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MANAGEMENT REVIEW OF NUCLEAR MATERIAL CONTROL AND ACCOUNTING SYSTEMS

A. INTRODUCTION

Section 70.58, "Fundamental Nuclear Material Controls," of 10 CFR Part 70, "Special Nuclear Materials," requires, in paragraph 70.58(c), that certain licensees authorized to possess more than one effective kilogram of special nuclear material establish a management system to provide for the development, revision, implementation, and enforcement of nuclear material control and accounting procedures.

Such a system must provide for a review of the nuclear material control system at least every 12 months. The individuals performing this review must be independent both of nuclear material control management and of personnel who have direct responsibility for the receipt, custody, utilization, measurement, measurement quality, and shipment of nuclear material. This review must include a review and audit of material control and accounting procedures and practices and an audit of nuclear material records. The results of the review and audit, along with recommendations for improvements, are required to be documented, reported to the licensee's corporate and plant management, and kept available at the plant for inspection for a period of five years.

This guide describes the purpose and scope, personnel qualifications, depth of detail, and procedures that are acceptable to the NRC staff for the management review of nuclear material control systems required under paragraph 70.58(c) of 10 CFR Part 70.

B. DISCUSSION

1. Purpose and Scope

The basis of any effective system of control is a program of review to ensure that the procedures are effective and appropriate and that such procedures are being carried out in practice. The NRC conducts compliance inspections to ensure that licensees' nuclear material control and accounting systems are in compliance with the requirements of the regulations and conditions of licenses. Licensee management, however, is responsible for implementing the NRC requirements by means of an effective system of nuclear material control and accounting.

Assurance of the adequate discharge of this responsibility is obtained by review, evaluation, and modification of the system by licensee management or representatives thereof. It is assumed for such a review that a system has been established, documented, and implemented. The purposes of the review are to ensure that the system is being operated as designed and to determine whether the established system is appropriate and effective for the current operations.

Changes in management relationships, production technology or capacity, operating practices, or plant mission could result in the need to change the material control and accounting system. The management review will provide evaluation of the system to determine whether such changes should be made.

2. Personnel

The people most knowledgeable of the material control and accounting system of a plant are those directly responsible for its operation. These people, however, would have difficulty in conducting an objective evaluation of their own system. Personnel other than those directly responsible for the system, but still knowledgeable of its basic concepts, can provide an independent viewpoint. Such personnel also can view the system from a management standpoint, as well as from a purely technical standpoint.

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ENCLOSURE 1

3. Coverage

Material control and accounting systems can be divided into several areas of investigation for purposes of a management review. These are:

a. Internal Control, including storage and internal handling, tampersafing, item identification and control, shipping and receiving control, scrap and waste control, and establishment of material balance and item control areas;

b. Measurements System, including the measurement and sampling procedures and the measurement quality assurance program;

c. Statistical Control, including the statistical aspects of the measurement quality assurance program, shipper-receiver difference control and evaluation, and statistical methodology associated with measurement and material balance limits of error;

d. Physical Inventory;

e. Records and Reports; and

f. Organization and Management.

Other divisions or groupings could be used, depending on the design and complexity of the system being reviewed and the disciplines represented on the review team. For example, the measurement and sampling procedures might be considered as a category separate from the measurement quality assurance program. The way in which the system is divided or assigned for review is not particularly significant. It is important, however, that the division and assignment of review tasks is such that all aspects are covered.

C. REGULATORY POSITION

The management review of nuclear material control and accounting systems should include the following considerations and coverage.

1. Purpose and Scope

The purpose of the management review of the nuclear material control and accounting system should be to ensure that practices follow approved procedures and that practices and procedures are appropriate for current operations and are in compliance with NRC-approved material control and accounting plans. The scope of the review should include evaluation of the effectiveness of the system in maintaining control of and accounting for the nuclear materials. Measures of effectiveness should be considered in each part of the review.

2. Personnel

Personnel assigned to the review team should be knowledgeable in the basic principles of material control and accounting. They also should be selected so that their responsibilities on the review team do not cause a conflict of interest with their regular duties. They should provide an independent viewpoint and one that is management oriented as well as technically oriented.

Individual members of the team should be knowledgeable in the specific disciplines appropriate to their assigned areas of investigation. Review team personnel should be sufficiently knowledgeable to permit them to evaluate the appropriateness of procedures as applied in a given system. In this respect review team personnel should keep in mind the question: "Is there a better way of doing this and still complying with the system requirements?"

Task assignments for review team personnel should be made in writing to ensure complete coverage and minimize duplication of effort. One person should be assigned the task of overall review coordination. For small facilities the entire review may possibly be done by one person if that person is knowledgeable in all aspects of the system.

3. Planning

Review of the nuclear material control and accounting systems should include advanced planning to establish the extent and depth of coverage in each part of the system and to ensure that all parts are covered.

a. Review Program

A program for the review should be prepared to ensure complete coverage and development of adequate information on which to base review decisions. The review program should include a checklist for the review to cover all parts of the material control and accounting system. A preprinted program can save considerable time in planning but should not be used as an inflexible checklist or as a substitute for judgment and initiative in investigation.

The basic review program should be supplemented with checklists and questionnaires for more detailed coverage of the various parts of the review. Appendix A to this guide is an example of a review program checklist.

b. Procedure Manual

Review of the current procedure manuals and completion of a procedure manual checklist should be a part of the review planning. Reviewers should use such reviews to familiarize themselves with current procedures and to identify changes that may need coverage in

more depth. Appendix B to this guide is an example of a procedure manual checklist.

c. **Prior Review Workpapers**

Prior review workpapers should be used to acquaint the reviewers with past performance and audit procedures and to identify control practices that were previously found to be weak or inadequate. Such practices should be noted for more thorough investigation, whereas areas that were found to be satisfactory and that had been reviewed thoroughly on the prior review could be given less emphasis in the current review.

d. **Correspondence, Reports, and Discussions**

Correspondence and reports pertaining to material control and accounting, as well as preliminary discussions with plant management, plant operations personnel, and material control and accounting personnel, should be used to identify problem areas and areas that require a thorough investigation during the review. Discussion with the plant material control staff also should provide information for scheduling the nuclear material records audit and the observation of a routine physical inventory.

4. **Coverage**

All parts of the nuclear material control and accounting system should be covered in each review. However, not all parts need be given the same depth of coverage each time. Decisions as to depth of coverage should be based on considerations such as evidence of problems in certain parts, changes in procedures, or coverage in prior reviews. Information on which to base such decisions should be obtained before the review from sources such as prior review workpapers and reports, plant reports that give indications of problem areas, review of procedure manuals, and discussions with appropriate plant personnel.

To ensure complete coverage, review checklists and questionnaires should be used. Such checklists and questionnaires are referenced in the following sections. These checklists and questionnaires should be considered only as guides and should not be used as a substitute for judgment and investigative initiative. The subdivision of the review into the parts covered in the following six sections should be considered flexible. Other arrangements may be used where appropriate to the facility and the talents of the review team.

a. **Organization and Management**

This part of the review should include review and evaluation of:

(1) Organizational relationships;

(2) Functional statements of responsibilities and authorities;

(3) The system for development, revision, implementation, and enforcement of procedures; and

(4) The effectiveness of the system in terms of losses and material unaccounted for relative to expected values for these items.

Appendix C to this guide is an example of an organization and management review checklist. Personnel conducting this part of the review should be knowledgeable of the basic concepts of management and administration. All review team personnel should be made aware of the information developed in this part so that they may take into consideration any areas that may be pertinent to their specific part of the review.

Information regarding organization and management should be contained in the facility organization manuals and charts, job descriptions, and instruction manuals.

b. **Internal Control**

This part of the review should include review and evaluation of:

(1) Internal storage and handling;

(2) Item identification and control;

(3) Tamper-safing;

(4) Shipping and receiving controls;

(5) Scrap and waste controls; and

(6) Material balance area and item control area selection and establishment.

Appendix D is an example of an internal control checklist. Personnel conducting this part of the review should be knowledgeable of the basic concepts of material control.

Information regarding internal control should be contained in the facility procedure manuals, instruction manuals, and other facility management directives.

c. **Measurements System**

This part of the review should include review and evaluation of:

(1) Sampling and measurement points;

(2) Sampling methods including sample control procedures;

(3) Weight and volume methods;

(4) Analytical methods including nondestructive methods;

(5) Measurement data control procedures; and

(6) Measurement quality assurance programs.

Appendix E to this guide is an example of a measurement system checklist. Personnel conducting this part of the review should be knowledgeable of the chemical and physical properties of the materials involved, of the fundamentals of sampling and measurement of such materials, and of the basic concepts of measurement quality assurance.

Information regarding measurement systems should be contained in the facility procedure manuals, analytical manuals, laboratory data records, and measurement quality assurance manuals and data logs.

d. Statistical Controls

This part of the review should include review and evaluation of:

(1) The determination of measurement bias, random error variances, and limits of systematic error;

(2) The determination of material balance limits of uncertainty, i.e., limit of error of material unaccounted for (LEMUF);

(3) MUF – LEMUF evaluation;

(4) Shipper-receiver difference evaluation and control; and

(5) Statistical methodology employed in measurement quality assurance.

Appendix F to this guide is an example of a statistical control checklist. Personnel conducting this part of the review should be knowledgeable of the basic concepts of mathematical statistics and their application to nuclear material control. (See Regulatory Guides 5.18, "Limit of Error Concepts and Principles of Calculation in Nuclear Materials Control," 5.28, "Evaluation of Shipper-Receiver Differences in the Transfer of Special Nuclear Materials;" and 5.33, "Statistical Evaluation of Material Unaccounted For.")

Information regarding statistical controls should be contained in the facility procedure manuals, analytical manuals, laboratory data records, and measurement quality assurance manuals and data logs.

e. Physical Inventory

This part of the review should include review and evaluation of the facility's physical inventory procedures, instructions, and practices. The review should include observation of a routine physical inventory. The review need not include independent verification of the physical inventory by the review team.

Appendix G is an example of a physical inventory checklist. Personnel conducting this part of the review should be knowledgeable of the basic concepts of material control and accounting, especially those pertaining to the conduct of physical inventories (see Regulatory Guide 5.13, "Conduct of Nuclear Material Physical Inventories").

Information regarding physical inventories should be contained in the facility procedure manuals and physical inventory instruction directives.

f. Records and Reports

This part of the review should include a review and evaluation of the facility data-handling practices and procedures and an audit of nuclear material records. Appendix H is an example of a records and reports checklist.

Appendix I is an example of a nuclear materials records audit program. Personnel conducting this part of the review should be knowledgeable in the basic concepts of data handling and audit techniques and procedures.

Information regarding records and reports should be contained in the facility procedure manuals and in the facility records and reports pertaining to nuclear materials.

D. IMPLEMENTATION

This section provides information to applicants and licensees regarding the staff's plans for using this regulatory guide.

Except in those cases in which the applicant or licensee proposes an alternative method, after publication of this guide the Commission's staff will use the methods described herein for evaluating an applicant's or licensee's capability for and performance in complying with the specified portions of the Commission's regulations.

APPENDIX A

Review Program Checklist

1. **Planning the Review**

a. **General**

Arrange with plant management and nuclear material control and accounting management for the review dates, inventory dates, and discussions with appropriate plant personnel. Request information from plant personnel on specific areas that they believe should be given special attention during the review.

b. **Personnel**

Prepare a schedule of review personnel with specific assignments for each review team member. Each review team member should be given a copy of the schedule.

c. **Document Review**

Each member of the review team should survey prior review workpapers, suspense files, plant reports, and other documents pertinent to his assigned part of the review and should prepare a schedule of items for special investigation.

d. **Procedure Review**

Each member of the review team should survey plant organization and procedure manuals pertinent to his part of the review and prepare a schedule of items for special attention. Each member should complete a procedure manual checklist or that portion of the checklist pertinent to his assigned tasks.

e. **Physical Inventory**

Review the plant procedures and instructions pertaining to the conduct of plant inventories. Make personnel inventory assignments and prepare specific inventory instructions for the review team.

f. **Measurement System Review**

Review plant procedure manuals, prior workpapers, special reports, and other information to prepare or update measurement system flowcharts or data sheets as shown in the measurement system checklist. Select areas of the measurement system to be given special emphasis during the review.

g. **Statistical Controls Review**

Review measurements system reliability data, measurements quality assurance procedures, and other documents related to measurements reliability and material balance uncertainties to select areas for special emphasis during the review.

h. **Records and Reports**

Identify the records that will be subject to the audit and special report items that merit special investigation. Complete the planning portion of the audit program.

2. **Conducting the Review**

a. **General**

(1) Discuss with plant management the general aspects of the scope of review.

(2) Discuss details of the review with material control and accounting management and arrange meetings with other plant personnel as necessary.

b. **Organization and Management**

Complete the organization and management checklist on the basis of document reviews, discussions with plant personnel, and observations during the review.

c. **Internal Control**

(1) Review notes and findings from reviews of the various aspects of internal control to determine adequacy with respect to:

(a) Procedures reflecting actual practice and

(b) Appropriateness and effectiveness of the procedures.

(2) Complete the internal control checklist using notes and observations collected during the review.

d. **Measurement Systems Review**

(1) Review the measurement system with appropriate plant personnel to determine adequacy with respect to:

(a) Procedures reflecting actual practice and

(b) Completeness, appropriateness, and effectiveness of the procedures.

(2) Observe those areas selected in planning for emphasis during the review. Complete checklists as appropriate for the various aspects of the measurement system.

e. Statistical Controls Review

(1) Review and evaluate the statistical basis for measurement reliability for individual measurements, factors, and material balances in the areas selected for emphasis during the review.

(2) Review and evaluate the statistical methodology and controls used in determining and controlling limits of error for measurements, factors, and material balances.

(3) Complete the statistical control checklist and evaluate the controls with respect to:

(a) Procedures reflecting actual practice and

(b) Appropriateness and effectiveness of the procedures.

f. Physical Inventory

(1) Review detailed inventory plans with appropriate plant personnel.

(2) Observe inventory-taking as planned. Note changes and deviations from the plan. Document observations and complete the physical inventory checklist.

(3) Evaluate inventory practices and procedures with respect to:

(a) Procedures and plans reflecting actual practice and

(b) Appropriateness and effectiveness of the procedures.

g. Records and Reports

Complete the review of the records and reports and the audit of the nuclear material records according to the audit program.

3. Reporting Review Results

a. The team leader should discuss the review results with the review team to:

(1) Determine the effectiveness and appropriateness of the plant material control and accounting system in its entirety and in its several parts.

(2) Determine the accuracy with which procedures reflect actual practice.

(3) Determine areas in which recommendations for improvements are to be made.

(4) Develop points for discussion with plant and material control and accounting managements.

b. Discuss the findings of the review with plant and material control and accounting managements.

c. Prepare and issue the written report.

4. Review Workpapers

a. Complete and tie-in all workpapers.

b. Index and cross-reference all workpapers to:

(1) Other workpapers

(2) Review report

(3) Appropriate plant files.

APPENDIX B

Procedure Manual Checklist

When using a checklist to review a facility procedure manual, referenced supplementary documents and appendixes should be considered a part of the manual. With this taken into consideration, determine whether the facility procedure manuals contain the following information and whether that information is in agreement with current practices:

1. Facility Organization

a. Organization charts of:

(1) The facility organization

(2) The nuclear materials control and accounting unit

b. Charts and descriptions of all MBAs and ICAs

c. Basis for establishing MBAs and ICAs

d. Statements of responsibility and authority for:

(1) The central material control and accounting unit

(2) MBA or ICA custodians

(3) Others concerned with material control and accounting

2. Facility Operations

a. Functional statement of the facility operations and processes

b. Material flow description

(1) By charts

(2) By narrative

(3) Including material composition and type at significant points

(4) Including usual or normal material quantities

3. Receiving, Shipping, and Other Receipts and Removals

a. Description of shipping and receiving points

(1) Notation of these points on material flowchart

(2) Description of the receiving and shipping procedures at each point

b. Procedures for review, evaluation, and resolution of shipper-receiver differences

c. Description of and procedures for determining, reporting, and recording other additions to or removals from inventory

d. Procedures for evaluation and control of removals from inventory, such as MUF and measured discards

e. Statements of receiving and shipping responsibilities

4. Inventory

a. Procedures by MBA or ICA

b. Statements of inventory timing and frequency

c. Cutoff and plant shutdown procedures

d. Inventory measurement procedures

e. Description of general inventory techniques

f. Supplemental inventory instructions

g. Statement of inventory responsibilities

5. Storage and Internal Transfers

a. Description of procedures and mechanisms for segregating nuclear materials by material type and enrichment

b. Specific nuclear material identification and labeling procedures

c. Description of tampersafing procedures and devices

d. Description of storage facilities

e. Description of burial grounds, including location records

f. Description of procedures, documents, and document flows for internal transfers of nuclear material

g. Methods of determining nuclear material quantities transferred or stored

h. Statement of storage and internal transfer responsibilities

6. Scrap Control

a. Description of procedures for segregating, packaging, and identifying scrap

b. Methods for determining the nuclear material content of scrap

c. Description of procedures for recovering nuclear material from scrap, including offsite recovery if appropriate

7. Measurements and Statistical Controls

a. Description of nuclear material sampling and measurement points

(1) By process or material flowchart

(2) By narrative description

(3) For all material streams

b. Description of methods and techniques used at each sampling and measurement point, including:

(1) Weight or volume measurements

(2) Sampling procedures

(3) Special equipment for sampling or measurements

(4) Analytical procedures

(5) Measurements for calculation of quantities related to nuclear loss or production or factors

c. Description of supporting programs:

(1) Scale and balance program

(2) Calibration programs

(3) Quality control programs

(4) Analytical control programs

d. Description of the techniques and programs used to determine and control the measurements system biases, random error variances, and limits of systematic error

e. Description of the flow and use of measurement data

f. Procedures and techniques for statistical evaluation of:

(1) Shipper-receiver differences

(2) Material unaccounted for

(3) Individual measurement and shipment limits of error

(4) Calibration uncertainty

(5) Other

g. Statements of responsibility for measurements and statistical controls

8. Records and Reports

a. Chart of accounts

(1) General ledger accounts

(2) Control accounts

(3) Subsidiary accounts

(4) Plant and MBA or ICA accounts

b. Document flowchart

(1) Physical flow of documents

(2) Posting points

(3) Retention points

(4) Data elements

c. Description of the system

(1) Posting procedures

(2) Sample forms, including instructions

(3) Description and basis of reports

(4) Method of compiling reports from records

APPENDIX C

Organization and Management Checklist

1. Organization

a. Does the facility maintain current written procedures that contain organization charts or descriptions of the plant management structure, identifying all positions having responsibility for or control over special nuclear material? Is the nuclear material control structure described, including the relationship of the material control functions and responsibilities to those of other organizational functions and responsibilities?

b. Have appropriate separations of functions been identified in the procedures to provide a system of control checks and balances?

(1) Are the nuclear materials control and accounting functions organizationally independent of the operating departments?

(2) Does the unit include (or have available) personnel qualified in:

(a) Accounting

(b) Analytical chemistry

(c) Physics or nondestructive assay

(d) Quality control

(e) Statistics

(3) Can the material control and accounting unit cross organizational lines to enforce policy?

(4) Are the analytical and assay measurement laboratories organizationally independent of the operating departments?

c. Are statements of responsibility and authority included for those positions having responsibility for receiving and shipping, inventory, storage and internal transfers, measurements, statistics, and the records and reports system?

d. Are statements of responsibility and authority provided for other positions concerned with input to the material control system, such as production quality control, analytical laboratory, measurement system quality control, accounting, and auditing?

e. Do the procedures contain the job titles of the key positions in the safeguards program and describe the required qualifications for these positions?

2. Management

a. Are nuclear material control procedures and revisions reviewed and approved in writing by appropriate management?

b. Are delegations of material control and accounting responsibilities made in writing?

c. Are nuclear material control procedures contained in standard operating procedures, process specifications, manufacturing instructions, etc., so that the worker is informed of the accountability requirements of his job?

d. Is there evidence that appropriate management action has been taken to ensure that practices comply with procedures?

e. Is there evidence that appropriate management action has been taken to ensure that written procedures are revised to reflect approved changes in material control and accounting practices?

f. Were there any losses of discrete items or containers of special nuclear material? If so, was appropriate management action taken?

g. Did MUF for any material balance exceed the associated LEMUF for that balance? If so, was appropriate management action taken?

APPENDIX D

Internal Control Checklist

1. Internal Storage and Handling

a. Are containers and items containing special nuclear material properly labeled and uniquely identified?

b. Are records maintained for containers and items in storage? Transferred to or from storage?

c. Is there control of material removal from storage?

d. Is there segregation in storage of dissimilar materials, e.g., material types, enrichments, scrap, raw material, in-process material and product?

e. Are records maintained showing the identity, location, source, disposition, and special nuclear material content of all containers and items?

f. Are there records showing the quantities of special nuclear material added to, removed from, and currently in process?

g. Are all transfers of special nuclear material between MBAs or ICAs documented by means of transfer documents signed by appropriate authorized individuals?

h. Are transfer documents prenumbered, controlled, and accounted for?

i. Are tampersafing procedures used for effective control of and accounting for special nuclear material?

j. Is access to tampersafing devices and records controlled?

k. Do the tampersafing procedures include installation of the devices by authorized personnel and the recording of the date and time of installation, along with the identity of the device and the authorized installer?

2. Shipping and Receiving Controls

a. Receipts

(1) Is receiving of special nuclear material centralized at the facility?

(2) Is receiving performed by employees other than those who keep material accounting records?

(3) Is receipt of material acknowledged in writing by authorized employees?

(4) Is a lot or item number assigned upon receipt?

(5) Is the material identified by its assigned number on the various materials accounting and production forms?

(6) Are copies of receiving reports sent to the materials accounting office:

(a) Immediately

(b) Directly

(7) Is information from the receiving department compared with the quantities and description on the shipping form?

(8) Is the checking completed prior to signing the shipping form that is returned to the shipper?

(9) Are the shipping forms completed by the receiver within the required time?

(10) Is an item count made and the gross weight of material determined on receipt?

(11) Are tare and net weights determined?

(12) Is material sampled and analyzed upon receipt?

(13) Does the receiver take an independent sample (or participate in the shipper's sampling)?

b. Shipments

(1) Are written instructions as to lots or items to be shipped issued to the shipping departments?

(2) Is notice of shipment sent directly to the materials accounting office?

(3) Is the shipping form, NRC-741, prepared from loading sheets or other data received from the shipping department?

(4) After preparation, is the NRC-741 checked by other than the typist, prior to signature?

(5) Are the NRC-741's dispatched on time?

(6) Are there defined procedures for processing receipted shipping forms returned by the receiver, including:

(a) Review for authorized signatures and completeness of information

(b) Evidence on the shipping form (e.g., by employee's initials) that the required work has been done

(7) Is the gross weight of material determined prior to shipment?

(8) Is the tare weight of each individual shipping container determined?

(9) Are there procedures in use to ensure that the special nuclear material content of each container is valid?

c. Shipper-Receiver Differences

(1) Are there established procedures for detecting and evaluating statistically significant shipper-receiver differences?

(2) Do the plant records indicate any shipper-receiver differences during the period covered by the review?

(3) Were the shipper-receiver differences brought to the attention of the appropriate management personnel for evaluation?

(4) Are written reports prepared regarding the resolution of shipper-receiver differences?

3. Scrap and Waste Control

a. Scrap

(1) Is scrap classified and identified for purposes of:

(a) Measurement

(b) Recovery

(2) Is scrap packaged to facilitate accurate measurement?

(3) What portion of material balance uncertainty for each material type is due to scrap?

(4) What percent of inventory is in scrap?

(5) Are there plans and schedules for timely recovery of scrap?

(6) Is there evidence of scrap on inventory longer than:

(a) 6 months

(b) 12 months

(7) What basis is used for establishing the special nuclear material content of scrap?

(8) Is there a program to evaluate and reduce scrap generation?

(9) Is there a program to evaluate and improve scrap measurements?

b. Waste

(1) Are there procedures to ensure that wastes containing special nuclear material are measured before discard?

(2) What basis is used to determine the special nuclear material content of wastes?

(3) Are there recording and reporting procedures to ensure that the special nuclear material content of wastes is properly accounted for by:

(a) MBA

(b) Process

(c) Material type

(d) Type of discard

(4) Are there fail-safe procedures or devices in use to ensure that significant quantities of special nuclear material cannot be inadvertently discarded?

(5) Are there procedures for action in case of an inadvertent discard of a significant quantity of special nuclear material?

(6) Are there procedures or devices to monitor waste streams that normally should not contain special nuclear material?

(7) Are there continuing studies with respect to process discard residues to:

(a) Establish normal levels

(b) Improve measurements

(c) Reduce losses

(8) Are control charts or other series evaluation mechanisms used for routine discard streams?

4. Material Balance Areas and Item Control Areas

a. Does each MBA or ICA have identifiable physical boundaries sufficient to segregate the material in it from that in all other areas?

b. Are the number of MBAs and ICAs appropriate to isolate losses and facilitate investigation?

c. Are there procedures for providing valid measurement values for special nuclear material being transferred between MBAs and ICAs?

d. Is MBA and ICA structure compatible with management structure?

e. Are different individuals assigned custodianship for MBAs or ICAs that have transactions with each other?

f. Are custodians informed in writing of their responsibilities and duties?

g. Is there evidence that all items in ICAs are properly tampersafed or are sealed sources?

h. Are items in ICAs properly identified?

i. Is there evidence that model material balances were used in establishment of MBAs?

j. Are material balances prepared for individual MBAs?

k. Are MBA material balances used in evaluation of total plant MUF and LEMUF?

l. Are there MBAs in which internal material balances are prepared?

m. Are MBAs and ICAs structured so that no material is in more than one at any one time and all materials are located in a control area?

n. Should consideration be given to dividing MBAs identified in question l into separate MBAs?

o. Are there other MBAs or ICAs that should be:

(1) Combined

(2) Divided

APPENDIX E

Measurement System Checklist

1. Measurements Review

a. Based on planning review of plant procedure manuals and other documents, select those measurement points in the system to be reviewed in more detail. For each such point prepare a Measurement Point Data Sheet such as the one shown in Annex 1 to this appendix.

b. For each measurement point selected, review and discuss with the personnel responsible for the measurements the procedures actually used.

(1) Note any deviations from specified procedures or from good practice, along with any reasons for such deviations.

(2) Review available data supporting the precision and accuracy statements associated with each measurement point.

c. Observe analytical laboratory operations and procedures, including contract laboratories, if appropriate, and discuss them with laboratory personnel, as appropriate. An Analytical Laboratory Checklist such as the one shown in Annex 2 to this appendix should be used.

d. Check scales and balances using standard weights and observe their use. A Scale and Balance Checklist such as the one shown in Annex 3 to this appendix should be used.

2. Measurement Quality Control

a. Review and discuss with the personnel responsible the program of standardization and calibration of measurement equipment and analytical procedures.

b. Determine the extent of analytical control programs, participation in analytical exchange programs, validity and care of standards, and frequency of calibration of measurement equipment.

c. Does the measurement control program include:

(1) Sampling

(2) Bulk measurement

(3) Nondestructive measurements

(4) Analytical methods

(5) Use of control charts

d. Review Measurement Point Data Sheets, Analytical Laboratory Checklists, and Scale and Balance Checklist for data pertinent to measurement control.

e. Are the performance trends shown by the control program acceptable?

f. Are the frequencies of calibration, standardization, and precision checks acceptable?

g. Are quality control checks made in a representative fashion over time to include different equipment, shifts, and operators?

h. Are personnel training and qualification programs carried out?

i. Are there records and procedures to ensure that only trained and qualified personnel carry out material accounting measurements?

APPENDIX E – ANNEX 1

Measurement Point Data Sheet

This data sheet should be used to record observations and information regarding the actual functioning of the plant's material accounting measurement system. The reviewer should be familiar with the plant's written procedures before observing the actual functioning of the system.

1. Identify the measurement point by location, MBA, process, flowchart reference, etc.

2. Identify material by type, form, composition, normal quantities, source, use, and disposition.

3. Review bulk measurements:

   a. Scale, tank volume, or pipeline data

   b. Capacity

   c. Measurement increment

   d. Measurement control data

   e. Calibration procedure and frequency

   f. Calculation parameters and formulae

   g. Factor data, including:

      (1) Basis

      (2) Measured parameters

      (3) Measurement control data

      (4) Frequency of verification

4. Review sampling procedures, including:

   a. Portion sampled

   b. Basis for sampling, e.g., statistical plan, economic criteria, judgment, etc.

   c. Type and size of sample

   d. Sampling equipment

   e. Special or unique techniques

   f. Compositing

   g. Measurement control data

5. Review analytical procedures, including:

   a. Element concentration

   b. Isotopic composition

   c. Nondestructive assay

   d. Measurement control data

   e. Laboratory, including:

      (1) Process lab

      (2) Plant lab

      (3) Contract lab

6. Are the measurement methods at this measurement point appropriate?

APPENDIX E – ANNEX 2

Analytical Laboratory Checklist

This data sheet should be used to record observations and information regarding the actual functioning of the plant analytical laboratory. The reviewer should be familiar with the written procedures pertinent to the laboratory before observing the actual laboratory operation.

1. Is the laboratory that performs material accounting analyses independent of the production organization?

2. Are written requests for analyses submitted to the laboratory with the samples?

3. Are special prenumbered forms used for analytical requests?

4. Do the analytical requests include:

   a. Analyses required

   b. Date of request

   c. Identity of requesting unit

   d. Identity of material sampled

   e. Identity, description, and quantity of sample

   f. Disposition instructions for sample

   g. Reporting instructions for results

5. What record is made of incoming samples:

   a. Card file

   b. Log book

   c. Analyst assigned

   d. Other

6. Are samples permanently and adequately identified?

7. Are current written analytical procedures available to all appropriate analysts?

8. Are there written approved procedures to provide for changes in analytical procedures?

9. Is there evidence that the analysts follow:

   a. The written analytical procedures

   b. The approved change procedures

10. Is there a standard form for reporting analytical results that includes:

   a. Date of analysis

   b. Analytical results

   c. Identity of:

      (1) Analytical request

      (2) Sample

      (3) Analytical method

      (4) Analyst

   d. Disposition of sample

11. Are analytical results retained in the laboratory:

   a. Files

   b. Log books

   c. For 5 years

12. Does the laboratory control program include:

   a. Disguised samples when appropriate

   b. Adequately disguised samples

   c. Internal standards

   d. Reference standards traceable to national standards

   e. Analyst certification

   f. Independent evaluation such as participation in the SALE program

13. Are analytical services obtained from laboratories outside the plants?

14. Are the controls on any such outside analytical services adequate to ensure analytical results acceptable to the criteria of the in-plant analytical program?

APPENDIX E – ANNEX 3

Scale and Balance Checklist

This data sheet should be used to record observations and information regarding the actual use, maintenance, and calibration of scales and balances used for material accounting purposes. The reviewer should be familiar with the written procedures pertinent to the scales and balances used for material accounting before observing the actual use.

1. Are written calibration and use procedures available?

2. Is calibration performed properly and at satisfactory intervals?

3. Are calibrations traceable to national standards?

4. Are regular inspections, testing, and service performed?

5. Are inspection stickers on equipment?

6. Is there a training or qualification program for operators and supervisors?

7. Are working standards available and satisfactory?

8. Are working standards checked? How often?

9. Are standards accurate, handled with lifters or gloved hands, and kept under cover when not used?

10. Is the equipment sufficiently accurate for the intended use?

11. Is the equipment being used within the manufacturer's recommended capacity?

12. Are control charts or other statistical media maintained for scale and balance precision and accuracy?

13. Is statistical determination of precision and accuracy (weighing limits of error) performed?

14. Are buoyancy corrections made when appropriate?

15. Are weights handled carefully – not slid in place, etc.?

16. Are temperature and air current effects taken into consideration in the procedures and in practice?

17. Is proper action taken to correct weighing errors?

18. Are only approved scales used for material accounting?

19. Are scales checked before each use?

20. Are scales permanently identified?

21. Are tags applied to scales which are out of order? Do these tags show the reason why they are not used and that calibration is required after repair?

22. Are weights verified by more than one person (or printed tape) for shipments, receipts, scrap, etc.?

23. Is responsibility for scale and balance use, maintenance, and calibration assigned in writing?

APPENDIX F

Statistical Controls Checklist

1. Review any information recorded by the measurement system reviewer that is pertinent to the statistical controls of that system, including:

   a. Scale and balance calibration and measurement control data

   b. Sampling control data

   c. Analytical or NDA measurement control data

2. Are the data used for estimating bias and for determining error variances and limits of systematic errors of measurement:

   a. Generated by statistically valid procedures

   b. Sufficient in quality and quantity

   c. Collected by procedures to ensure accuracy and completeness

3. Are the data-handling and calculational procedures used to determine measurement precision and accuracy statistically valid and appropriate?

4. Are calibration data used appropriately in estimating measurement bias and limits of systematic errors?

5. Are sampling precision and accuracy based on statistically valid sampling plans and studies?

6. Are replication program data used appropriately for determination of random errors?

7. Are the data-handling and calculational procedures used to determine material unaccounted for (MUF) and the limit of MUF statistically valid and appropriate?

8. Are the data-handling and calculational procedures used to determine the limits of error of the physical inventory statistically valid and appropriate?

9. Is MUF localized by material balance area? By process within a material balance area?

10. Are there routine procedures for investigating excessive MUF?

11. What evidence is there that such procedures have been used?

12. Are valid statistical techniques employed to evaluate MUF on a series, as well as on an individual, basis?

13. Do such techniques include the use of control charts?

14. Are there routine procedures for evaluating shipper-receiver differences?

15. Do these procedures include valid statistical techniques for evaluating shipper-receiver differences by:

   a. Individual shipment

   b. Shipment series

   c. Individual lot or container

16. Do these procedures include the use of control charts?

17. Is there evidence that these procedures have been used?

18. Is there evidence that significant shipper-receiver differences have been investigated and reconciled?

19. Are the results from statistical evaluations made available to management and operating personnel for control purposes?

20. Are data retained for five years?

APPENDIX G

Physical Inventory Checklist

This checklist should be completed on the basis of observations of a physical inventory being conducted at the plant under review. The observer should have reviewed the general inventory procedures for the plant and the specific inventory instructions for those areas to be observed during the inventory.

1. Was the inventory based on measured quantities?

2. Was the inventory a shutdown, cleanout type; a dynamic type; or a combination thereof?

3. Was measurement information based on:

   a. Prior measurements ensured through item identification and tampersafing

   b. Uniquely identified sealed sources

   c. Prior measurements verified by remeasurement

   d. Measurements made during the inventory

   e. Factors or calculated values. If factors were used, were the factors determined on the basis of measurements, their continued validity monitored through a measurement control program, and the limits of error of the factors determined from the measurement control program data? If calculated values were used, were they based on completely known and measured components?

4. Were sufficient data available to determine the limits of error for the inventory?

5. Were the measurements and measurement controls adequate to establish the quantity of material on inventory within valid limits of uncertainty?

6. Were proper cutoff procedures used for:

   a. Internal transfers

   b. Shipments and receipts

   c. Records

   d. Processing

7. Was one person assigned overall responsibility for the inventory?

8. Were written inventory instructions issued to:

   a. The inventory teams

   b. The MBA and ICA custodians

   c. Other appropriate operating personnel

9. Did inventory orientation include:

   a. Review of instructions by inventory personnel

   b. Tour of areas by teams

   c. Preliminary inspection by inventory supervisor

10. Were there any deviations from the written instructions?

11. Were such deviations approved by the inventory supervisor?

12. Were MBAs and ICAs inventoried separately so that the inventory could be compared with the book inventory for each area?

13. Were the various areas prepared for the inventory in that:

   a. Material was arranged to expedite inventory

   b. Process conditions were arranged so that quantities in difficult-to-measure locations were at a minimum

   c. Items were properly labeled and identified

14. Was the inventory taken in a systematic and accurate manner?

15. Were inventory lists prepared from listing items from the floor or were prelisted items checked off as items were located?

16. Were there procedures to ensure that all items and material were listed once and only once?

17. Was the physical inventory in agreement with the custodian's record inventory?

18. If there were differences, were appropriate actions taken to explain, investigate, and reconcile them?

19. Were the results of the physical inventory reflected in the material accounting records?

20. Was the inventory conducted within the required frequency interval?

APPENDIX H

Records and Reports Checklist

1. Is the plant material accounting system designed so that it will clearly delineate the responsibility for the materials?

2. Are double entry records maintained?

3. Are subsidiary accounts maintained for each MBA and ICA?

4. Are subsidiary accounts periodically reconciled to control accounts?

5. Are records maintained of:

   a. Material added to, and removed from, the process

   b. The quantity of material in-process at any given time

   c. Identity and location of items and containers containing special nuclear material

   d. Source and disposition of items containing special nuclear material

6. Are control and subsidiary accounts periodically reconciled and adjusted to the results of physical inventories?

7. Is there written approval by authorized individuals for all adjustments to:

   a. Control accounts

   b. Subsidiary accounts

   c. Perpetual inventory records

8. Are standard approved forms used to record adjustments to the records, including the reason for the adjustment?

9. Is there a system for controlling and accounting for all such forms?

10. Are all special nuclear material accounting measurement data routinely reported to the material accounting office?

11. Are such measurement data reported on standard approved forms that adequately identify the material to which the measurement data apply?

12. Are such measurement data used appropriately in preparation of material accounting records and reports?

13. Have the required Material Status Reports (Form NRC-742) and Material Transaction Reports (Form NRC-741) been:

   a. Prepared and submitted in the required time

   b. Prepared accurately and according to approved plant procedures

   c. Verified as to accuracy by a member of the material accounting staff other than the original preparer

   d. Signed by the appropriate authorized individual

14. Are standard approved forms used to report internal material transfers between MBAs or ICAs?

15. Is there a system for controlling and accounting for all such forms?

APPENDIX I

Audit Program

Part I – Planning the Audit

1. Document Review

a. Review documents and contracts as indicated in the Review Program Checklist. Note items pertinent to records and reports examination.

b. Review plant reports (or suspense file notes) for:

(1) Date and proper signature

(2) Proper form, including subschedules

(3) Basis for inventory

(4) Explanation of MUF

(5) Timely receipt

c. Review receiving and shipping documents (or suspense file notes) for preparation and issuance in accordance with requirements and regulations.

d. Review backup documents and authorizations for measured discards.

e. Prepare notes in workpapers on specific items to investigate.

2. Procedure Manuals and Internal Control

a. Review procedure manuals, Internal Control Checklist, and associated documents to become reacquainted with facility records and reports.

b. Prepare notes on specific items to be investigated.

3. Trial Balances

a. Using the plant material balance reports, schedule external receipts and shipments and inventory adjustments (losses, measured discards, and material unaccounted for) by reporting identification symbol (RIS), contract number, material type, and date.

b. Using the schedules prepared in 3a, set up proforma trial balances for each material and material type, showing total facility balances in all cases.

4. Sampling Plans

Prepare master data sheet and sampling plans for audit tests to be performed on statistical sampling basis. Preliminary plans and sampling plan criteria can be established before the review by using data from prior reviews and reports and general knowledge of the plant.

Part II – Conducting the Audit

1. Initial Meetings

At initial meetings with plant personnel:

a. Discuss information developed in audit planning

b. Review audit plans where necessary

c. Discuss any changes in plant procedures that affect records and reports

d. Arrange for necessary assistance and availability of records and reports

2. Review of Ledgers

Review general and subsidiary ledgers and list and investigate any unusual items occurring in journal vouchers or posting media.

3. Receipts

a. Procurement

(1) Using invoices as bases, trace quantities to permanent records.

(2) Test internal data supporting receipts (e.g., by use of receiving reports and measurement results), using statistical samples where appropriate.

(3) Review purchase orders and payment vouchers to determine if quantities of material purchased agree with invoices.

(4) Test-check extensions, footings, and postings of invoices and/or other documents supporting quantities procured. Use statistical sampling plans where appropriate.

b. Other Source and Special Nuclear Material Categories

Check the bases of transfer and reconcile with the corollary account under "Removals" (see 4d below).

c. NRC Transfer Documents

Test-check postings of Form NRC-741 to the records. Use statistical sampling plans where appropriate.

4. Removals

a. Measured Discards, Losses, and Material Unaccounted For

(1) From material balance reports, prepare schedules of each account for the survey period.

(2) Trace schedule to ledgers.

(3) Examine supporting evidence for posting documents.

(4) Test-check postings of source documents to ledgers, using statistical sampling plans where appropriate.

(5) Check footings, extensions, and descriptions of data on source documents to ascertain correctness and propriety of data.

b. Sales

(1) Check sales authorizations.

(2) Check sales slips and/or invoice quantities to ledgers.

(3) Check footings, extensions, etc., of posting documents.

(4) Trace postings to ledgers.

c. Decay

Check calculations on the basic posting documents and trace postings to records.

d. Other Source and Special Nuclear Material Categories

Check bases of transfer and reconcile with corollary account under "Receipts" (see 3b above).

e. NRC Transfer Documents

Test-check postings of Form NRC-741 to the records, using statistical sampling plans where appropriate.

5. Internal Transfers

a. Trace documents supporting internal transfers (e.g., production notices, laboratory reports, weight tallies, transfer forms) to records.

b. Check footings, postings, and extensions of intra-area supporting documents.

c. Review internal transfer documents for propriety and numerical sequence of intra-area transfer forms.

d. Reconcile records of internal transfers to books of final entry.

6. Measurement Records

Trace on a selected basis, using statistical sampling plans when appropriate:

a. Quantities from records to laboratory workbooks

b. Results in laboratory workbooks to quantities in records

c. Extensions, footings, and descriptions, as applicable

7. Findings

Summarize findings to be discussed with other team members, facility personnel, and management and included in report.

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