SAFETY EVALUATION REPORT

DOCKET: 70-3098

CERTIFICATE HOLDER: CB&I AREVA MOX Services
Aiken, South Carolina

SUBJECT: SAFEGUARDS EVALUATION REPORT: CB&I AREVA MOX SERVICES, MATERIAL CONTROL AND ACCOUNTING PLAN REVISION FOR THE MIXED OXIDE FUEL FABRICATION FACILITY UNDER CONSTRUCTION IN AIKEN, SC, SUBMITTAL DATED APRIL 25, 2016, AS REVISED ON OCTOBER 17, 2016

1.0 BACKGROUND

By cover letter dated April 25, 2016 (Ref. DCS-NRC-000423), CB&I AREVA MOX Services (MOX Services) (Agencywide Documents Access and Management System [ADAMS] Accession Number ML16138A069) submitted a revision of their Fundamental Nuclear Material Control Plan (FNMCP), renaming it the Material Control and Accounting (MC&A) Plan. The revision was supplemented by a letter dated October 17, 2016 (ML16299A277). MOX Services submitted the April 2016 revision in accordance with Title 10 of the *Code of Federal Regulations* (10 CFR) Section 70.34, requesting U. S. Nuclear Regulatory Commission (NRC) approval of the revision of the MC&A Plan. Prior to the submittal of the April 2016 revision, the existing approved FNMCP was originally written for the license application of the Mixed Oxide Fuel Fabrication Facility (MFFF) in Aiken, South Carolina. As construction has progressed, the MC&A Plan has required frequent revisions to be in agreement with planned operating conditions.

The changes in the April 2016 revision involved a total rewrite of the document. The revised MC&A Plan (Plan) is organized into new sections by subject matter, as indicated in the Table of Contents. The evaluation of the submittal was conducted in order to ensure that the revised Plan continues to meet the applicable requirements of 10 CFR Part 74, “Material Control and Accounting of Special Nuclear Material.” Specifically, the review was performed to ensure that the revised Plan describes the MC&A system, how the system features, and capabilities specified in 10 CFR Paragraph 74.51(b) are achieved and maintained and how such features and capabilities are used to achieve the general performance objectives listed in 10 CFR 74.51(a).

The NRC staff used NUREG-1280, Revision 1, “Standard Format and Content Acceptance Criteria for the MC&A Reform Amendment,” to determine if the revised Plan meets the applicable requirements in 10 CFR Part 74 Subpart E, “Formula Quantities of Strategic Special Nuclear Material.”

2.0 DISCUSSION

The NRC staff reviewed and evaluated information provided by MOX Services in the April 2016 submittal. The enclosures to the submittal included a description of the proposed changes with the corresponding reasons for the changes, a marked-up copy of the Plan indicating the proposed changes, and a copy of the revised Plan with the proposed changes incorporated.

During the review of the April 2016 submittal, the NRC staff identified additional information that was needed before final action could be taken. A meeting with MOX Services was conducted on August 24, 2016, to discuss the submittal. Subsequently, a request for additional information (RAI), was issued to MOX Services on October 6, 2016 (ML16272A492). The RAIs included general comments on the revised format, as well as specific comments for various sections of

the Plan. MOX Services provided a response to the RAI (Ref. DCS-NRC-000433) on October 17, 2016, and included the updated Plan, designated as the October 2016 revision, with the RAI responses incorporated.

A summary of the general changes made throughout the Plan is listed below:

General changes throughout the entire document

- Changed title of document from “Fundamental Nuclear Material Control Plan” to “Material Control & Accounting Plan”
- Reformatted the document into 18 sections by subject matter and updated references to the new section numbers
- Renumbered tables and figures and references to these to be consistent with new section numbers
- Replaced references to “zinc stearate” and “lubricant” with “dry lubricant” for clarification
- Replaced “PuO_2” with “Strategic Special Nuclear Material (SSNM)” and added other types of materials, where applicable
- Replaced “measurement control program” with “measurement control system”
- Corrected grammar, punctuation, and sentence structure
- Added or corrected procedure numbers where indicated

These revisions listed above are administrative in nature and did not change the scope or intent of the Plan. Therefore, the NRC staff finds these changes are acceptable. A summary of the specific changes within each section of the Plan and the staff’s evaluation by section are listed below:

Section 1.0 – General Discussion

- Updated acronyms and terms to provide additional information for terms used throughout the Plan

Section 1.0 of the Plan provides a general discussion of the Plan organization, glossary of terms and acronyms, and the MFFF plant and process general descriptions.

Section 2.0 – Summary Description of the MFFF MC&A Program

- Clarified descriptions of the reports required to be submitted to the NRC and the Nuclear Materials Management and Safeguards System (NMMSS)

Section 2.0 provides a summary description of the MC&A program, including the MFFF MC&A organization, the five general performance objectives set forth in 10 CFR 74.51(a), tests to detect loss or diversion, statistics, two-person rule, daily administrative checks, the NRC and NMMSS reporting.

The information provided in sections 1.0 and 2.0 is supplemental regarding the facility and the MC&A system, and the changes in these sections are administrative or clarify information. Therefore, the staff finds the information provided in Sections 1.0 and 2.0 to be appropriate and acceptable.

Section 3.0 – Process Monitoring SSNM Loss Detection Capability at the MFFF

- Corrected description of process monitoring model in section 3.1.1.4
- Revised Figure 3-10, "MOX Fuel Fabrication Facility MC&A Diagram," to remove unnecessary Department of Energy designations
- Updated information regarding the calculation of alarm thresholds, abrupt loss statistics, variance propagation, and use of data plots in section 3.2.7
- Revised section 3.4 regarding material substitution
- Removed redundant information in section 3.5

The intent of 10 CFR 74.53 is to require licensees to implement a production process monitoring program that is capable of monitoring the status of material in process and that will provide early indications of diversion or theft and a prompt detection system for significant abrupt loss involving at least five formula kilograms of SSNM from processing operations.

Section 3.0 of the Plan provides the unit process detection capability for both aqueous and MOX process monitoring programs to include process subdivision and measurement points, material control test criteria, location categorization, material substitution, and exemptions to the process monitoring program. Additionally, the section provides a description of the trend analysis test used to test the processes for protracted losses. The changes in this section update information regarding the process monitoring program, but do not change the intent or the scope of the section. Therefore, the staff finds the information in Section 3.0 acceptable and in accordance with 10 CFR 74.53 to provide a high probability of the timely detection of any abrupt material loss of five formula kilograms or more of SSNM.

Section 4.0 – Item Monitoring

- Clarified information regarding laboratory samples in section 4.2.1
- Clarified information regarding container markings in section 4.2.2
- Clarified information regarding frequency of item monitoring activities throughout section 4.6.3
- Updated information regarding Category 1B materials within manual storage areas in section 4.6.3.3
- Added new information regarding samples in the Sample Storage Glove Box in section 4.7.1.2

The intent of the 10 CFR 74.55 is to require licensees to establish the capability to detect a five formula kilograms or greater loss in item form using any statistical test that has a 99 percent power of detection and to ensure timely plant-wide detection of the loss of items that total five formula kilograms or more.

Section 4.0 of the Plan describes the item monitoring program using the Manufacturing Management Information System Perpetual Inventory Report and the physical item mapping recorded in the Programmable Logic Controllers that provide the facility with an item verification plan that has at least a 99 percent probability of detecting the loss of items plant-wide that total five formula kilograms within the allotted timeframes. The Plan describes the needed elements of the facility's item monitoring program to include the item loss detection, item identification, item categorization, item measurements, item verification, tamper-safing, accessibility, accounting and control procedures, and monitoring of samples of small SSNM quantity. The changes in this section update the information regarding item monitoring activities, but do not

change the intent or the scope of the section. Therefore, the staff finds the description of the item monitoring program for ensuring timely plant-wide detection of the loss of items that total five formula kilograms or more acceptable and in accordance with 10 CFR 74.55.

Section 5.0 – Alarm Resolution

- Moved control unit descriptions to the beginning of the section
- Clarified description of response times in section 5.3

The intent of the alarm resolution program in 10 CFR 74.57 is to require licensees to resolve the nature and cause of any MC&A alarm as generated from process monitoring and item monitoring activities within an approved time period, and to provide alarm reporting in case the alarm in question remains unresolved.

Section 5.0 of the Plan describes the alarm resolution program developed to respond promptly to alarms indicating a potential loss of SSNM and determine whether the alarm was caused by an actual loss or by a system error. The Plan provides descriptions for the general alarm resolution procedures, alarm reporting, and all procedures and flowcharts for the process control units. Additionally, the Plan describes the procedures and policies regarding the ability to respond rapidly to alleged thefts or alarms occurring external to the MC&A system. The changes in this section update the information regarding alarm resolution activities, but do not change the intent or the scope of the section. Therefore, the staff finds the description of the alarm resolution program acceptable and in accordance with 10 CFR 74.57.

Section 6.0 – Management Structure and Personnel Qualification and Training

- Updated the description of the responsibilities and authority of the MC&A organization
- Updated the listings of policies, procedures, and program requirement documents

The intent of 10 CFR 74.59(b) and 10 CFR 74.59(c) management structure and personnel qualification and training requirements is to ensure that licensees implement a management structure that permits effective functioning of the MC&A program and to ensure that the plant management structure will not adversely affect MC&A program performance. The intent of 10 CFR 74.59(h)(3) is to ensure licensees incorporate checks and balances in the MC&A system to control the rate of human errors in MC&A information.

Section 6.0 of the Plan provides a management structure that includes defined responsibilities for the planning, coordination and administration of MC&A functions, independence of MC&A functions from production responsibilities, separation of duties such that control and cross-checks can be implemented for validation and reliability purposes, and use of MC&A procedures on a consistent basis to effectively implement MC&A activities and functions. A training and qualification program to ensure the effectiveness of the MC&A program for MC&A personnel is described. Additionally, the section provides a description of the program to minimize human error, as well as the system of checks and balances incorporated into the MC&A information system. The changes in this section are administrative in nature and do not change the intent or scope of the section. Therefore, the staff finds the information provided for management structure, training and qualification, and human error rates acceptable and in accordance with 10 CFR 74.59(b), 10 CFR 74.59(c), and 10 CFR 74.59(h)(3).

Section 7.0 – Measurements

- Updated the descriptions of the measurements systems used for MC&A purposes in section 7.2, Updated Table 7-1, “MFFF MC&A Measurements” and Table 7-2, “MFFF MC&A Typical Measurement Uncertainties & Sensitivities,” to be consistent with the changes to Section 7.2

The intent of 10 CFR 74.59(d) is to ensure that licensees establish, utilize and maintain a system of measurements to ensure that all quantities of Special Nuclear Material (SNM) and SSNM in their accounting records are based on reliable measurements.

Section 7.0 of the Plan provides the measurement capabilities of the facility’s MC&A system. The section describes the formal measurement program implemented with measurement systems used to substantiate the element and fissile isotope content of all SNM and SSNM received, shipped, discarded, and listed in the physical inventory. The Plan provides information regarding the measurement points, the measurement systems used at those locations, the intended methods of their use, and the uncertainty expected for their measurements. Additionally, information regarding measurement procedures and scrap control are provided. The changes in Section 7.0 update information in order to clarify processes and practices regarding the measurement program, but do not change the scope or intent of the section. Therefore, the staff finds the description of the program for ensuring that all quantities of SNM and SSNM are based on reliable measurements acceptable and in accordance with 10 CFR 74.59(d).

Section 8.0 – Measurement Control System

- Clarified information regarding the engineering analyses and evaluations associated with measurement systems to be used for MC&A purposes in section 8.2
- Clarified information regarding the process and engineering tests associated with existing procedures for mixing and sampling SSNM in section 8.6.2
- Clarified information regarding the cumulative shipper-receiver differences (SRDs) in section 8.5.1

The intent of the 10 CFR 74.59(e) measurement control requirements is to ensure that licensees control measurement systems used to establish SNM and SSNM accounting quantities by a formal measurement control system that results in a level of effectiveness sufficient to satisfy the capabilities required for detection, response, and accounting.

Section 8.0 of the Plan provides a description of the measurement control system developed to ensure the measurement systems used for MC&A measurements are monitored and controlled. The section includes descriptions of the organization and management, calibrations, control standards, replicate sampling, control limits and response actions, trend analysis for cumulative SRDs, engineering analyses, and mixing and sampling studies. The section was updated to clarify the information regarding the measurement control system, but did not change the scope or intent of the section. Therefore, the staff finds the description of the system for measurement control acceptable and in accordance with 10 CFR 74.59(e).

Section 9.0 –Statistics

- Added this new section to the Plan
- Clarified information regarding bias corrections in section 9.3

Section 9.0 of the Plan provides a general overview of the statistical methodologies and techniques used to ensure the requirements in 10 CFR 74.51, 10 CFR 74.53, 10 CFR 74.55, 10 CFR 74.57, and 10 CFR 74.59 are met. Topics covered include determination of measurement uncertainty, determination of the standard error of inventory difference, and bias corrections. Section 9.0 is supplemental information, and the staff finds the information provided to be appropriate and adequate.

Section 10.0 –Physical Inventories

- Added Table 10-1, "Typical Item Strata"
- Updated section 10.4 regarding facility preparation activities prior to initiating physical inventory
- Revised section 10.5.7.4 regarding process holdup

The intent of the 10 CFR 74.59(f) physical inventory requirements is to ensure that licensees maintain inventory control and conduct physical inventories to confirm that a loss or diversion of a significant quantity of SNM or SSNM has not occurred.

Section 10.0 of the Plan provides a description of the physical inventory program, beginning with the organization, procedures, and schedules information. Descriptions of the measures taken to prepare the facility for the physical inventory are provided. The conduct of the physical inventory is described, including inventory team organization; cutoff procedures; tamper-safing criteria, controls and procedures; inventory measurements; and process holdup. The inventory reconciliation procedure is also described. The changes in this section clarified the information regarding the physical inventory program, but did not change the scope or intent of the section. Therefore, the staff finds the description of the program for performing physical inventories acceptable and in accordance with 10 CFR 74.59(f).

Section 11.0 –Shipments and Receipts

- Revised section 11.2 regarding the calculation and evaluation of SRDs

The intent of 10 CFR 74.59(h)(1) is to ensure licensees accurately identify and measure the quantities of SNM or SSNM shipped and received, and promptly detect and resolve all significant SRDs.

Section 11.0 of the Plan provides the policies and procedures governing the shipment and receipt of SNM and SSNM. The receiving procedure describes how materials are received, stored, and measured. The SRDs are evaluated to verify the quantity of SNM and SSNM received. Statistically significant SRDs are investigated and resolved in a timely manner. The shipping procedure describes the preparation and certification procedures for shipping SNM and SSNM. The changes in this section update the information regarding the calculation of SRDs, but do not change the scope or intent of the section. Therefore, the staff finds that the description for conducting SRD evaluations and resolving significant SRDs acceptable and in accordance with 10 CFR 74.59(h)(1).

Section 12.0 – Scrap Control

- Clarified information regarding receipt of offsite scrap in section 12.5.

The intent of 10 CFR 74.59(h)(2) is to ensure licensees regularly process scrap with relatively large measurement uncertainties to preclude such scrap being the cause of a problem at the time of physical inventory.

Section 12.0 of the Plan describes the program for scrap and waste inventory control. The section covers the location, processing, measurement, and inventory control of internally generated scrap and waste. The changes in this section clarified information regarding the receipt of offsite scrap, but do not change the scope or intent of the section. Therefore, the staff finds the description of the program for scrap control acceptable and in accordance with 10 CFR 74.59(h)(2).

Section 13.0 – Assessment and Review of the MC&A Program

- Updated section titles in 13.1, 13.2, and 13.3
- Clarified description of MC&A Manager responsibilities with respect to selecting the assessment team leader in section 13.3

The intent of 10 CFR 74.59(h)(4) is to ensure that licensees independently assess the MC&A program to periodically review its effectiveness relative to the performance objectives defined in 10 CFR 74.5(a) and the system capabilities of 10 CFR 74.51(b).

Section 13.0 of the Plan provides the description of the annual assessment and review of the MC&A program. The section addresses the general requirements for the assessment team, the reporting of the findings and recommendations, and the management review and response to the findings and recommendations. The changes to this section are administrative in nature and do not change the scope or intent of the section. Therefore, the staff finds the description of the program for MC&A assessments acceptable and in accordance with 10 CFR 74.59(h)(4).

Section 14.0 – Designation of Material Balance Areas, Item Control Areas, and Custodians

- Clarified description of material control boundaries in section 14.1

The intent of 10 CFR 74.59(h)(5) is to ensure licensees assign custodial responsibility for all SSNM possessed under license in a manner that ensures that such responsibility can be effectively executed. In order to achieve effective execution of custodial responsibility, a facility is subdivided into a sufficient number of areas, such as material balance areas and item control areas.

Section 14.0 of the Plan provides the description of the program for the execution of custodial responsibility, including the facility's material control boundaries and specific duties of the custodians. The changes to this section clarified the information regarding material control boundaries, but did not change the scope or intent of the section. Therefore, the staff finds the information provided regarding the designation of material control areas, item control areas, and custodians acceptable and in accordance with 10 CFR 74.59(h)(5).

Section 15.0 –Tamper-safing

- Clarified information regarding tamper-safe sealing of certain laboratory samples

The intent of 10 CFR 74.59(f)(2)(i) is to ensure licensees establish and maintain tamper-safing procedures to ensure the continuing validity of previously measured and attested to SNM and SSNM values assigned to unique items.

Section 15.0 of the Plan describes the program for tamper-safing items or vaults containing SNM or SSNM. The section includes descriptions of the characteristics of tamper indicating devices and their use, records, and control of seals. The changes to this section clarify information about the tamper-safing program, but the scope and intent remains unchanged. Therefore, the staff finds the plan for tamper-safing acceptable and in accordance with 10 CFR 74.59(f)(2)(i).

Section 16.0 –Resolving Indications of Loss, Theft, Diversion, or Misuse of SNM and SSNM

- Added this new section to the Plan

Section 16.0 indicates the specific sections within the Plan that address various topics regarding diversion, item loss, alarm resolution, alleged thefts, and general theft allegation assessment.

Section 17.0 –Information Aid for Assisting in the Investigation and Recovery of Missing SNM and SSNM

- Added this new section to the Plan

Section 17.0 provides listings of the types of information that may be useful in the investigation and recovery of missing SNM or SSNM in the event of an actual loss, theft, diversion or misuse.

The intent of the general performance objectives in 10 CFR 74.51(a) is to require licensees to promptly investigate and resolve any indications of a possible loss, theft, diversion, or misuse of SNM/SSNM. This includes describing methods and procedures for identifying indicators; investigating and resolving loss indicators; response actions for unsolved indicators; and documenting the investigation and resolution activities. Furthermore, any information relevant to the recovery of SNM/SSNM involved in a loss, theft, diversion or misuse should be ready and available to investigators.

Sections 16.0 and 17.0 describe the activities and the informational aid for assisting in the investigation and recovery of SNM or SSNM in the event of an actual loss, theft, diversion or misuse of SNM or SSNM. Therefore, the staff finds the information provided in sections 16.0 and 17.0 to be acceptable and in accordance with 10 CFR 74.51(a).

Section 18.0 –Recordkeeping

- Clarified description of the records system in section 18.1
- Revised description of the storage and access of records in section 18.2.2

The intent of 10 CFR 74.59(g) is to ensure that licensees establish and maintain specific

records to demonstrate compliance with the requirements in 10 CFR 74.53, 74.55, 10 CFR 74.57, and 74.59.

Section 18.0 of the Plan describes the auditable records system, including automated data records, manual data records, records retention, and data records flow charts. This section also provides a description of the program and controls for ensuring an accurate and reliable record system, including monitoring compliance, storage and access, data redundancy, data integrity, data review and auditability, and traceability. The changes to this section clarified information concerning the records system, but did not change the scope or intent of the section. Therefore, the staff finds the information regarding the recordkeeping system acceptable and in accordance with 10 CFR 74.59(g).

Appendix A

- Updated the titles of the enclosures
- Moved table on measurement uncertainties into Section 7.0, and renumbered tables and figures accordingly
- Included an example of a historical inventory difference variation calculation in Enclosure M

The appendix is supplemental information, and the staff finds the information provided to be appropriate and adequate. In addition to the changes listed above, minor editorial changes, including correction of typographical errors, were made throughout the document.

Based on the staff's review and evaluation of the submittal and MOX Services' response to the RAI, the staff has determined that, while the October 2016 revision is a major rewrite of the previously approved document, the revised MC&A Plan continues to meet the requirements of 10 CFR 74 Subpart E, "Formula Quantities of Strategic Special Nuclear Material." Therefore, approval of the revised MC&A Plan, Revision of October 2016, is recommended.

3.0 ENVIRONMENTAL REVIEW

The staff has determined that the MC&A Plan changes are related to safeguards matters, which are categorically excluded from the requirements to prepare a site-specific environmental assessment. Therefore, in accordance with 10 CFR 51.22(c)(12), neither an environmental assessment nor an environmental impact statement is warranted for this action.

4.0 CONCLUSION

The staff concludes that the MOX Services' revised MC&A Plan is an acceptably robust document for facility operations that contains appropriate and necessary commitments to meet applicable MC&A requirements as stipulated in 10 CFR Part 74. The MOX Services' MC&A Plan, revision dated October 2016, continues to describe acceptable methods for achieving the general performance objectives in 10 CFR 74.51(a) and the system features and capabilities of 10 CFR 74.51(b). Therefore, the staff recommends approval of the revised MC&A Plan, Revision of October 2016.

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