



U.S. NUCLEAR REGULATORY COMMISSION

# REGULATORY GUIDE

OFFICE OF STANDARDS DEVELOPMENT

REGULATORY GUIDE 5.57  
(Task SG 908-4)

## SHIPPING AND RECEIVING CONTROL OF STRATEGIC SPECIAL NUCLEAR MATERIAL

### A. INTRODUCTION

Requirements for the physical protection of special nuclear material (SNM) at licensee facilities and in transit and of plants in which SNM is used are specified in 10 CFR Part 73, "Physical Protection of Plants and Materials," and are the subject of various regulatory guides issued or under development. Section 73.20 of 10 CFR Part 73 provides the general performance objective and requirements for each licensee who is authorized to operate a fuel reprocessing plant pursuant to 10 CFR Part 50, possesses or uses formula quantities of strategic special nuclear material (SSNM) at any site or contiguous sites subject to control by the licensee, is authorized to transport or deliver to a carrier for transportation pursuant to 10 CFR Part 70 formula quantities of SSNM, takes delivery of formula quantities of SSNM free on board (f.o.b.) the point at which it is delivered to a carrier for transportation, or imports or exports formula quantities of SSNM. Section 73.25 requires specific performance capabilities for physical protection of SSNM in transit. Section 73.45 requires specific performance capabilities for fixed site physical protection systems. This guide is applicable to the shipping and receiving control of SSNM subject to §§ 73.20, 73.25, and 73.45.

Other regulations are also pertinent to shipping and receiving control. Section 70.58, "Fundamental Nuclear Material Controls," requires licensees to establish, maintain, and follow detailed fundamental material control and accounting procedures, including procedures for shipping and receiving special nuclear material (SNM). Certain material control and accounting procedures related specifically to the protection of SSNM from theft during shipping and receiving and related to preventing the misuse of shipments to disguise a diversion are discussed in this guide. Additional guidance on fundamental material controls and accounting is included in the following regulatory guides:

- 5.10 Selection and Use of Pressure-Sensitive Seals on Containers for Onsite Storage of Special Nuclear Material.
- 5.12 General Use of Locks in the Protection and Control of Facilities and Special Nuclear Materials.
- 5.13 Conduct of Nuclear Material Physical Inventories (In particular, Section C.2.b.(1), Receipts, Shipments, and Other Removals).
- 5.15 Security Seals for the Protection and Control of Special Nuclear Material.
- 5.45 Standard Format and Content for the Special Nuclear Material Control and Accounting Section of a Special Nuclear Material License Application.
- 5.47 Control and Accountability of Plutonium in Waste Material.
- 5.51 Management Review of Nuclear Material Control and Accounting Systems.

Section 70.57 and paragraph (f) of § 70.58 require that the licensee's measurement control program for SNM include a means for the control and evaluation of measurement bias, random errors, and limits on systematic errors for all parts of the measurement process, including scales, balances, volume measurements, analytical quality control, nondestructive assay, and sampling. Certain measurements made in conjunction with shipping and receiving are used as part of the material accountability program and are subject to § 70.57. Specific guidance on measurements and measurement control are provided in the following regulatory guides:

- 5.4 Standard Analytical Methods for the Measurement of Uranium Tetrafluoride (UF<sub>4</sub>) and Uranium Hexafluoride (UF<sub>6</sub>).

\* Lines indicate substantive changes from June 1976 version.

### USNRC REGULATORY GUIDES

Regulatory Guides are issued to describe and make available to the public methods acceptable to the NRC staff of implementing specific parts of the Commission's regulations, to delineate techniques used by the staff in evaluating specific problems or postulated accidents, or to provide guidance to applicants. Regulatory Guides are not substitutes for regulations, and compliance with them is not required. Methods and solutions different from those set out in the guides will be acceptable if they provide a basis for the findings requisite to the issuance or continuance of a permit or license by the Commission.

Comments and suggestions for improvements in these guides are encouraged at all times, and guides will be revised, as appropriate, to accommodate comments and to reflect new information or experience. This guide was revised as a result of substantive comments received from the public and additional staff review.

Comments should be sent to the Secretary of the Commission, U.S. Nuclear Regulatory Commission, Washington, D.C. 20555, Attention: Docketing and Service Branch.

The guides are issued in the following ten broad divisions:

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| 1. Power Reactors                 | 6. Products                       |
| 2. Research and Test Reactors     | 7. Transportation                 |
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| 4. Environmental and Siting       | 9. Antitrust and Financial Review |
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Copies of issued guides may be purchased at the current Government Printing Office price. A subscription service for future guides in specific divisions is available through the Government Printing Office. Information on the subscription service and current GPO prices may be obtained by writing the U.S. Nuclear Regulatory Commission, Washington, D.C. 20555, Attention: Publications Sales Manager.

- 5.5 Standard Methods for Chemical, Mass Spectrometric, and Spectrochemical Analysis of Nuclear-Grade Uranium Dioxide Powders and Pellets.
- 5.6 Standard Methods for Chemical, Mass Spectrometric, and Spectrochemical Analysis of Nuclear-Grade Plutonium Dioxide Powders and Pellets and Nuclear-Grade Mixed Oxides ([U,Pu]O<sub>2</sub>).
- 5.11 Nondestructive Assay of Special Nuclear Material Contained in Scrap and Waste.
- 5.21 Nondestructive Uranium-235 Enrichment Assay by Gamma-Ray Spectrometry.
- 5.34 Nondestructive Assay of Plutonium in Scrap by Spontaneous Fission Detection.
- 5.53 Qualification, Calibration, and Error Estimation Methods for Nondestructive Assay.

Licenseses who transfer and receive SNM are required under § 70.54 to complete DOE/NRC Form-741, "Nuclear Material Transaction Report," and submit a copy to the U.S. Department of Energy (DOE), Oak Ridge, Tennessee. In addition, paragraph 70.42(c) requires that, before transferring SNM, the person making the shipment verify that the recipient is authorized to receive the type, form, and quantity of SNM to be transferred. Paragraph 70.42(d) outlines the methods to be used to make this verification.

Paragraph 70.58(g)(2) requires that procedures be established to review and evaluate shipper-receiver differences on an individual container or lot basis, a shipment basis, and a cumulative basis for shipments of like material. Guidelines are contained in Regulatory Guide 5.28, "Evaluation of Shipper-Receiver Differences in the Transfer of Special Nuclear Materials." Any loss of SNM (other than normal operating loss) must, under § 70.52, be reported immediately to the Director of the appropriate NRC Inspection and Enforcement Regional Office (listed in Appendix A to Part 73) by telephone, telegram, mailgram, or facsimile.

This guide and the guides referenced above describe procedures acceptable to the NRC staff for complying with the Commission's regulations regarding the control of SSNM during preparation for shipment and receipt by a licensee. Safety-related requirements for packaging and transporting SNM are specified in 10 CFR Part 71, "Packaging of Radioactive Material for Transport and Transportation of Radioactive Material Under Certain Conditions," and in the applicable portions of the regulations appropriate to the mode of transportation in Title 49 of the Code of Federal Regulations. These requirements are not included in the scope of this guide.

## B. DISCUSSION

Adequate control of SSNM during transfer between licensees includes (1) physical protection of the material at

the licensee's facilities and while in transit and (2) the timely, accurate, and independent identification and measurement of the SSNM by both shipper and receiver to determine and evaluate any shipper-receiver differences. These measurements are necessary to (1) detect loss or theft of SSNM being transferred between licensees, (2) detect and permit correction of clerical or handling errors, (3) detect falsification or errors in the shipment source data, (4) provide assurance that measurement bias is detected and corrected, and (5) detect and prevent the transfer of "inventory difference" (ID) from one licensee to another.

The application of tamper-indicating seals to each item or container by the shipper immediately after sampling or assay, checks on those seals before shipment, and the prompt verification of the seals by the receiver can help ensure the integrity of the material measured. Additional receiving checks made immediately after receipt can determine if loss, theft, or substitution of SSNM may have occurred during transfer and can detect packaging and clerical mistakes. These checks can include counting and identifying the containers; identifying and weighing the containers or items received; comparing the results with the same information on a bill of lading, DOE/NRC Form-741, "Nuclear Material Transaction Report," or other appropriate document supplied by the shipper; and, to the extent possible, performing an overcheck of each container by nondestructive analysis to provide a gross verification of the SSNM content.

After these initial checks have been made, prompt quantitative verification of the contents of each container will provide early assurance that the contents of the packages received are identical to those shipped. Written procedures that call for performing these verifications within specific time limits after shipment can help ensure that DOE/NRC Form-741 is filed in a timely fashion. In addition, the validity of both the shipper and receiver measurements is dependent on the existence of a program of standardization and calibration and control of measurement equipment and procedures.

Prior coordination between the carrier and receiver can ensure that SSNM will be delivered to the receiver's facility at a time when trained personnel are available to properly handle the material received. This procedure will eliminate the possibility of material arriving at times when proper receiving checks or adequate physical security cannot be provided.

Appropriate procedures that identify employees who are authorized to ship SSNM and the responsibilities of the various organizational components that have cognizance of the shipment will ensure that all aspects of the shipment are coordinated adequately. The following organizational components are listed with typical responsibilities as related to the shipment:

- 1. Organizational component that fabricates or assembles material:
  - a. Determine the correct weights of the SSNM,

- b. Tamper-seal and document the contents of the containers,
- c. Obtain appropriate analysis of the SSNM,
- d. Ensure product specifications,
- e. Package material properly or provide guidance on packaging as required.

2. Shipping and receiving control:

- a. Prepare shipping forms,
- b. Ensure proper packaging,
- c. Check integrity and seal numbers of tamper-safed containers and identification numbers on such items as sealed fuel pins,
- d. Verify seal integrity and number of receipts,
- e. Check weight of items and containers.

3. Security:

- a. Accompany package to shipping area when appropriate,
- b. Be cognizant of the storage areas while shipment is in them,
- c. Guard shipment while it is being loaded,
- d. Coordinate security plans and arrangements with the dispatcher of the material,
- e. Obtain signed receipts and pass them on to the appropriate departments.

4. Traffic (dispatcher):

- a. Make carrier arrangements,
- b. Coordinate shipments and ensure that delivery is at a time when the proper personnel are available to properly handle the material received,
- c. Prepare bill of lading and other formal shipping papers,
- d. Notify receivers when shipments will be made and approximate time of scheduled arrival.

5. Nuclear materials control:

- a. Ensure that the receiver is authorized to receive the shipment of SSNM,
- b. Approve all SSNM shipping memos,
- c. Prepare and transmit DOE/NRC Form-741,
- d. Transmit information for computer records, if used,
- e. Arrange transfer of material to shipping area,
- f. Post shipping transactions to control records,
- g. Investigate and reconcile shipper-receiver differences.

To document the transfer of SSNM containing 1 gram or more of contained uranium-235, uranium-233, or plutonium, DOE/NRC Form-741 is initiated on the day the material is shipped and distributed promptly by the shipper. Normally, the licensee receiving SSNM is required to independently measure its element and isotopic content and complete and distribute DOE/NRC Form-741 within 10 days of receipt of the material. However, if receipt measurements cannot

be completed within 10 days, a licensee may prepare and distribute NRC Form-284, "Nuclear Material Transfer Report," or use DOE/NRC Form-741 as a temporary receipt record after performing an initial receiving check to verify that the items, containers, and gross quantities shipped have been received. In such cases, the receiver is then required to complete the measurements and report them on DOE/NRC Form-741 within 30 days of receipt of the shipment. If the material received is scrap or irradiated material that may take longer than 30 days to measure, DOE/NRC Form-741 is completed and distributed to indicate temporary acceptance of the shipper's values; at a later date, the receiver prepares and distributes a "corrected copy" of DOE/NRC Form-741 that reports the receiver's own measurements.<sup>1</sup> There are no requirements for shipments of nuclear wastes to burial grounds to be measured independently by the receiver. DOE and its prime contractors complete DOE/NRC Form-741 in accordance with DOE manual chapters.

### C. REGULATORY POSITION

Procedures should be provided to ensure that records reflect accurately the quantity and form of material shipped and received, to protect against the deliberate falsification of information on shipments or receipts to conceal diversion of SSNM, and to protect against the use of waste shipments or shipments of quantities not subject to § 73.25 as a means for unauthorized removal of SSNM from a licensee's facility. The following procedures are acceptable to the NRC staff.

#### 1. PRESHIPMENT CONTROLS ON WASTE

a. Nondestructive assay (NDA) measurements for accountability purposes should be made using one of the following procedures or an alternative procedure that provides equivalent protection against falsification of accountability measurements:

(1) Measurements should be performed by two individuals working and recording as a team and who do not have access to material processing and storage areas,

(2) Measurements should be performed by three individuals working and recording as a team, or

(3) Arrangements should be made for independent verification of the accountability measurements by a party other than the licensee.

b. Tamper-safing controls at the time of accountability measurements should include one of the following:

<sup>1</sup>Section 70.54 and the written instructions entitled "Instructions to NRC and Agreement State Licensees for Reporting Nuclear Material Transfers on DOE/NRC Form-741 - Nuclear Material Transaction Report," U.S. Nuclear Regulatory Commission. Copies of the latter may be obtained from the Division of Safeguards, Office of Nuclear Material Safety and Safeguards, U.S. Nuclear Regulatory Commission, Washington, D.C. 20555.

(1) If the containers being measured are already tamper-safed, individuals performing the measurement should confirm the seal identification and integrity, or

(2) Containers should be sealed at the time of NDA measurement and each member of the team should attest in writing to the nature of the contents of the container and the seal identification.

c. Prior to removal of a waste container from a material access area (MAA), an overcheck should be performed to ensure that the container is not being used as a means for concealment and unauthorized removal of SSNM from an MAA. Controls should also be placed on packaging of smaller containers that are sealed and subsequently combined in larger containers prior to final sealing and removal from an MAA. Teams performing functions for a. and b. above may simultaneously perform the functions described below. Acceptable procedures are:

(1) For each stage in sequential packaging, containers should be filled and sealed by two individuals working and recording as a team and who do not have access to material processing and storage areas. Each individual should attest in writing to the nature of the contents of the container and the seal identification. At any stage in sequential packaging, the team filling the large container should include at least one individual who was not involved in filling the smaller containers,

(2) Same as (1), except that, if any individual involved in filling and sealing the containers has access to material, three-man teams should be used,

(3) Intermediate packaging may be performed by two-man teams if the final package receives an NDA overcheck using a segmented scanner with a transmission source or neutron counter, as appropriate, capable of detecting concealed SSNM and gamma ray or neutron absorbers of sufficient density to preclude accurate NDA measurement, or

(4) Intermediate packaging may be performed by two-man teams if the final sealed package is retained in the MAA until the next material balance is closed. The package may be released if the inventory difference is less than the limit of error which in turn is less than 1/10 of a formula quantity as defined in paragraph 73.2(bb). If the inventory difference for the period is greater than its limit of error, the containers should be unsealed and the contents verified in accordance with Regulatory Position C.1.c.(1) or (2) or left sealed and the contents verified in accordance with Regulatory Position C.1.c.(3) as a part of the investigation of the excessive inventory difference. If the limit of error is greater than 1/10 of a formula quantity, verification should be performed in accordance with Regulatory Position C.1.c.(1), (2), or (3) before the package is released.

## 2. OVERCHECKS ON PRODUCT, SAMPLES, AND SCRAP

a. For shipments that are not subject to the in-transit physical protection requirements of §§ 73.20 and 73.25, overchecks such as those discussed in Regulatory Position

C.1.c. above should be provided to protect against concealment and unauthorized removal of SSNM.

b. If an independent accountability measurement is not required to be made by the receiver and reported within 30 days, NDA overchecks on accountability measurements should be provided by the shipper or controls such as those discussed in Regulatory Position C.1.a. should be provided.

## 3. ADDITIONAL SHIPPING CONTROLS

a. Before shipping SSNM, the licensee should ensure that the intended receiver is authorized to receive the type, form, and quantity of SSNM to be transferred in accordance with § 70.42. This does not include forecasting the receiver's inventory at the time the shipment arrives.

b. The shipper should establish and maintain written procedures that identify employees who are authorized to initiate shipment of SSNM and identify the responsibilities of the various departments that should have cognizance of the shipment in accordance with paragraphs 70.58(b)(3) and 73.45(e)(2)(i).

c. Written procedures should be established and maintained to assign to specific organizational components the responsibility for packaging the shipment and ensuring that it is packaged and transported in accordance with the provisions of 10 CFR Parts 70, 71, and 73 and other applicable regulations.

d. Organizational components responsible for the shipment within the plant and in transit should have a set of written procedures that cover both normal and emergency conditions in accordance with paragraphs 70.58(b)(3), 73.25(d), and 73.45(g).

e. The shipper should notify the consignee of the pertinent details of the shipment as described in § 73.27.

f. The shipper should initiate and distribute a Nuclear Material Transaction Report (DOE/NRC Form-741) in accordance with § 70.54 and the printed instructions for completing the form.

g. In accordance with paragraph 73.45(e)(2)(ii), the shipping group should, as a minimum, check the items and tamper-safing tag information and the tag quantities against the information on the transfer forms. Each tamper-indicating device should be checked. It is also desirable that the shipping group make a gross weighing of each item.

h. Shipper-receiver differences, the quantity difference between the amount of SSNM stated by the shipper as having been shipped and the amount received as measured by the receiver, should be reviewed and evaluated in accordance with paragraph 70.58(g).

## 4. RECEIPTS

a. A licensee should accept receipt of only those types and quantities of SSNM authorized by his license. If other

material is delivered to the facility, the licensee should notify the shipper immediately so that appropriate arrangements can be made for the disposition of the material and the continuous maintenance of adequate physical protection.

b. Arrangements should be made to deliver the material to the receiver at a time when personnel are available to properly handle the material in accordance with paragraph 73.25(b)(1)(i). It is the responsibility of shipper, receiver, and carrier to ensure that trained personnel are available to properly handle deliveries of SNM. If it appears to the shipper or carrier that the shipment may arrive at a time other than that for which arrangements were made, the shipper or carrier should immediately inform the receiver so that the receiver can have trained personnel available when the shipment arrives. If the shipment fails to arrive at the scheduled time, the receiving licensee should notify the shipper in accordance with paragraph 73.71(b) so that a prompt investigation can be initiated.

c. The identification and integrity of the shipper's tamper-safing devices on each item or container should be verified in accordance with paragraph 73.25(c)(4). The piece count and identification and gross weight of the items or containers received should be checked against the bill of lading, DOE/NRC Form-741, or other appropriate shipping document to provide assurance that the shipment was received intact. To the extent possible, an overcheck determination by NDA or other appropriate means should be made to provide a prompt estimate of the SSNM content of each item or container. After the initial receiving checks have been performed, the material should be sent to an area where the contents of the containers or items can be verified quantitatively in accordance with paragraph 70.58(e). Written procedures should be established and maintained for verifying the receipts within specific time limits so that DOE/NRC Form-741 can be filed within the time required by § 70.54.

d. If any of the tamper-safing devices have been disturbed in a way that may indicate an attempt to render the device inoperable or if the device has been damaged accidentally, the following actions should be taken:

(1) The affected containers should be resealed immediately by the receiver with another tamper-safing device, and the resealing should be witnessed and attested to by the personnel delivering the containers.

(2) After resealing, containers with damaged seals should be isolated until the licensee can inspect the containers to determine if a loss of SSNM has occurred. This should be accomplished in accordance with the procedures described in (3) and (4).

(3) If a gross weight or NDA overcheck, as appropriate, indicates that the contents of any container appear to have been removed, the Director of the NRC Inspection and Enforcement (IE) Regional Office listed in Appendix A to 10 CFR Part 73 should be notified immediately in accordance with § 73.71. The shipper should also be notified as soon as

possible. Both IE and the shipper should be given the option of witnessing a quantitative assessment of the container's contents. The contents of the container should be quantitatively assessed as soon as possible. If the shipper and IE elect not to witness the measurement, the assessment should be witnessed and attested to by personnel from at least two different groups within the receiver's organization.

(4) If the contents of the containers appear to be in order, the shipper should be notified and given the option of witnessing a quantitative assessment (weighing and sampling) of the containers contents within 48 hours following receipt of the shipment. If the shipper does not respond to this offer, the contents of the container should be assessed as soon as possible, but in no case later than 48 hours after receipt.

(5) The shipper or IE should be given the results of the quantitative assessment immediately if either did not witness the assessment.

e. Within the time specified in the instructions for the preparation of DOE/NRC Form-741, the receiver should make an accurate, precise, and independent measurement of the SSNM content of the material received. This measurement should be in accordance with a program for acceptable measurement quality as required by paragraph 70.58(f).

f. The difference between the amount of SSNM stated by the shipper as having been shipped and the amount received as measured by the receiver should be reviewed and evaluated in accordance with paragraph 70.58(g). All measurement discrepancies should be reported to the nuclear material control manager or alternate, who should personally verify the discrepancy in the presence of the employee who discovered them. Written procedures should quantitatively define what constitutes a discrepancy for each type of SSNM received. Appropriate action should be taken to reconcile those shipper-receiver differences that are statistically significant at the 95% confidence level, except for shipments that involve differences of 50 grams or less of U-235 or plutonium. When a discrepancy is identified, the nuclear material manager should resolve the discrepancy with the shipper. If the discrepancy cannot be resolved, the appropriate NRC Inspection and Enforcement Regional Office should be notified by telephone, telegram, mailgram, or facsimile. Additional guidance on shipper-receiver differences is contained in Regulatory Guide 5.28.

g. Within 10 days of receipt of material, the receiver should complete and distribute the DOE/NRC Form-741 prepared by the shipper in accordance with § 70.54. When receipt measurements cannot be completed within this 10-day period, the receiver should complete a temporary receipt in one of the following two ways: (1) as indicated in the instructions for reporting nuclear material transfers on DOE/NRC Form-741, complete blocks "Date Received or Correction Entered" and "Signature of Authorized Official and Date Signed" of the form, note on the form whether the containers, boxes, or cases reported as shipped were received, and mark on the form "Nuclear Material Transfer Receipt" or (2) if authorized in the license,

prepare NRC Form-284, "Nuclear Material Transfer Report," as a temporary receipt. In either case, a copy of the original DOE/NRC Form-741 issued by the shipper should then be completed and distributed within 30 days of receipt to show the receiver's measurements. However, if measurements of scrap and irradiated material cannot be

completed and reported within 30 days of receipt of material and if a temporary receipt has been filed on NRC Form-284 or DOE/NRC Form-741, the licensee should complete DOE/NRC Form-741 accepting the shipper's weights and file a corrected copy to report his or her own measurements at a later date.

## VALUE/IMPACT STATEMENT

A separate value/impact analysis has not been prepared for the revision to this regulatory guide. The changes were made to make the guide consistent with the upgraded physical protection amendments to the regulations published in the *Federal Register* November 28, 1979 (44 FR 68184). A value/impact analysis prepared for the proposed

amendments was made available in the Commission's Public Document Room, 1717 H Street NW., Washington, D.C., at the time the proposed amendments were published. This analysis is appropriate for the final amendments as well as for the regulatory guide revisions appropriate to those amendments.

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