design standards.

(8) Provide for required training, testing, and certification of manufacturing and inspection personnel involved in special processes, such as welding and nondestructive examination, and for the required certification of equipment and procedure used in the performance of special processes.

(9) Field organizations provide for a periodic audit of the contractors' programs and new packaging to assess effectiveness of the quality assurance program.

OPERATING PROCEDURES.

8. Establishment and Maintenance of Procedures. The shipper shall establish and maintain:

(1) Operating procedures adequate to assure that the determinations and controls required by this section are accomplished.

(2) Regular and periodic Inspection procedures adequate to assure that the procedures required by paragraph 10a(1), above, are followed.

b. Assumptions as to Unknown Properties. When the isotopic abundance, mass, concentration, degree of irradiation, degree of moderation, or other pertinent property of fissile material In any package is not known, the shipper shall package the fissile material as if the unknown properties have such credible values as will cause the maximum nuclear reactivity. Any special instructions needed to safely open the package are to be made available to the consignee.

c. Preliminary Determinations.

(1) Prior to the first use of any packaging for the shipment of more than a Type A quantity of radioactive material or fissile materials. such packaging shall be inspected to ascertain that them are no cracks, pinholes, uncontrolled voids, or other defects that could significantly reduce its effectiveness.

(2) Prior to the first use of any packaging for the shipment of more than a Type A quantity of radioactive or fissile materials, where the maximum normal operating pressure will exceed 5 pounds per square inch gauge, the containment vessel shall be tested to assure that it will not leak at an integral pressure 50 percent higher than the maximum normal operating pressure.

(3) Packaging shall be marked conspicuously and durably with its model number. Prior to ● pplyfng the model number, an inspection shall be made to determine that the packaging has been fabricated in accordance with the ● pproved design.

d. Routine Determinations. Prior to ● ach use of a package for shipment of radioactive or fissile materials, the shipper shall ascertain that the package with its contents satisfies the applicable requirements of paragraph 8 Including determination that:

(1) The packaging has not been significantly damaged.

(2) Any moderators end nonfissile neutron ● bsorbers, if required, are as authorized.

(3) The closure of the package ● nd ● ny sealing gaskets present ● re free from defects.

(4) Any valve through which primary coolant can flow Is protected against tampering.

(5) The internal gauge pressure of the package will not exceed, during the anticipated period of transport, the maximum normal operating pressure.

(6) Contamination of the primary coolant will not ● xceed, during the ● ntfclpated period of transport, the limits as prescribed In paragraph 8e(1)(d).

e. Records. The shipper shall maintain for 2 years or more a record of ● ach shipment of fissile material and ● ach shipment of amounts of radioactive material greater than Type A quantities in single packages, showing where ● pplicable:

(1) Identification of the packaging by model number ● nd the number of the certificate of compliance.

(2) Details of any significant defects In the packaging, with the mans employed to repair the defects ● nd prevent their recurrence.

(3) Volume and identification of coolant.

(4) Type and quantity of material in ● ach package, and the total quantity in ● ach shipment.

(5) For ● ach item of Irradiated fissile material:

(a) Identification by model number.

(b) Irradiation and decay history to the extent appropriate to demonstrate that its nuclear and thermal-characteristics comply with appropriate conditions.

(c) Any abnormal or unusual condition relevant to radiation safety.

(6) Date of the shipment.

(7) For Fissile Class III, any special controls exercised.

(8) Name and address of the transferee.

(9) Address to which shipment was made.

(10) Results of the determination required by paragraphs 10c and 10e, above.

f. Documentation of Technical Backup Support for Specification, Certified, and Exempt Packagings. Packagings that have been certified by the Department of Energy as meeting Department of Transportation regulations and packaging, for which specifications have been published by the Department of Transportation, may be used by other Department of Energy shippers having authority to ship radioactive or fissile materials. If the Nuclear Regulatory Commission also certifies that the standards of 10 CFR 71 have been met, licensees can be listed as users by the Nuclear Regulatory Commission and ship in the packaging to either Department of Energy contractors or to other licensees. Therefore, It is essential that technical information and limits pertinent to the construction and use of these packaging be available to all potential users. The following are requirements to meet these objectives:

(1) Heads of Field Organizations shall require contractors under their jurisdiction to prepare a distributable document for each new specification or certified packaging designed, developed, and fabricate for offsite shipment of fissile and other radioactive materials in quantities exceeding Type A. Obsolete packagings no longer in use and containers used for onsite movement of materials are not subject to these documentation requirements unless they are reactivated, altered, or requested for use in offsite shipments. In such instances, the party or parties requiring reactivation or iterations shall prepare or have prepared the appropriate document.

(2) Each document shall provide, as a minimum, the information below (reference 10 CFR 72.31):

(a) A complete physical and technical description of the package.

(b) A safety analysis report for packaging including considerations for meeting the requirement for packaging and transport safety, nuclear criticality safety, and radiological safety. Type B packaging should meet the Type B hypothetical accident test conditions.

(c) Design and development information including pertinent data, analytical methods, and the results of the prescribed tests.

(d) Tests, graphs, drawings, pictures, and technical references as required to give a clear treatment of the subject.

g. Notification Procedures for Shipment and Nonreceipt of Radioactive Materials. To reduce to a minimum the number of shipments that must ultimately be considered lost, the following procedures shall be Implemented:

(1) Prior to each shipment of fissile radioactive materials, or shipments of more than Type A quantity of radioactive material, the shipper shall notify the consignee of the dates of the shipment end of expected arrival. The shipper shall also notify each consignee of any special loading or unloading instructions prior to his or her first shipment.

(2) The consignee shall be requested to notify the shipper immediately at the end of 4 days after the estimated arrival date if the shipment has not been received. Prompt notification by telephone or teletype should be followed by receipted registered mail to provide a written notice.

(3) Lost, strayed, or stolen shipments that are not recovered or accounted for shall be reported to the field organization transportation officer as an unusual occurrence. The cognizant field organization head shall determine if an investigation is warranted and advise the Office of Operational Safety, PE-24, of his or her decision at the time of the unusual Occurrence report.

(4) For all radioactive material shipments, (Type A, Type B, low specific activity) a return receipt shall be requested. The shipper shall follow up on the shipment status if the return receipt is not received within 1 month.

1. NORMAL CONDITIONS TRANSPORT. Each of the following normal conditions of transport is to be applied separately to determine its effect on package.

a. Heat. Direct sunlight and ambient temperature of 130 degrees Fahrenheit in still air.

b. Cold. An ambient temperature of -40 degrees Fahrenheit in still air and shade.

c. Pressure. Atmospheric pressure of 0.5 times standard atmospheric pressure.

d. Vibration. Vibration Is normally incident to transport.

e. Water Spray. A water spray sufficiently heavy to keep the entire exposed surface of the package except the bottom continuously wet during a period of 30 minutes.

f. Free Drop. Between 1-1/2 and 2-1/2 hours after the conclusion of the water spray test, a free drop through the distance specified in Figure 1, below, onto a flat essentially unyielding horizontal surface, striking the surface In a position for which maximum damage Is expected.

ckage Weight (pounds)	Distance (feet)
ss than 10,000	4
,000 to 20,000	3
,000 to 30,000	2
re than 30,000 "	1

Figure 1
Free Fall Distance

g. Corner Drop. A free-drop onto each comer of the package in succession or, in the case of a cylindrical package, onto each quarter of each rim, from a height of 1 foot onto a flat essentially unyielding horizontal surface. This test applies only to packages which are constructed primarily of mod or fiberboard and do not exceed 100 pounds gross " weight, and to all Fissile Class 11 packages.

h. Penetration. Impact of the hemispherical nd of a vertical steel cylinder 1-1/4 inches in diameter and weighing 18 pounds, dropped from a height of 40 inches onto the xposed surface of the package which is expected to be more vulnerable to puncture. The long axis of the cylinder shall be perpendicular to the package surface.

i. Compression. For packages not xceedfng 10,000 pounds in weight, compressive load equal to fther 5 times the weight of the package or 2 pounds per square inch multiplied by the maximum horizontal cross sectic of the package, whichever is greater. The load shall be applied during period of 24 hours, uniformly gafnst the top and bottom of the package in the position in which the package would normally be transported.

12. HYPOTHETICAL ACCIDENT CONDITIONS. The following hypothetical ccident test conditions are to be applied sequentially, in the order indicated, to determine their cumulative ffect on a package or rray of packages:

a. Free Drop. A free drop through a distance of 30 feet onto a flat essentially unyielding horizontal surface, striking the surface In a position for which maximum damage Is xpected.

b. Puncture. A free drop through a distance of 40 Inches striking In position for which maximum damage is expected, the top nd of a vertica cylindrical mild steel bar mounted on an ssentially unyielding horizontal surface. The bar shall be 6 inches in diameter, with the to horizontal and Its dge rounded to a radius or not more than 1/4 inch, nd of such length as to cause maximum damage to the package. but not less than 8 inches long. The long axis of the bar shall be perpendicul to the unyielding horizontal surface.

c. Thermal. Exposure to a thermal test in which the heat input to the package is not less than that which would result from exposure of the whole package to a radiation environment of 1475 degrees Fahrenheit for 30 minutes with an emissivity coefficient of 0.9, ssuming the surfaces of the package have n bsorption coefficient of 0.8. The package shal not be cooled artificially until 3 hours after the test period unless i can be shorn that the temperature on the inside of the package has begu to fall in less than 3 hours.

d. Water Immersion (fissile material packages only). Immersion in water t the extent that all portions of the package to be tested m under t least 3 feet of water for a period of not-less than 8 hours.

13. -A? VALUES FOR RADIONUCLIDES. These values are found in 49 CFR. 173.433.

ESTS FOR SPECIAL FORM MATERIAL.

1. Free Drop. A free drop through a distance of 30 feet onto a flat ● ssentially unyielding horizontal surface, striking the surface in such a position ● s to suffer maximum damage.

2. Percussion. Impact of the flat circular end of a l-inch diameter steel rod weighing 3 pounds dropped through ● distance of 40 Inches. The capsule or material shall be placed On a sheet of lead, or hardness number 3.5 to 4.5 on the kickers scale, ● nd not more than 1 Inch thick, supported by a smooth ● ssentially unyielding surface.

3. Heating. Heating In ● lr to a temperature of 1475 degrees Fahrenheit and remaining ● t that temperature for ● period of 10 minutes.

4. Immersion. Immersion for 24 hours In water at room temperature. The waber shal 1 be pH5 to pH8 WI th ● maximum conductivi ty of 10 mi cromhos per cent imeter.

:R OF THE SECRETARY OF ENERGY:

WILLIAM S. HEFFELFINGER
Director of Administration