



U.S. ATOMIC ENERGY COMMISSION

REGULATORY GUIDE

DIRECTORATE OF REGULATORY STANDARDS

REGULATORY GUIDE 5.28

EVALUATION OF SHIPPER-RECEIVER DIFFERENCES IN THE TRANSFER OF SPECIAL NUCLEAR MATERIALS

A. INTRODUCTION

Paragraph (g) of proposed § 70.58 of 10 CFR Part 70 (38 FR 3077) would require certain AEC licensees authorized to possess special nuclear material to establish, maintain, and follow procedures for reviewing and evaluating shipper-receiver differences. This guide identifies concepts, principles, and methods that are acceptable to the Regulatory staff for determining significant shipper-receiver differences.

B. DISCUSSION

Statistical controls are required as an integral part of special nuclear materials control and accounting systems to assure that licensees of fuel processing and fuel fabrication facilities effectively account for the special nuclear material they possess and identify losses when they occur. An important statistical indicator of control is an observed shipper-receiver difference, which results from comparing two independent determinations of transferred material. A shipper-receiver difference is the difference between the amount stated by the shipper as having been shipped and the amount stated by the receiver as having been received.

Essential to a comprehensive evaluation of the significance of this indicator are statistical techniques using associated limits of error for testing whether detected differences may be attributable to measurement error. The power or discernibility of such significance tests depends on the quality and amount of data evaluated.

The shipper and receiver of transferred material should make independent measurements to determine the amount of SNM in a shipment. A non-zero shipper-

receiver difference generally occurs because of errors introduced by sampling bulk materials and measuring weights or volumes and SNM concentrations. Additionally, a shipper-receiver difference could be the result of a diversion, theft, unmeasured loss of SNM, or recording mistake.

The identification and evaluation of shipper-receiver differences is one of the means of detecting diversion, theft, loss, or misstatements of the amount of SNM transferred. Additionally, such evaluation and subsequent resolution will tend to limit the amount of material unaccounted for (MUF) transferred from one facility of another.

Subcommittee N15-3 of the American National Standards Institute (ANSI) Standards Committee N15. Methods of Nuclear Materials Control, has developed a standard that provides concepts and principles for the statistical evaluation of shipper-receiver differences in the transfer of special nuclear materials. This standard, to be designated ANSI N15.17, "Concepts and Principles for the Statistical Evaluation of Shipper-Receiver Differences in the Transfer of Special Nuclear Materials," has been reviewed by Subcommittee N15-3.

This standard references the standard ANSI N15.16. "Limit of Error Concepts and Principles of Calculation in Nuclear Materials Control," which defines limit of error as twice the standard deviation of the estimates. This is not always consistent with 10 CFR Part 70 and Regulatory Guide 5.3, "Statistical Terminology and Notation for Nuclear Materials Management," which define limit of error as the uncertainty component used in constructing a 95% confidence interval.

USAEC REGULATORY GUIDES

Regulatory Guides are issued to describe and make available to the public methods acceptable to the AEC Regulatory 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.

Published guides will be revised periodically, as appropriate, to accommodate comments and to reflect new information or experience.

Copies of published guides may be obtained by request indicating the divisions desired to the U.S. Atomic Energy Commission, Washington, D.C. 20545. Attention: Director of Regulatory Standards. Comments and suggestions for improvements in these guides are encouraged and should be sent to the Secretary of the Commission, U.S. Atomic Energy Commission, Washington, D.C. 20545. Attention: Chief, Public Proceedings Staff.

The guides are issued in the following ten broad divisions:

- | | |
|-----------------------------------|------------------------|
| 1. Power Reactors | 6. Products |
| 2. Research and Test Reactors | 7. Transportation |
| 3. Fuels and Materials Facilities | 8. Occupational Health |
| 4. Environmental and Siting | 9. Antitrust Review |
| 5. Materials and Plant Protection | 10. General |

C. REGULATORY POSITION

The recommendations contained in the proposed ANSI Standard N15.17, "Concepts and Principles for the Statistical Evaluation of Shipper-Receiver Differences in the Transfer of Special Nuclear Materials," Draft 5, dated April 10, 1974,¹ are generally acceptable to the Regulatory staff for use in nuclear material control and accounting procedures, except that in section 4.6 of the standard the variances used in the evaluation of shipper-receiver differences should be considered as defined in Regulatory Guide 5.18, "Limit of Error Concepts and Principles of Calculation in Nuclear Materials Control," which provides two clarifications with regard to ANSI Standard N15.16-1974 having the same title.

In addition, the following should be done:

1. Shipper-receiver differences should be reviewed and evaluated on an individual container, material batch, and shipment basis and on a transfer series of like-type material. Appropriate investigative and corrective action should be taken to reconcile shipper-receiver differences that are statistically significant at the 95% confidence level.

2. A statistically significant shipper-receiver difference warrants investigation to decide whether corrective action, e.g., reconciliation, is necessary or, more important, whether diversion or theft has occurred. The following measurement information should be available in order to perform an adequate investigation:

a. Number of measurements of weight for each lot and container.

b. Random and systematic errors for weighings and basis for the error estimates.

- c. Replicate weighing data,
- d. Sampling scheme used and replicate sampling information,
- e. Replicate analysis data.
- f. Number of samples and elemental analyses going into each average value reported,
- g. Sampling errors and basis for the error estimates,
- h. Random and systematic errors for the elemental analyses and basis for the error estimates,
- i. Sampling scheme for isotopic analyses,
- j. Number of isotopic analyses per lot, and
- k. Random and systematic errors of the isotopic analyses and basis for the error estimates.

3. In regard to principle 4.3 of the standard, the receiver's measurements, including sampling, should be made independent of the shipper's.

4. In regard to principles 4.2 and 4.4 of the standard, the procedure for evaluating shipper and receiver data should provide the capability to localize any detected diversion to specific transfer material batches and either to a specific container or a specific group of containers.

5. Paragraphs 1.1 and 1.2 of the standard purposely limit the scope of the standard. The detection of missing material and, in turn, the uncovering of diversion or theft should be timely. Receipts should be piece-counted and item-identified for comparison with the shipment bill of lading as soon as possible, but in no case later than 24 hours after receipt. Also within 24 hours, the integrity of tamper-safing devices should be verified, and receipts should be measured by weighing and, to the extent practical, by nondestructive analysis (NDA) for comparison with shipper's values. More accurate and precise measurements for completing AEC Form 741 and for further data evaluation should be made as soon as practicable.

¹Copies may be obtained from the Institute of Nuclear Materials Management, 505 King Avenue, Columbus, Ohio 43201, Attn: Mr. H. L. Toy.