December 20, 2012

Gary J. Laughlin, Chief Nuclear Officer
and Head of Technical Services
National Enrichment Facility
P.O. Box 1789
Eunice, NM 88231

SUBJECT: Inspection Report No. 70-3103/2012-203

Dear Mr. Laughlin,

The U.S. Nuclear Regulatory Commission (NRC) conducted a routine, announced nuclear criticality safety (NCS) inspection of your facility in Eunice, New Mexico, on November 26-30, 2012. The purpose of the inspection was to determine whether operations involving special nuclear material were conducted safely and in accordance with regulatory requirements. An exit meeting was held on November 30, 2012.

The inspection, which is described in the enclosure, focused on the most hazardous activities and plant conditions, the most important controls relied on for safety, and the principal management measures for ensuring controls are available and reliable to perform their safety functions. A particular focus of this inspection was the NCS aspects of the newly-installed TC21 centrifuge cascades. The inspection consisted of a selective review of safety basis documents, related procedures and records, examinations of safety-related equipment, interviews with plant personnel, and facility walkdowns. The inspection observations and findings were discussed with members of your staff and management throughout the inspection.

In accordance with Title 10 of the *Code of Federal Regulations* (10 CFR) 2.390 of NRC's "Rules of Practice," a copy of this letter and the enclosure will be made publicly available in the public electronic reading room of the NRC's Agencywide Documents Access and Management System (ADAMS). ADAMS is accessible from the NRC Web site at http://www.nrc.gov/reading-rm/ADAMS.html.

If you have any questions concerning this report, please contact Christopher S. Tripp of my staff at (301) 492-3214, or via e-mail to christopher.tripp@nrc.gov.

Sincerely,

/RA/

Sheena A. Whaley, Acting Chief
Programmatic Oversight
and Regional Support Branch
Division of Fuel Cycle Safety
and Safeguards
Office of Nuclear Material Safety
and Safeguards

Docket No. 70-3103

Enclosure:
Inspection Report No. 70-3103/2012-203

w/encl: (See page 3)

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U.S. NUCLEAR REGULATORY COMMISSION
OFFICE OF NUCLEAR MATERIAL SAFETY AND SAFEGUARDS

Docket No.:	70-3103
License No.:	SNM-2010
Report No.:	70-3103/2012-203
Licensee:	URENCO USA, LLC (UUSA)
Location:	Eunice, New Mexico
Inspection Dates:	November 26-30, 2012
Inspectorss:	Christopher S. Tripp, Senior Criticality Safety Inspector Timothy Sippel, Criticality Safety Inspector
Approved By:	Sheena A. Whaley, Acting Chief Programmatic Oversight and Regional Support Branch Division of Fuel Cycle Safety and Safeguards Office of Nuclear Material Safety and Safeguards

Enclosure

EXECUTIVE SUMMARY

Louisiana Energy Services, LLC, National Enrichment Facility
NRC Inspection Report 70-3103/2012-203

Introduction

The inspectors performed a routine, announced criticality safety inspection at the URENCO USA, LLC, (UUSA) facility in Eunice, New Mexico, November 26-30, 2012. The inspectors reviewed the licensee's nuclear criticality safety (NCS) program, new and revised NCS analyses, NCS-related internal events, the criticality alarm system, and plant operations. The inspectors also reviewed open NCS inspection items. As a primary focus of this inspection, the inspectors reviewed NCS analyses and operational data associated with the newly-installed cascades of Assay 1003.

Results

- No safety concerns were identified regarding the NCS program.

- No safety concerns were identified regarding NCS events.

- No safety concerns were identified regarding the criticality alarm system.

- No safety concerns were identified regarding the conduct of plant operations.

- No safety concerns were identified regarding the installation and operation of the newly-installed TC21 cascades in Assay 1003.

REPORT DETAILS

1.0 Plant Status

During this inspection UUSA was performing routine enrichment and supporting operations. As of the date of the inspection, five newly-installed TC21 cascades in Assay 1003 (numbered 3.1 through 3.5) had been brought on-line. Large scale construction activities were also underway.

2.0 Nuclear Criticality Safety Program (IP 88015, 88016)

a. Scope of Inspection

The inspectors reviewed licensee criticality analyses, interviewed licensee criticality engineers, operators, and managers, and walked down portions of the facility. The inspectors reviewed selected portions of the following documents:

- 1003-MECH-457-001, "C3.1 Safe-by-Design Verification of Centrifuges (SBDV-2012-0063)," Rev. 0.
- CALC-S-00137, "Cascade In-Leakage Determination (U)," Rev. 1, dated July 12, 2012.
- CR-2012-2176, "Safe Mass in IROFS Periodicity Calculation," dated August 3, 2012.
- CR-2012-2257, "QA Documentation Requirements for Software Used for Nuclear Criticality Safety," dated August 8, 2012.
- CR-2012-2629, "High Sample Rig Pressure Causes Cascade 3.1 to Enter Recirculation," dated September 17, 2012.
- CR-2012-2885, "High Sample Rig Pressure Causes Cascade 3.2 to Enter Recirculation," dated October 3, 2012.
- CR-3-1000-05, "Preparation and Control of Non-Design Calculations," Rev. 3, effective date: July 19, 2012.
- EG-3-3100-03, "Quality Assurance Level Assignments," Rev. 8, march 28, 2011.
- ETC4089702, "National Enrichment Facility Separation Building Module 1003 (SBM-1003) Assay Unit 1003 (AU1003) Cascade System (450)," Issue 2, dated January 21, 2011.
- ETC4089706, "National Enrichment Facility Separation Building Module 1003 (SBM-1003) Assay Unit 1004 (AU1004) Cascade System (450)," Issue 1, dated May 12, 2011.
- ETC4100854, "Criticality Safety Analysis of the Contingency Dump System," Issue 8, dated June 19, 2012.
- ETC4107395, "Criticality Safety Analysis of UUSA Assay Units1001/1003/1003/1004 and SBM 1001 Extension Module Process Gas Pipework," Issue 6, dated June 22, 2012.
- ETC4156706, "The Nuclear Criticality Safe Number of Fully Filled TC21 Centrifuge Recipients in Cascade Arrangement at 6% Enrichment," Issue 3, dated May 1, 2012.
- ETC4158184, "Criticality Safety Calculation for Mass of Uranium in TC21 Centrifuge Cascade Arrangement at 6% Enrichment – Partially Filled Bores," Issue 3, dated April 24, 2012.
- ETC4168214 [title withheld], Rev. 1.
- ETC4160865 [title withheld], Rev. 1 and 2.
- ETC4187298 [title withheld], Rev. 1.
- ETC4189315, "Criticality Safety Analysis of the UUSA SBM1003 Cascade Header Pipework and Contingency Dump Buffer Volume," Issue 2, dated July 30, 2012.

- ETC4195325, “Nuclear Criticality Safety Evaluation (NCSE) of Evacuation into a Single 48Y Cylinder for Assay Unit 1003 and Assay Unit 1004 (U),” Issue 1, dated October 21, 2011.
- ETC4195333, “Criticality Safety Analysis of UUSA Assay Unit 1003 and 1004 Cascade Valve Frames at 7.4% Enrichment,” Issue 3, dated August 1, 2012.
- ETC4195340, “Cascade System (450): Criticality Assessment of Passive Safe-by-Design Components,” Issue 1.
- ETC4195341, “Contingency Dump System Criticality Assessment of Passive Safe-By-Design Components SBM1003,” Issue 1, dated July 12, 2012.
- ETC4202396 [title withheld], Rev. 1.
- ETC4216228, “Light Gas Sensitivity for UUSA Cascades (U),” Issue 1, May 8, 2012
- Memo from [redacted] (QA Supervisor) to [redacted], “Response to CASCAL Software being QL-1,” dated November 1, 2012.
- NCS-CSA-006, “Criticality Safety Analysis of the Product Vent Pump and Chemical Trap Set,” Issue 7.
- NCS-CSA-015, “Nuclear Criticality Safety Analysis of IROFSC22 Periodicity,” Rev. 2, dated August 28, 2012.
- NCS-CSE-015, “NCSE of the Contingency Dump Pump and Trap Set,” dated August 23, 2011.
- NCS-CSE-021, “Movement of Components,” Rev. 1, dated October 24, 2012.
- NCS-CSE-031, “NCSE of the SBM 1003 Run Up Rig and Contingency Dump Pump and Trap Set”
- NCS-REP-001-00, “MONK 8A Validation and Verification: National Enrichment Facility,” Rev. 4, dated March 17, 2009.
- NEF-BD-C22, “Verify Subcriticality by Mass Balance Calculation,” Rev. 2, dated August 10, 2012.
- NSR-2012-034, “Contingency Dump Pump and Trap Sets for Assay 3 (excluding 1003-445-3D1),” Rev. 0, dated August 12, 2012.
- NSR-2012-043, “Cascade 3.1 Centrifuges,” Rev. 0, dated August 9, 2012
- OP-3-3300-01-F-6, “Mass Balance Verification (IROFSC22) Data Sheet,” dated November 4, 2012.
- RJK-2012-006, “Reduction of Centrifuge (TC-12) Sampling for Criticality Attributes,” dated April 12, 2012.
- RJK-2012-013, “Determination of Sample Size for TC21 Centrifuge Criticality Attributes (U),” Rev. 0, dated July 2012.

b. Observations and Findings

Criticality Safety of the TC21 Cascades in Assay 1003

A major focus of this inspection was verifying that the newly-installed TC21 cascades in Assay 1003 were operated safely and in compliance with regulatory requirements. The inspectors reviewed NCS analyses and supporting documentation, reviewed operational data associated with operation of Cascades 3.1 through 3.4 in SBM 1003, walked down SBM 1003, and discussed the new cascades with plant engineering and operators. This included entering the Centrifuge Assembly Building (CAB) and observing disassembled centrifuge components to verify firsthand the bounding nature of the criticality analyses.

The inspectors reviewed NCS analyses and evaluations for the enrichment cascades and supporting processes in SBM 1003. The inspection focused on design differences between the existing TC12 and the new TC21 SBMs. The inspectors verified that the safety basis documents identified those critical attributes relied on for NCS, and that these critical attributes were verified prior to start-up. The inspectors noted that safe-by-design (SBD) components were not subject to 100% verification, but rather verified on a sampling basis. Over time, the sampling frequency was decreased as justified in plant internal memoranda (RJK-2012-006 and -013). The licensee based the sample size on an industry standard, ANSI/ASQ-Z1.4-2003, "Sampling Procedures and Tables for Inspection by Attributes," which establishes sample sizes provided certain criteria have been met. The inspectors determined that the criteria in ASQ-Z1.4 had been met. The inspectors discussed this with NRC Headquarters QA experts, who indicated that the Quality Assurance Program Description (QAPD) states that statistical sampling may be used to verify critical attributes, and that the method shall be "based on recognized standard practices and…implemented through applicable approved procedures." The inspectors determined that the sampling method was consistent with the standard as well as the EPRI (Electric Power Research Institute) document TR-017218-R1, "Guideline for Sampling in the Commercial-Grade Item Acceptance Process" for reduced sampling frequency.

The inspectors noted that the NCS analysis for the SBM 1003 cascade valve frames (ETC4195333) had been done at an enrichment of 7.4 wt% ^{235}U, even though Safety Analysis Report (SAR) Sections 5.1.2 and 5.2.1.3.2 state that all processes, except for the contingency dump system (CDS) and Tails Take-off Station, are analyzed at 6 wt% ^{235}U. The inspectors reviewed the MONK 8A validation report and determined that the Upper Subcritical Limit (USL) established was still valid at the higher enrichment. The critical benchmarks analyzed in the validation spanned enrichments both above and below 7.4 wt% ^{235}U, and there was no statistically significant trend of the calculated k_{eff} with enrichment. Because calculation at 7.4 wt% ^{235}U is more conservative than what is committed to in the SAR, and because these calculations are still adequately bounded by the validation report, this is a minor violation of no safety significance.

In most cases, differences in critical attributes (most notably volumes and dimensions) of components associated with the TC12 and TC21 cascades were minor and resulted in new calculations to demonstrate subcriticality with no other changes to the safety basis. The inspectors determined that, in general, components considered SBD for the TC12 cascades were also SBD for the TC21 cascades. In one instance (in NCS-CSE-031), a series of pumps was found to exceed the safe volume limits for SBD components listed in the SAR. However, the internal volume was verified by ultrasonic testing, after which the pumps were shown to be safely subcritical by explicit calculation. Thus while their status as SBD was not changed, items formerly identified as the first category of SBD became identified under the second category of SBD.

Licensee analyses ETC4156706 and ETC4158184 were previously submitted on the docket and had been reviewed to support licensee amendment request (LAR) 11-11 (as documented in the NRC's Safety Evaluation Report (SER), dated May 22, 2012). The inspector determined that these analyses, which were performed to show subcriticality in the cascade following air in-leakage, had been revised since the previous inspection and submittal of LAR 11-11. The inspector determined that the changes were made in response to previous inspection findings, were editorial in nature, and did not impact the safety basis or any critical attributes of the centrifuge cascade.

The inspector reviewed operating data collected on the first four cascades in SBM 1003 (Cascades 3.1 through 3.4), which had been brought on-line in stages starting in August 2012. The operating data reviewed consisted of printouts of real-time data in one-week increments from the Plant Control System (PCS) covering a two-month period from mid-September to mid-November 2012. These data included information on product and feed cylinder masses and pressures, motor loads from the Medium Frequency System (MFS), and pressures, temperatures, and flow rates within the cascades themselves. In addition, to support the inspection, the licensee installed local humidity monitors with continuous readout in the cascade halls. The inspector reviewed this continuous data for the previous two months of operation of Cascades 3.1 through 3.4 to determine whether the new TC21 cascades were operating within the range of parameters relied on in criticality analyses and given as assumptions in LAR 11-11.

LAR 11-11 based the maximum air in-leakage rate, which determines the rate of mass accumulation in a failed centrifuge, on three cascade systems. First, the required annual cascade sample cannot be taken if pressure at the sampling rig exceeds a certain value. The inspector verified that the cascade pressures remained within the analyzed range. Second, the MFS will trip if cascade motor loads exceed a certain value. The inspector verified that the cascade motor loads remained within the analyzed range. Third, an excessive frequency of cylinder vent cycles would alert operators to an unacceptable level of light gases in the cascade. The inspectors verified that cylinders were vented when they reached the appropriate pressure, and that the frequency of vent cycles was within the analyzed range. The inspectors also verified that cascade temperature and cascade hall relative humidity were within their analyzed ranges. These assumptions, verified in a review of real-time PCS data, were summarized and translated into a net mass accumulation rate in licensee document CALC-S-00137, "Cascade In-Leakage Determination (U)," which was a primary reference in the review of LAR 11-11 and in Inspection Report 70-3103/2012-201. The inspector noted that this calculation, which had been developed to demonstrate safety of the existing TC12 cascades, has been updated to address the new TC21 cascades since the licensing review. In particular, motor load parameters were updated with ETC design data for the TC21 centrifuges (whereas the original calculation was based on cascade measurements, which were then only applicable to the TC12 centrifuges). ETC confirmed that the new data was based on actual experiments on the centrifuge response to light gases performed at its facility in Juelich, Germany. While the operating data displayed some transients outside the acceptable ranges, typically around the startup of a new cascade, these transients were short-lived and quickly corrected. Accumulation of greater than a safe mass in a centrifuge array requires operation in excess of allowed conditions over a period of several years.

The inspector also noted that two events had occurred in which high sample rig pressure caused the cascade to go into recirculation (CR-2012-2629 and -2885). While the cause of these events is a matter of operational concern, they illustrate that protective systems, in place to prevent air in-leakage, worked as designed.

The inspector also questioned how IROFSC22, which relies on mass balance calculation for enrichment control in the cascade, would function for the new TC21 cascades. The inspector performed an in-depth review of the implementation of IROFSC22, by walking down the recording of data at local cylinder readout stations, reviewing the analysis and the procedure for performing the mass balance calculation, reviewing the most recently completed form OP-3-3300-01-F-6, "Mass Balance Verification (IROFSC22) Data Sheet, and discussing development of the mass balance curve. The inspector determined that IROFSC22 is conducted as follows: (1) an analyst develops an acceptance curve based on the flow rates that produce a cascade assay of 6 wt% ^{235}U (the analytical limit), which is based on current conditions within the cascade; (2) an operator writes down the corresponding values from the local readout station; (3) the operator uses a calculator to perform specified calculations and determine actual operating conditions in the cascade; and (4) the IROFS test is judged successful if the current operating point lies below the acceptance curve. Both development of the acceptance curve and the hand calculation are independently verified. The inspector determined that, because the curve is based on the current cascade conditions, a new curve is developed for every performance of IROFSC22. The licensee stated that the curve is generated by the CASCAL computer code, also used in the PCS to monitor cascade performance, which is derived from the ETC code GAPHAL. The licensee provided the inspector an audit that had been done (the above-listed memo dated November 1, 2012), that concluded that CASCAL played a crucial role in the performance of IROFSC22 and should therefore be treated as QL-1. While this audit recommendation has not yet been acted upon, the inspector determined that the parent code, GAPHAL, has been used extensively for many years in Europe, but noted that UUSA does not have access to GAPHAL. However, CASCAL, the daughter code, is used continuously by the PCS to monitor conditions within the cascade and to ensure that product enrichment is on-specification. Therefore, there is a high degree of confidence in the code's ability to correctly monitor cascade enrichment. The inspector nevertheless concurs in the audit finding that CASCAL should be controlled as a QL-1 code.

IROFSC22 is an administrative control performed on a specified frequency that varies according to the number of operating cascades (because upsets are assumed to occur in a single cascade and other cascades assumed to be operating normally). When done at the maximum interval, this interval exceeds the time required to fill a product cylinder. In addition, while the administrative control is bolstered by independent verification, it still requires an operator to perform a series of calculations by hand. Although the individual steps in the calculation are specified on form OP-3-3300-01-F-6, the complexity of steps involved appears to make the control highly susceptible to human error. The inspectors, however, determined that there is no safety concern, because there are other systems and procedures in place that provide a high degree of assurance that enrichment will be maintained below the analytical limit of 6 wt% ^{235}U. These include continuous monitoring of cascade performance by the PCS, which uses much of the same data and CASCAL to determine monitor enrichment on a real-time basis, as well as more frequent mass spectrometry assay measurements.

Based on the above post start-up inspection, the inspectors determined that the newly-installed Cascades 3.1 to 3.5 of AU 1003 would be safely subcritical under normal and credible abnormal conditions, complied with the double contingency principle, and met other applicable regulatory requirements. Equipment was installed as specified in plant safety basis documentation and demonstrated to operate within parameters assumed in criticality analysis.

c. Conclusion

No safety concerns were identified regarding the NCS program. The TC21 cascades in AU 1003 were confirmed to be installed and operated safely and in accordance with the applicable regulatory requirements.

3.0 Nuclear Criticality Safety Event Review and Follow-up (IP 88015)

a. Scope of Inspection

The inspector reviewed several recent internally reported NCS conditions and licensee procedures governing reportability. There were no NRC reportable NCS events since the last NCS inspection. The inspector reviewed selected portions of the following documents:

- AD-3-1000-07, "UUSA Incident Reporting and Response," Rev. 10, effective date: October 5, 2012.
- CALC-S-00124, "Time to Safe Mass for Product Dump into NaF Traps," Rev. 1, dated June 12, 2012.
- CR-2012-839, "Evaluate Options to Reduce the IEZ within the TSB," dated March 29, 2012.
- CR-2012-1129, "Violation of Nuclear Criticality Safety Requirements," dated April 27, 2012.
- CR-2012-1177, "Revision to 'CALC-S-00124, Time to Safe Mass for product dump into NaF traps,' required for SBM-1003 FCOL," dated May 2, 2012.
- CR-2012-1224, "Contingency Dump System Safe-by-Design (SBD)," dated May 7, 2012.
- CR-2012-1317, "Roots Pump Material Type Verification Insufficient," dated May 16, 2012.
- CR-2012-1707, "SBM Extension Pumps Sets with non-verified SBD characteristics," dated June 21, 2012.
- CR-2012-2303, "SBM 1003 Contingency Dump Pump and Trap Set – Correct Pump Volume (CAP Assessment 2012-0019)," dated August 13, 2012.
- CR-2012-2917, "Seismic Qualification of GEVS 662 System Support Frames," dated October 4, 2012.
- LS-3-1000-05, "Notification and Event Reporting," Rev. 7, effective date: November 7, 2012.
- ORM 3500-1, "Safe by Design," Rev. 0.

b. Observations and Findings

The licensee provided a list of condition reports for internal events related to criticality safety that have occurred since the last NRC NCS inspection. There were forty-one CRs; three appeared to relate to IROFS, three appeared to relate to the CAAS, and twenty two appeared to relate to Safe-By-Design components. The inspectors selected a sample to review in more depth.

In CR-2012-1129, the licensee identified that NCS-CSE-029 required 30B UF_6 cylinders to be stored in certified shipping containers. However, the certification for some of the shipping containers lapsed because they hadn't been inspected within the required time. UUSA inspects the shipping containers before shipping them. Because some of the shipping containers were simply sitting in storage they were not inspected, and their certification lapsed. As part of their corrective actions the licensee accelerated an effort to revise the criticality safety evaluation. The new evaluation does not credit the presence of the shipping containers when storing 30B cylinders and demonstrates that the shipping containers aren't needed to maintain criticality safety. UUSA also recertified the shipping containers and now tracks the inspection of the shipping containers in their work order tracking system, so that the containers' certification doesn't lapse again. This issue is of minor safety significance because the delay of the inspection didn't challenge the control itself (spacing), merely the confidence in the control. In addition, the licensee was able to demonstrate that the control wasn't needed to meet the performance requirements.

The inspector reviewed several condition reports (e.g. CR-2012-1224, CR-2012-1317, CR-2012-1707, CR-2012-2303) that related to the verification of safe-by-design attributes (e.g. volume, material type). In all cases selected the safe-by-design attributes were maintained. However, the verification of the attributes wasn't demonstrated properly, often due to a record keeping error. In most cases these issues were identified by the licensee's QA process and resolved before the SBD component was installed or operated.

The inspector reviewed the licensee's procedures for reporting events (AD-3-1000-07, LS-3-1000-05) with a focus on how a loss of a safe-by-design attribute would be reported. While the documentation didn't clearly address the loss of an SBD attribute (e.g., if an SBD component was improperly manufactured); the inspector interviewed licensee staff who unanimously indicated that the loss of an SBD attribute would be treated like a failed IROFS. The licensee staff provided ORM-3500-1, in which SBD components are treated in an identical manner to IROFS; but ORM -3500-1 does not specifically address reportability. The licensee staff also considered the loss of an SBD attribute to be an 'unanalyzed condition,' which would be clearly reportable under the licensee's procedures. Therefore, the inspector considers the licensee's reportability procedures lack of clarity regarding SBD components would not likely lead to an incorrect reportability determination.

c. <u>Conclusions</u>

No safety concerns were identified regarding the review and verification of SBD components. No safety concerns were identified regarding the licensee's reportability determinations and procedures.

4.0 Nuclear Criticality Safety Inspections, Audits, and Investigations (IP 88015)

a. <u>Scope of Inspection</u>

The inspector reviewed the licensee's internal audit procedure and results of the two most recent NCS self assessments to assure that appropriate issues were identified and resolved. The inspector reviewed recent NCS weekly walkthroughs (NCSIs, Nuclear Criticality Safety Inspections), and a selection of recent Nuclear Safety Releases (NSRs). Both inspectors accompanied the Criticality Safety Officer on a routine weekly walkthrough of the Cold Traps for Assay 1001, and reviewed selected portions of the following documents:

- CR-3-1000-03, "NCS Weekly Walkthroughs and Periodic Assessments," Rev. 10, effective date: May 22, 2012.
- CR-3-1000-04, "Response to Nuclear Criticality Safety Anomalous Condition or Criticality Accident," Rev. 3, effective date: February 4, 2010.
- CR-2012-3240, "SBM 1001 Product Station LTTS drip pan contains pump not previously approved – NCSAS-12-0002," dated November 7, 2012.

- NCS-CSA-006, “Criticality Safety Analysis for the Product Vent Pump and Chemical Trap Set,” Rev. 7, dated August 15, 2011.
- NCS-CSE-006, “NCSE of the Assay Sampling Rig (System 426),” Rev. 3, dated August 9, 2012.
- NCSAS-12-0001, “Criticality Safety 2012 Self Assessment Report Assessment 12-0001,” dated October 2012.
- NCSAS-12-0002, “Criticality Safety 2012 Self Assessment Report Assessment 12-0002,” dated November 2012.
- NCSI-12-0038, “SMB1003 UF6 Handling Area,” dated September 7, 2012.
- NCSI-12-0040, “UF6 Waste Handling SBD Drums,” dated September 19, 2012.
- NCSI-12-0042, “SBD Waste Drum Connex Box Storage,” dated October 4, 2012.
- NCSI-12-0045, “SBM1001 Posting Verification,” dated October 25, 2012.
- NCSI-12-0049, “Waste and Recycling Assessment,” dated November 19, 2012.
- NSR-2012-032, “Process Gas Pipework for Assay 3,” Rev. 0.
- NSR-2012-033, “Product Pumping Trains for Assay 1003,” Rev. 0.
- NSR-2012-036, “SBM 1003 GEVS,” Rev. 0.
- NSR-2012-039, “Product Vent Pump and Trap Set for Assay 3,” Rev. 0.
- NSR-2012-048, “Assay Sampling Rig (System 426) for SBM 1003, Rev. 0.

b. Observations and Findings

Before reviewing the licensee’s weekly walkthroughs or accompanying the Criticality Safety Officer on the weekly walkthrough the inspector reviewed the licensee’s procedure (CR-3-1000-03) for conducting the walkthroughs. The procedure included a form to fill out when documenting the walkthrough, a requirement for a semi-annual operations assessment, and the areas that must be inspected every year.

The inspector verified that the licensee was using the form (CR-3-1000-03-F-1, “Criticality Safety Weekly Walkthrough”) when documenting the walkthroughs. Often, not all sections of the form were applicable to the area, process, or components that were the subject of the walkthrough. The inspector reviewed the two self assessments which contained several findings and recommendations. The self assessments are used to meet the requirement in CR-3-1000-03 for an operations assessment. The inspector also discussed the scheduling of the walkthroughs with the Criticality Safety Officer. The Criticality Safety Officer stated that areas that have, or are expected to soon have, uranium are subject to walkthroughs such that all area that have Uranium are walked-through yearly. These walkthroughs are now scheduled using computerized work order system. To log a walkthrough as complete it is necessary to document how it was completed. This is more effective than simply receiving a reminder to complete a task. The remaining walkthroughs are performed in areas that may need additional criticality safety support. These include areas and processes that are about to start up, as well as those where there are adverse trends.

The licensee’s first self assessment this year documented how it met the license commitment to Regulatory Guide 3.71, and the American Nuclear Society Standards on criticality safety that it endorses. In the second self assessment, the criticality staff audited the radioactive waste group. As a result of these assessments the licensee’s criticality safety staff generated findings and recommendations.

The inspector also compared a selection of NSRs against the attributes listed in the related NCSA or NCSE. In all cases the inspector sampled, the licensee verified that the SBD attributes met the requirements in the applicable NCSA or NCSE.

c. Conclusions

No safety concerns were identified regarding NCS self assessments, or NCS weekly walkthroughs.

5.0 Criticality Accident Alarm System (IP 88017)

a. Scope of Inspection

The inspectors reviewed calculations and tests supporting the installation of criticality alarms in SBM 1003 (housing Assays 1003, installed, and 1004, yet to be installed) and the CRDB. The inspectors reviewed selection portions of the following documents:

- CAT-1003-561, "Sound Pressure Level Testing of the Criticality Accident Alarm System (CAAS) for Validating IEZ Coverage," Rev. 0, dated August 10, 2012.
- CALC-S-00138, "Shielding Requirement Evaluation of CAAS CIDAS Equipment Panels in the SBM 1003," Rev. 0, dated July 30, 2012.
- CALC-S-00139, "Evaluation of CAAS Placement in the SBM 1003," Rev. 0.
- CERTIFICATE OF CALIBRATION, "Certificate-2520-2/020," dated December 13, 2011.
- DOC-25725 Issue B, "Specification for Standard CIDAS Mk X System," dated March 2008.

b. Observations and Findings

During the review of the detectors' response to a criticality accident the inspectors identified what appeared to be a discrepancy in the licensee's documentation. Various documents provided different activation times and different dose rates for detector activation. For example CALC-S-00139 stated that "the detectors have a stated trigger response of 1 mGy/hr (0.1 rad/hr) as a gamma radiation rate meter detector." However, other documents indicated that the detector threshold was at 0.15 mGy/hr (15 mrad). This discrepancy was resolved in DOC-25725, which clarified that dose rates below 0.15 mGy/hr (15 mrad) do not cause the detector to activate; while a dose rate of 1 mGy/hr (0.1 rad/hr) would cause the detector to activate within 1 second. For dose rates higher than 0.15 mGy/hr (15 mrad), the activation time (time the detector is exposed to the radiation field before sending an alarm signal) depends on the dose rate. The CERTIFICATION OF CALIBRATION records the results of a test where a detector was exposed to three different dose rates. One of the dose rates was less than 0.15 mGy/hr (15 mrad), and did not cause the detector to activate. For the other two dose rates the detector activated in less than or equal to the times specified in DOC-25725. And for the highest dose rate, that is more consistent with a detector located near a criticality, the detector activated within 1.0 millisecond.

The inspectors reviewed the sound pressure level testing procedure and attached map of survey points and test results. For each of approximately one hundred survey points, sound levels were tested using a decibel (dB)-meter to determine whether the location met three acceptance criteria—(1) whether the alarm sound is greater than 75 dB; (2) whether it is greater than 10 dB above ambient; and (3) whether it is clearly audible (a subjective determination). In some cases, certain locations could not be surveyed due to construction activities, but the inspectors determined there were sufficient survey points to determine the boundaries of the immediate evacuation zone (IEZ). (The IEZ was also determined conservatively based on a 10-rad dose boundary, which is larger than the 12-rad boundary indicated in ANSI/ANS-8.3.) The areas had also been surveyed in the past and the licensee stated there had been no evidence of system degradation. In addition, one area at the entrance to the CAB was measured at slightly below the 75 dB sound level. However, the licensee had indicated that the alarm was still clearly audible. The licensee has committed to ANSI/ANS-8.3 -1997 (Reaffirmed in 2003), which requires "the number and placement of criticality alarm signal generators shall be such that the signals are adequate to notify personnel promptly," but states the exact dB levels above as recommendations. Therefore, the inspectors determined that the applicant's system of evacuation alarm horns associated with the criticality alarm system was adequate.

c. <u>Conclusions</u>

No safety concerns were identified regarding the criticality accident alarm system.

5.0 Plant Operations

a. <u>Scope of Inspection</u>

The inspectors walked-down the SBM 1001, SBM 1002, and the CRDB with the criticality safety officer. The inspectors also conducted a walkdown in SBM 1003 with an operator and the CAB with ETC staff, as mentioned above.

b. <u>Observations and Findings</u>

The plant was observed to be operating normally. Construction activities were ongoing in SBM 1003, and the CRDB is not yet operational. Licensee staff members were familiar with the processes and NCS controls, including SBD components. According to the criticality safety officer, the construction workers in operating areas have received basic criticality safety training.

The inspector also reviewed FP-5-1000-01, "Pre-Incident Plan," Rev. 6, effective date: July 23, 2012 and discussed the use of water in fighting fires with the licensee's staff. Areas with fissile material are marked on a map in the Pre-Incident Plan, and in these areas they wouldn't use water without consulting criticality safety. In all areas dry extinguishers would be used first in fire fighting, before resorting to other means. The licensee stated that copies of the Pre-Incident Plan have been provided to local emergency response organizations that may assist in responding to a fire or similar event at UUSA.

c. <u>Conclusions</u>

No safety concerns were identified while on walkdowns of operating plant areas, or with regard to plant operations.

6.0 Open Item Review

VIO 70-3103/2011-201-01 and VIO 70-3103/2011-201-02

During a previous inspection, the inspectors identified a failure to identify and analyze an accident sequence leading to criticality in the cascade, and to demonstrate compliance with the performance criteria of 10 CFR 70.61 for this event. Specifically, the licensee had improperly categorized the accumulation of greater than a safe mass in the cascade as a result of air in-leakage as an incredible event, and did not establish control systems relied on in making this determination as IROFS. A determination of incredibility cannot be based on facility features that can credibly degrade or be rendered ineffective as the result of a change, under the licensee's ISA methodology.

During a subsequent inspection (Inspection Report 70-3103/2012-201), the licensee provided information that adequately demonstrated that criticality in the cascade was not credible, and revised its ISA Summary description of the event to be consistent with its approved ISA methodology. However, the violations were left open because issues remained concerning the licensee's implementation of its methodology for concluding whether events were credible, and the documented basis for the event in question. Subsequent to that inspection, in the SER for LAR 11-11, the NRC staff determined that the same considerations were equally valid when applied to the new TC21 cascades.

During the current inspection, the inspectors observed that the licensee had revised procedure EG-3-3100-06, "Integrated Safety Analysis Process," Rev. 10, August 22, 2012, to incorporate the credibility criteria into its ISA process. Specifically, procedure EG-3-3100-06 was revised to add the applicable guidance regarding the "many unlikely events" (second of the three bullets from NUREG-1520, Chapter 3) category of events, and Form 9, "Human Actions/Errors Credibility Determination Form," was issued. This form is required to be filled out as part of ISA team meetings considering events, to give structure and ensure the appropriate criteria for determining credibility are followed. Form 9 is attached to the ISA Team meeting minutes, and requires enumerating the individual steps in the sequence and documenting whether each step is independent from the other steps, whether there is any reason or motive, and whether it is unlikely. The inspectors determined that the form is consistent with the licensee's approved ISA methodology, and also checked recent ISA Team meeting minutes to see how it is being implemented in practice. Only one such meeting had been documented since revision of procedure EG-3-3100-06, in ISA-MEM-0040, "SBM-1001 and -1003 Cascade System HAZOP and Risk Determination Analysis," Rev. 2, September 28, 2012. The inspectors also checked other recent ISA Team meeting minutes and found one example predating the issuance of EG-3-3100-06 where information from Form 9 was included, ISA-MEM-034, "Potential Accident Sequence Following a Cascade Dump in SBM-1001 and 1003." The events analyzed in these cases included both the air in-leakage sequence and other types of events. The inspectors did not review the merits of these specific events, as the licensee has not had much experience with the revised procedure. However, based on the incorporation of the credibility criteria in the revised procedure, these violations are closed.

7.0 Exit Meeting

The inspectors communicated their observations and findings to licensee management and staff throughout the inspection, including daily debriefs. The inspectors presented results of the inspection to the licensee during an exit meeting on November 30, 2012. The licensee acknowledged that it understood the findings presented.

SUPPLEMENTARY INFORMATION

1.0 Items Opened, Closed, and Discussed

Items Opened

None

Items Closed

VIO	**70-3103/2011-201-01**	The failure to identify and analyze an accident sequence leading to criticality in the cascade in accordance with its approved ISA methodology
VIO	**70-3103/2011-201-02**	The failure to demonstrate compliance with the performance requirements or establish IROFS for a credible event

Items Discussed

None

2.0 Event Reports Reviewed

None

3.0 Inspection Procedures Used

IP 88015 Nuclear Criticality Safety Program
IP 88016 Nuclear Criticality Safety Evaluations and Analyses
IP 88017 Criticality Alarm Systems

4.0 Key Points of Contact

UUSA

A. Bridges	HS&E
T. Foster	Plant Engineering
T. Knowles	Licensing Manager
R. Lehman	Plant Engineering
A. Lynn	HS&E
S. Magill	Operation & Support
P. McCasland	Licensing Specialist
A. McGee	Plant Engineering
Q. Newell	Criticality Engineer/Plant Engineer
W. Padgett	ISA (Criticality Safety Supervisor)
E. Parkes	Plant Engineering
O. Parry	ETUK Criticality
A. Riedy	Plant Engineering
C. Slama	Licensing Engineer
P. VanDerHeide	ETUS Security and Regulatory Affairs

NRC

T. Sippel	Criticality Safety Inspector
C. Tripp	Criticality Safety Inspector

All attended the exit meeting on November 30, 2012.

5.0 List of Acronyms and Abbreviations

ANSI/ASQ	American National Standards Institute/American Society for Quality
AU	assay unit
CAB	centrifuge assembly building
CDS	contingency dump system
CR	condition report
CRDB	cylinder receipt and dispatch building
EPRI	Electric Power Research Institute
ETC	Enrichment Technology Corporation
ETUK	Enrichment Technology—United Kingdom
ETUS	Enrichment Technology—United States
FCOL	First Cascade Online
GEVS	gaseous effluent ventilation system
IEZ	immediate evacuation zone
IROFS	items relied on for safety
LTTS	Low Temperature Takeoff Station
LAR	licensee amendment request
MFS	medium frequency system
NCS	nuclear criticality safety
NCSA	nuclear criticality safety analysis
NCSE	nuclear criticality safety evaluation
NCSI	Nuclear Criticality Safety Inspection
NSR	nuclear safety release

PCS	plant control system
QA	quality assurance
QAPD	quality assurance program description
SAR	safety analysis report
SER	safety evaluation report
SBD	safe-by-design
SBDV	safe-by-design verification
SBM	separation building module
TSB	Technical Services Building
USL	upper subcritical limit