

# NRC INSPECTION MANUAL

NMSS

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## INSPECTION PROCEDURE 85503

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### RESOLUTION PROGRAM

PROGRAM APPLICABILITY: 2683

#### 85503-01 INSPECTION OBJECTIVES

The objective of this inspection procedure is to verify that the licensee's<sup>1</sup> material control and accounting (MC&A) program, for a Category III uranium enrichment facility, includes a resolution program that meets existing regulatory requirements, including the stated general performance objectives.

The regulatory requirements are summarized, as follows:

01.01 Statistically significant shipper-receiver differences (SRDs) are investigated and resolved within a reasonable amount of time [as specified in the licensee's Fundamental Nuclear Material Control (FNMC) Plan].

01.02 Indications of missing SNM, or unauthorized enrichment or production of uranium, are resolved.

01.03 Aid is provided in the investigation of missing SNM, or of unauthorized production or enrichment of uranium.

#### 85503-02 INSPECTION REQUIREMENTS

The inspector should ensure that the licensee has implemented a resolution program capable of the timely resolution of SRDs and of potential indicators of missing uranium and unauthorized enrichment. The inspector should review the following:

02.01 SRD and Indicator Resolution Procedures.

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<sup>1</sup>Hereinafter, the term licensee subsumes the term "certificate holder," which applies in the case of the gaseous diffusion plants (GDPs). Likewise, all certificate-related requirements, including those in GDP compliance plans and corrective action commitments, are subsumed under the term "license."

- 02.02 Investigation and Resolution. Activities and records for investigating and resolving SRDs.
- 02.03 Procedures, Records, and Documentation of Indications of Missing SNM.
- 02.04 Investigation and Resolution. Investigation and resolution of indicators of missing SNM, and response actions to unresolved indicators of missing SNM.
- 02.05 Informational Aid. Records, data, and reports considered relevant in the investigation of incidents.

### 85503-03 INSPECTION GUIDANCE

#### General Guidance

The resolution program must be effectively implemented. The program should be capable of resolving indications of uranium missing from shipments, or from the licensee's possession, or indications of unauthorized enrichment, within a reasonable time that is specified in the FNMC Plan (e.g., within 72 hours). Conclusions that the indicators may be true should be reported to NRC within 1 hour, pursuant to 10 CFR 74.11, unless the event is limited to a possible loss of source material (SM) (10 CFR 74.11 requirements pertain only to SNM).

To prepare for the inspection, the inspector should:

- a. Review those portions of the FNMC Plan and the license conditions pertaining to the planned inspection activities.
- b. Review the previous two material control and accounting (MC&A) inspection reports for the site.
- c. Review any unresolved or followup items from the previous inspections to be addressed during the current inspection.
- d. Review the contents of any communications (including information notices and bulletins), to the licensee, that were issued since the last inspection.

#### Specific Guidance

03.01 SRD and Indicator Resolution Procedures. The inspector should verify that SM and SNM receipts of container identity and integrity, seal identity and integrity, and bulk container gross weights are verified by the licensee within the time limits approved in the FNMC Plan. SRDs should be evaluated for significance for both element and isotope. Any statistically significant SRD (whether for element only, isotope only, or both) must be investigated and resolved unless the U-235 difference associated with a particular line item or the total shipment, as the case may be, is less than 500 grams. Shipping information should also be carefully checked and seal integrity examined before any container is shipped.

Shipping and receiving procedures that could provide indicators of SRDs are assessed in Section 03.02, "Material Transfer Control," of Inspection Procedure 85405. The inspector should verify that the shipper's and receiver's measurement uncertainties are treated in accordance with the FNMC Plan to calculate the combined measurement standard error. The SRD for either: (1) an individual container (for container batches) or a single batch or lot (when there is more than one container per batch), as appropriate, or (2) the total shipment, must be regarded as significant when the SRD is both greater than 500 grams of U-235 and twice the combined standard error. An extended analysis of shipper-receiver data is provided by reviewing the historical shipper-receiver data (i.e., cumulative SRD) to identify trends and biases (pertaining to shipments or receipts of like material) and to identify areas of concern that have not yet caused statistically significant SRDs.

The inspector should verify the following:

- a. The combined measurement standard error is calculated in accordance with the FNMC Plan.
- b. Limits of error at the 95 percent confidence level are assigned to shipper and receiver measurements of both element and isotope contents.
- c. SRDs are compared with twice the combined measurement standard error, to determine their significance.
- d. Statistically significant SRDs are evaluated, reported, and investigated.
- e. Procedures for evaluating SRDs are documented.

03.02 Investigation and Resolution. The inspector should verify that cumulative SRDs for each material type are routinely monitored, and when they are determined to be statistically significant, corrective action is taken to identify and correct measurement biases. The inspector should verify that the licensee implements the procedures for investigating and resolving significant SRDs, as described in the FNMC Plan. The criteria for defining a resolved SRD should also be reviewed. The investigation of a SRD should achieve a best estimate of the true amount of SNM in the affected shipment(s), and identify the cause of the SRD, so it can be resolved. Chronic causes that are identified need to be eliminated.

Resolution of a statistically significant SRD may involve a referee (or umpire) measurement of a retainer sample(s), but not of the material weight. The resolution process should specify whose weight value is used in the resolution process, if shipper's and receiver's weights differ by more than one-half of the total combined standard error.

Licensees are required to maintain current reliable information on the location of the source material and SNM they possess. This implies they should complete the investigation of statistically

significant SRDs within a reasonable amount of time, which may be specified in the FNMC Plan. In practice, this normally would be within 3 months; but should be within 30 days, in the case of discrepancies in the number of items. The inspector should review the corrective action plans developed for significant SRDs which occurred, and determine whether the stated actions were taken.

The inspector should verify the following general guidelines:

- a. Procedures for investigating and reporting statistically significant SRDs are documented.
- b. NRC and the shipper of the nuclear material are notified of any significant SRDs.
- c. Resolution of SRDs involves investigation and documentation of pertinent measurements and measurement errors by both the shipper and receiver.
- d. Shipper and receiver measurements are subject to approved measurement control procedures.
- e. Nuclear material with an associated statistically significant SRD in excess of 500 grams of U-235 is not processed until the differences are resolved.
- f. SRD data are subjected to trend analysis to detect measurement bias and/or cumulative material loss.
- g. Investigations of shipper-receiver quantity differences are completed within a reasonable time, as may be specified in the FNMC Plan (e.g., 3 months), or the reasons for not doing so are explained.
- h. SRDs involving a discrepancy in the number of items are resolved within a reasonable amount of time, as may be specified in the FNMC Plan (e.g., within 30 days of detection), or the reasons for not doing so are explained.
- i. Nuclear material transfer records are appropriately revised when an SRD is resolved.

03.03 Recognition of Indicators of Missing Uranium and Unauthorized Enrichment. The inspector should verify that the resolution program can recognize potential indicators of: (1) missing uranium involving 500 or more grams of U-235; and (2) unauthorized production or enrichment. Each specific indicator type should be identified with the associated material types; operational activities (e.g., process or storage); and credible causes (including innocent causes) of an alarm.

The inspector should review the material balance calculations for each dynamic and static physical inventory performed since the last inspection, to verify that calculations were performed correctly, as described in the FNMC Plan, and to determine if any additional inventory differences (IDs) should have been investigated. If an excessive ID was investigated and resolved, the inspector should

examine the records of the investigation to verify that all potential indicators were recognized and resolved. Because the ID provides a quality assurance measure for the item control and detection programs, the investigation of an excessive ID should include a review of item and process monitoring data, to identify potential causes, and to correct discrepancies identified in the data.

By reviewing the item control and detection program records, the inspector should determine if any indicators were produced that should have been investigated. If an indicator was investigated and resolved, the inspector should examine the records of the investigation, to verify that all potential indicators were recognized and resolved.

The inspector should verify the following:

- a. Indicators of potential missing uranium and unauthorized production or enrichment, and the resolution procedures for each, are documented.
- b. A high probability of an indicator being generated and recognized exists, if an actual loss of material or unauthorized production or enrichment occurs.
- c. Material balance closure procedures identify any significant IDs.
- d. Item control procedures identify potential losses of SM and SNM.
- e. Detection program procedures identify potential unauthorized enrichment activities.
- f. Abnormal situations and unscheduled alarm activations are evaluated and resolved.
- g. The resolution program is capable of recognizing indicators.

03.04 Investigation and Resolution of Indicators. The inspector should verify that the licensee has well-defined, systematic procedures for investigating and resolving indicators of both: (1) possible missing uranium (involving 500 grams or more of U-235); and (2) possible unauthorized production or enrichment activities. Indications of loss or unauthorized production or enrichment could be caused by procedural errors; process variabilities; measurement errors (e.g., bias and uncertainty); and record-keeping mistakes; along with malevolent acts by insiders (e.g., theft or diversion). Resolution of an indicator means that the licensee has made a determination that loss, theft, or unauthorized production or enrichment has not occurred and is not occurring. For each type of indicator, the licensee should have developed and documented detailed resolution procedures. The procedures should take into account the expected differences in unauthorized production and enrichment scenarios, loss mechanisms, and the necessary differences in response approaches for in-process materials, items, material types, and types of operations. The licensee should have

baseline data from periods free from potential incidents, against which system performance can be compared. Any investigation of an indication of a loss or unauthorized enrichment should document, whenever possible, the following items of information:

- a. The type of unauthorized activity detected.
- b. The timeframe within which the loss or activity could have occurred.
- c. An estimate of the quantity of SM and/or SNM involved.
- d. The material type or physical form of the material.
- e. The most probable cause(s).
- f. Recommendations for precluding reoccurrence.

The inspector should determine that the licensee's indicator resolution system is able to respond promptly to indications of potential uranium loss or unauthorized production or enrichment, and to determine whether the alarm was caused by an actual event or by a system error. If the cause was a system error, the program should identify that cause so that remedial actions may be taken. Response to the indicator should be timely to ensure that: (1) indicators are investigated and resolved while memories of events preceding the alarm are fresh; (2) materials are still available for remeasurement; and (3) few changes in process conditions, inventories, in-process holdup, and item locations have since occurred. Prompt resolution will facilitate: (1) recovery of "lost" or stolen material, or (2) interruption of unauthorized enrichment.

Criteria should establish an objective basis for defining what constitutes resolution of an investigated indicator. The criteria should be based on the identification of specific causes or sources of incorrect data that could have contributed to the indication. However, the criteria could verify, with high probability, that no loss occurred without having identified all contributing causes of an alarm. Resolution of an indicator is a verification of the system data, along with an authentication of the system description and of the characteristics that could produce an alarm. Authentication is especially important following system start-up and modifications.

A search for a missing item should not be terminated, without NRC permission, until that item is located, or evidence of its destruction is obtained. Items containing less than 500 grams of U-235 are exempted from the requirements for confirmatory evidence. Searches for missing items should not be interrupted by weekends, holidays, etc.

The inspector should examine actions taken to resolve any indicators that occurred, to determine that established procedures were followed, and that alarm requirements were observed. Problems encountered in responding to indicators should be resolved, and remedial actions should be taken as necessary to meet the FNMC Plan commitments. As part of the review of alarm resolution, the inspector should verify followup corrective actions. After a false alarm has been resolved, the planned corrective actions should include MC&A system revisions, if appropriate, that provide

reasonable assurance that future false alarms having the same or similar causes will be reduced.

The inspector should verify the following:

- a. The resolution program for potential loss of nuclear material and unauthorized production or enrichment is capable of prompt response, and of distinguishing between systems errors and actual events.
- b. The resolution program ensures that alarms are resolved, and that the resolution process identifies the most likely causes.
- c. Facility responses to, and resolution of, conditions that indicate potential loss of control of nuclear material or unauthorized production or enrichment, are documented.
- d. Procedures provide a systematic and logical sequence of steps for determining the cause(s) of an indicator.
- e. Responsibilities for evaluating material control indicators are documented.
- f. Criteria are documented for concluding that a particular cause of an indicator is applicable, and that the indicator can be resolved.
- g. Conclusions for resolved indicators are tested and validated.
- h. Procedures for responding to, and reporting, missing items, IDs in excess of control limits, SNM discharges exceeding acceptable limits, and unauthorized enrichment are documented.
- i. Monitoring and control systems provide sufficient information to correctly assess alarms; localize removals; and estimate the quantity, form, and enrichment of surreptitiously produced and/or diverted material.
- j. Significant trends are identified, investigated, and reported.
- k. Procedures for performing special inventories are documented and are consistent with procedures employed for routine inventories, where applicable.
- l. An emergency inventory capability exists and includes provisions for maintaining the availability of forms, tags, trained personnel, inventory listing, and other items that may be needed to initiate a plant-wide physical inventory within 24 hours.
- m. The resolution procedures identify MC&A system weaknesses that can cause false alarms.

- n. Corrective actions are taken following resolution of an indicator.
- o. The indicator resolution times comply with commitments documented in the FNMC Plan.
- p. The resolution program is monitored to ensure consistent and acceptable application of the response procedures and to provide a basis for upgrading the procedures in the environment in which they are performed.

The inspector should verify that response actions to unresolved indicators are clearly defined and are on a graded scale appropriate to the level of potential safeguards significance. The responsibility and authority for initiating and executing response actions also should be defined. The quality of the licensee's loss resolution capability should be such that the combination of resolution activities and resolution decisions will permit alarms remaining unresolved after investigation to be good indicators of material loss or unauthorized production or enrichment.

Incident reporting should make NRC aware of potential incidents of safeguards significance in a timely manner so that appropriate actions can be initiated. The information to be reported should include the magnitude of the discrepancy indicated by the indicator, the investigation procedure, the status of the investigation, the operational status of the facility, the safeguards status during the period, and the planned remedial measures.

An indicator is considered unresolvable when it cannot be determined whether it was caused by a system error, an actual loss of material, or unauthorized activity. At low-enriched uranium (LEU) enrichment (Category III) facilities, indicators of unauthorized uranium production or enrichment generally have a higher level of safeguards concern than indicators of missing LEU. The degree of concern for unauthorized production or enrichment indicators is related to such factors as:

- a. Whether the indicator pertains to unauthorized production or enrichment in the planning stage, currently in progress, or already accomplished.
- b. Whether the potentially produced material is low strategic SNM, moderately strategic SNM, or strategic SNM.
- c. The potential or confirmed quantity of unauthorized material already produced.

Response actions to unresolved indicators should have been clearly described in the FNMC Plan (e.g., shutdown of most continuous processing operations related to the indicator within 24 hours after the alarm; batch processing operations suspended immediately after the alarm or, on completion of the batch in process). The actions taken should be dictated by the level of safeguards concern attached to the potential quantity of unauthorized SNM produced, its attractiveness for illicit use, its enrichment level, etc.



If process shutdown is prescribed, it should be noted that gaseous diffusion enrichment operations cannot be shut down abruptly, because of potentially severe impacts to the process system that would occur. However, the gaseous diffusion enrichment system can be placed on internal recycle to eliminate new feeds and withdrawals from the system.

When an actual loss of SNM or an unauthorized enrichment event is indicated, the quantity of material lost or enriched should be estimated. Other information, that may aid in the recovery of the material (e.g., the material type, container type, and who last had responsibility for the SNM), should be generated if possible. 10 CFR 74.11(a) requires notification of such an event within an hour, and 10 CFR 74(33)(a)(7), (8), and (9) requires further that the licensee provide the appropriate information to aid in the investigation of the subject nuclear material.

The inspector should verify the following:

- a. Unresolved situations are reported to NRC.
- b. Procedures for responding to unresolved indicators are documented.
- c. Responsibilities for initiating and executing response activities are documented.
- d. Processing operations are conducted in a manner to support the investigation of unresolved situations (e.g., internal recycle or enrichment process, suspension of batch operations, etc.).
- e. Any loss or apparent loss of SNM for which there is evidence of theft or diversion is reported to NRC within 1 hour of the determination, and an investigation by the licensee is begun immediately.
- f. Any event for which there is evidence of unauthorized enrichment is reported to NRC within 1 hour of the determination and an investigation by the licensee is begun immediately.
- g. Any apparent loss of uranium or indication of unauthorized enrichment that is not resolved within a reasonable time that is specified in the FNMC Plan (e.g., 72 hours) is reported to NRC and investigated.

The inspector should review documentation associated with the licensee's program for the investigation, resolution, and reporting of indicators of missing uranium and unauthorized production or enrichment. As a minimum, the following documentation should be included:

- a. Reports notifying MC&A management of indicators, including the date and time the indicator was reported, the name of individual who discovered the indicator, and a description of the indication.

- b. Investigation findings and conclusion, including resolution status, date issued, name and signature of principal investigator, and approval signature of MC&A manager.
- c. Reports made to NRC for unresolved indicators and for indicators determined to be real, including the date and time the report was made, the method of communication, and the name of the NRC staff member(s) contacted.

The documentation of resolutions should be reviewed to determine whether a cause was assigned, and whether the documentation supports the assigned cause. Indicator resolution should be completed within the time periods specified in the FNMC Plan (e.g., 72 hours). The inspector should review alarm notification procedures to ensure that all required information is reported within the time periods specified in the FNMC Plan for each type of alarm response.

The inspector should verify the following:

- a. Procedures specify requirements for documentation of indicator resolution activities.
- b. Resolution activity and report review and approval requirements are defined.
- c. Documentation of investigations supports indicator resolutions.
- d. Indicator resolution is completed within FNMC Plan-specified time periods.

The inspector should review loss detection and alarm resolution records to determine whether the NRC should have been notified of any alarms that were not reported.

03.05 Informational Aid. When an investigation of actual (or highly suspected) events pertaining to missing uranium or unauthorized production or enrichment is conducted by NRC and/or other government agencies, the licensee should assemble the necessary information, and have it ready to provide to the government investigators when they request it. The burden is on the licensee to provide (without being requested) all information that it recognizes as being relevant, as opposed to only providing information that the investigators are knowledgeable enough to request. This information should include production records, accounting data, and routinely prepared reports. The types of information that might aid the investigation are:

- a. Data or observations that led an operator to determine that a loss or theft of uranium or unauthorized production or enrichment may have occurred.
- b. Data, observations, and assessments associated with attempts to resolve the indication of missing material or unauthorized production or enrichment, and to investigate the findings.

The inspector should verify the following:

- a. Procedures for assembling records and personnel to provide investigators with pertinent information are documented.
- b. Responsibilities for directing the collection of information to assist in investigations are documented.
- c. Locations and contents of reports, data, and files that could assist in the investigation of unresolved incidents are known and readily available.

#### 85503-04 REFERENCES

##### Regulations

10 CFR 74.33(a)(4), (5), (6), (7), (8), and (9); 10 CFR 74.33(c)(7).

##### Regulatory Guides and Reports

Regulatory Guide 5.67, "Material Control and Accounting for Uranium Enrichment Facilities Authorized to Produce Special Nuclear Material of Low Strategic Significance," Sections C.9 and C.11, 1992.

NUREG/CR-5734, "Recommendations to the U.S. Nuclear Regulatory Commission on Acceptable Standard Format and Content for the Fundamental Nuclear Material Control (FNMC) Plan Required for Low-Enriched Uranium Enrichment Facilities," Chapters 7, 10, and 11, November 1991.

NUREG/CR-4108, "Development of MC&A Alarm Resolution Procedures," October 1985.

NUREG/CR-2820, "Resolution of Shipper-Receiver Differences," September 1982.

NUREG/CR-2404, "Analyzing Safeguards Alarms and Response Decisions," July 1982.

A. Lamont and R. S. Strait, "Structured Approach to SNM Anomalies Resolution," Journal of Nuclear Materials Management, July 1989.

END