April 19, 2012

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

SUBJECT: INSPECTION REPORT NO. 70-3103/2012-201

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, March 19-22, 2012. The purpose of the inspection was to determine whether operations involving special nuclear material were conducted safely and in accordance with regulatory requirements. Inspection observations and findings were discussed with members of your staff and management throughout the inspection. An exit meeting was conducted at the conclusion of the inspection on March 22, 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 their analytical basis; and the principal management measures for ensuring controls are available and reliable to perform their functions relied on for safety. The inspection consisted of analytical basis review, selective review of related procedures and records, examinations of relevant NCS-related equipment, interviews with NCS engineers and plant personnel, and facility walkdowns to observe plant conditions and activities related to safety basis assumptions and related NCS controls. No new safety concerns were identified during the inspection.

In accordance with Title 10 of the *Code of Federal Regulations* 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 Tripp at 301-492-3214, or via email to Christopher.Tripp@nrc.gov.

Sincerely,
/RA/

Thomas G. Hiltz, Chief
Technical Support Branch
Division of Fuel Cycle Safety
and Safeguards
Office of Nuclear Material Safety
and Safeguards

Docket No. 70-3103

Enclosure:
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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.:	70-3103/2012-201
Licensee:	Louisiana Energy Services, LLC
Location:	Eunice, New Mexico (NM)
Inspection Dates:	March 19-22, 2012
Inspectors:	Thomas Marenchin, Criticality Safety Inspector Christopher Tripp, Criticality Safety Inspector Sheena Whaley, Criticality Safety Inspector
Approved By:	Thomas G. Hiltz, Chief Technical 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 70-3103/2012-201

Introduction

The staff performed a routine, scheduled criticality safety inspection at the Louisiana Energy Services, LLC (LES), facility in Eunice, NM, March 19-22, 2012. Staff reviewed the licensee's nuclear criticality safety (NCS) program, administrative and operating procedures, NCS-related internal events, NCS audits and inspections, the criticality alarm system and plant operations.

Results

- No safety concerns were identified regarding the NCS program.
- No safety concerns were identified related to internal and externally reportable events.
- A weakness was identified related to internal audits and inspections concerning the lack of interaction with operator personnel during weekly walkthroughs.
- No safety concerns were identified related to plant operations.
- Two severity Level IV violations remain open due to continuing questions regarding the implementation of your Integrated Safety Analysis (ISA) methodology, in regard to events considered not credible. Safety concerns about the possibility of criticality in the centrifuge cascade have been resolved.
- An Unresolved Item (URI) and an Inspection Follow-up Item (IFI) concerning your extent of condition review and Integrated Safety Analysis (ISA) Summary changes associated with events considered not credible were closed. These issues will be addressed as part of the follow-up of the two severity Level IV violations.
- Two URIs concerning the use of subcriticality in determining event reportability and plant modifications for criticality accident alarm system (CAAS) audibility were closed.

REPORT DETAILS

1.0 Plant Status

LES enriches uranium to a maximum of 5 percent enrichment in its gaseous centrifuge facility near Eunice, NM. During the inspection, LES was performing routine enrichment operations and testing of cascades. Large scale construction activities were underway at the site.

2.0 Nuclear Criticality Safety Program (IP 88015, 88016)

a. Scope of Inspection

The inspector reviewed criticality analyses for risk-significant operations at the LES facility. The inspector interviewed licensee criticality engineers, operators, and managers regarding operations, equipment and controls. The inspector reviewed selected portions of the following documents:

- 1001-MECH-492-002, "Safe by Design Verification for AU1/AU2 Blending and Liquid Sampling System," Revision 0, dated September 19, 2011.
- 1001-MECH-400-004, "Autoclave Support," Revision 0, dated August 29, 2011.
- 2008-1165-EXT-SURV, "Surveillance of Coats Engineering International Ltd," dated January 15, 2009.
- 2010-S-1-034, "SBD Verification – Product Cold Traps," Revision 1, dated February 9, 2010.
- ACE [Apparent Cause Evaluation] 2011-2560, "Mass Spec Room," dated August 5, 2011.
- CR [Condition Report] 2010-2211, "Reusable Parts with Enriched Material. Contamination Stored in the UF_6 Handling Area," dated July 7, 2010.
- CR 2011-0774, "Reportability of the Ventilated Storage Room Event," dated March 9, 2011.
- CR 2011-1191, "SAR Statement Needs to be Broader to Include Current Operations," dated May 13, 2011.
- CR 2011-2560, "Container in the Mass Spec Room," dated August 6, 2011.
- CR 2011-3840, "Compensatory Actions Due to Lack of Audible CAAS Alarms Inside CRDB Near SBM," dated March 3, 2012.
- CR 2011-4141, "Clarification for CAAS System Work Packages Review," dated December 29, 2011.
- CR 2012-0729, "CAB Posting Found Partially Illegible," dated March 21, 2012.
- CR 2012-0737, "Potential for Not Fully Meeting Intent of ANS 8.19 Section 7.8," dated March 22, 2012.
- CR-3-1000-3, "NCS Weekly Walkthroughs and Periodic Assessments," Revision 9, dated October 3, 2011.
- ETC4158206, "Criticality Safety of Blending and Liquid Sampling Systems for SBM1001," Revision 3, dated August 25, 2011.
- LES-11-00125-NRC, "Written Follow-up Report for Event Notification 47131," dated September 1, 2011.
- LO-3-2000-12, "Gantry Crane Operation," Revision 2, dated November 18, 2011.
- NCS-CSE-009, "CRDB Shell NCSE," Revision 0, dated September 23, 2011.

- NCS-CSE-025, “General Storage of Fissile Material,” Revision 0, dated September 23, 2011.
- NCSAS-11-0001, “SBM 1001 Mass Spectrometer Room,” Revision 1, dated June 17, 2011.
- NEF-BD-45, “Maintain Sub-Critical Geometry of Product Cylinders,” Revision 1, dated March 1, 2012.
- NSR [Nuclear Safety Release]-2011-010, “Blend and Sampling System,” Revision 0, dated September 26, 2011.
- RW-3-1000-09, “Waste Container Setup, Handling and Disposition,” dated November 28, 2011.
- NCSI-11-0043, “Assay 1002 Process Gas Pipework,” dated November 11, 2011.
- NCSI-11-0047, “CAAS Comp Measures,” dated December 09, 2011.
- NCSI-12-0006, “Header Pipework for Cascade 2.4,” dated December 09, 2011.
- NCS-CSA-14, “NCSA to Expand ETC 4072548, Cascade Header Pipework,” Revision 2.
- NCS-CSE-006, “NCSE of SBM Condensate Collection,” Revision 3.
- NCS-CSE-015, “NCSE of the Contingency Dump Pump and Trap Set,” Revision 3.
- NCS-CSA-016, “Criticality Safety Analysis of 30B Cylinders,” Rev 0, dated August 3, 2011.
- NCS-CSE-027, “NCSE of the Mobile Maintenance Rig,” Revision 1.

b. Observations and Findings

The inspectors determined that nuclear criticality safety evaluations (NCSEs) were performed by qualified NCS engineers, that independent reviews of the evaluations were completed by qualified NCS engineers, that subcriticality of the systems and operations was assured through appropriate limits on controlled parameters, and that double contingency was assured for each credible accident sequence leading to inadvertent criticality. The inspectors determined that NCS controls for equipment and processes ensured the safety of the operations. NCS analyses and supporting calculations demonstrated adequate identification and control of NCS hazards to assure operations within subcritical limits.

c. Conclusion

No safety concerns were identified regarding the NCS program.

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

a. Scope of Inspection

The inspector reviewed internally reported and one externally reported NCS condition.

b. Observations and Findings

The inspectors reviewed licensee conditions generated since the previous inspection and focused on several NCS-related problems. The inspectors determined that licensee internal events were identified and reported in accordance with written procedures. The licensee condition report system was used to track corrective actions.

EN 47131

On the morning of August 5, 2011, LES personnel discovered potentially contaminated waste being stored in an unmarked container in the Mass Spec Room. Upon learning that the unmarked container was not a Safe-by-Design (SBD) container, a criticality anomalous condition was declared at approximately 4:30 pm, in accordance with CR-3-1000-04, based on a violation of NCS guidelines and procedural requirements. LES treated the event as reportable. It considered reporting the event to be a conservative decision because the volume of waste (mostly gloves and wipes) was much less than 12 liters and could easily fit into an SBD container. The material that could be surveyed was cleared as non-radioactive material and placed in a clean waste container. The material that could not be surveyed was transferred to an SBD container pending further analysis. The initial analysis of the material placed in the SBD container did not indicate the presence of any trace uranic material. The inspectors determined that LES had taken the correct actions in reporting the event due the unknown amount of special nuclear material (SNM) in the unmarked container and not having established items relied on for safety (IROFS) for a non-SBD container in the mass spec room. LES had established eight corrective actions in its written follow-up report for the event notification (LES-11-00125-NRC). The inspectors verified that LES had completed all of the corrective actions associated with this event. As part of these corrective actions, LES had updated its procedure for handling waste containers (RW-3-1000-09), provided additional training, and generated a new Criticality Safety Evaluation (CSE) (NCS-CSE-022) to evaluate any inadvertent use of a non-SBD container. This closes EN 47131.

c. Conclusions

The inspectors did not identify any safety concerns related to internal and externally reportable events.

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

a. Scope of Inspection

The inspectors reviewed recent NCS-related internal audits, including selected portions of the following documents:

The inspectors reviewed the licensee's internal audit procedures, records of previously completed audits of fissile material operations, and records of NCS infractions. The inspectors observed the licensee's Criticality Safety Officer (CSO) conducting a weekly walkthrough for the cylinder storage areas. The inspectors reviewed selected aspects of the following documents:

- CR-3-1000-03, "NCS Weekly Walkthroughs and Periodic Assessments," dated October 03, 2011, Revision 9.
- NCSAS 11-0001 Self Assessment, "SBM 1001 Mass Spec Room," June 17, 2011.
- CS 2011 Self Assessment, "Maintenance and Testing Operations Related to the CAAS," December 12, 2011 and related Condition Report, 2011-4141-CR, "Clarification for CAAS System Work Package Reviews."

b. Observations and Findings

The inspectors reviewed 10 weekly walkthroughs and the 2 semi-annual self assessments performed during 2011. Walkthroughs are performed on a weekly basis for selected areas, typically by the CSO. The intent is to ensure that all areas are audited (by either a weekly walkthrough or self-assessment) every 2 years. All observations and findings are documented and tracked until closed. The inspectors found that NCS audits were conducted according to procedural requirements. However, the inspectors determined that no operations staff or supervisors were interviewed during the 10 weekly walkthroughs. This section of the walkthrough form was marked as "N/A" either because the auditor did not deem it applicable or operations staff was not available. Since the purpose of these walkthroughs is, in part, to determine the effectiveness of NCS controls, operations staff should be involved in the walkthroughs whenever possible. The NRC accompanied the CSO on a weekly walkthrough of the cylinder storage areas. The inspectors noted that the NCS walkthrough was focused on determining that plant operational requirements conform to those listed in the applicable NCS specification documents. The inspectors observed that licensee staff examined NCS postings, labels, and other controls. The inspectors also determined that a condition report was identified, and appropriately dispositioned, as a result of the NCS self-assessment for the CAAS. The recommendation to revise the applicable procedures had been tracked via a condition report, and the applicable procedures were in the process of being modified.

c. Conclusions

No safety concerns were identified regarding licensee audits and inspections. The inspectors noted a potential weakness concerning the lack of interaction with operation personnel.

5.0 Plant Operations

a. Scope of Inspection

The inspectors performed plant walkdowns to review activities in progress and to determine whether risk-significant fissile material operations were being conducted safely and in accordance with regulatory requirements. The inspector interviewed operations staff and NCS engineers both before and during walkdowns. The inspectors reviewed selected aspects of the following documents related to the CAAS and selected condition reports (CRs):

- LES Calculation CALC-S-00131, "Evaluation of CAAS Placement in the CRDB-Outside Bunkered Area," Revision 2.
- LES Calculation CALC-S-00132, "Evaluation of CAAS Placement in the CRDB-Bunkered Area," Revision 2.
- LES Calculation CALC-S-00127, "IEZ Calculation on East Side of SBM 1001."
- LES Calculation CALC-S-00107, "IEZ Calculation.
- CR-2011-0758, "Integration of NCSE/NCSA into ISA."
- CR-2011-1589, "Revision of NCSE/NCSA Affected By CR-2011-0758."
- CR-2011-1591, "Revision to SAR 5.1.3."

b. Observations and Findings

The inspectors performed walkdowns in Mini Halls, the uranium hexafluoride (UF_6) handling area, centrifuge test facility, the uranium byproduct cylinder storage pads, and the control room complex. The inspectors observed that one of the criticality safety postings that was outside of the Centrifuge Assembly Building had worn/faded so that the sign was illegible. The licensee staff generated a condition report, CR 2012-0729, to correct the problem. The NCS staff rewrote the information on the posting, and indicated that they were evaluating new types of signage that would be more durable.

The U.S. Nuclear Regulatory Commission (NRC) reviewed the CAAS detector placement and the immediate evacuation zone (IEZ) documents listed above. Some of these documents had been recently revised to update and correct the material information for the concrete used in the calculations. The inspectors determined that the assumptions and methodologies used were appropriately conservative.

The inspectors reviewed condition reports related to plant operations. Two of the condition reports were related to findings that dimensions important to NCS were not within the NCS limits during field measurements. The third was a recommendation to revise language in the Safety Analysis Report (SAR) related to NCS (which NCS did not accept). The licensee handled each of these CRs appropriately.

c. Conclusions

The inspectors determined that the CAAS analyses were performed by qualified NCS engineers and independent reviews were completed by other qualified NCS engineers. The inspectors determined that appropriate assumptions and methodologies were used to calculate the CAAS detector placement and the IEZ boundaries. For the CR process, the inspectors determined that the licensee's CR process was followed and that the NCS organization was involved in the disposition of these CRs. During field measurements, several conditions that were not within NCS limits had been discovered. The inspectors reviewed two of these CRs in detail (CR-2011-0758 and CR-2011-1589) and determined that each such condition has been appropriately resolved. No safety concerns were identified regarding plant operations.

6.0 Open Items Review

VIO 70-3103/2011-201-01, **VIO 70-3103/2011-201-02**, **URI 70-3103/2011-201-03, and IFI 70-3103/2011-201-04**

During a previous inspection, the inspectors identified that the licensee failed to identify and analyze an accident sequence involving the accumulation of uranium in an array of failed centrifuges (VIO 70-3103/2011-201-01) and to demonstrate compliance with the performance requirements or establish IROFS for this event (VIO 70-3103/2011-201-02). The licensee acknowledged the violations but still contended that criticality in such an array of crashed machines is not credible. The licensee revised the definition of "not credible" in Section 3.2.5.2 of its SAR to allow credit for "a sequence of many unlikely events or errors for which there is no reason or motive," in determining that an accident sequence is not credible. This is consistent with Revision 1 of NUREG-1520, "Standard Review Plan for the Review of a License Application for a Fuel Cycle Facility." The licensee also submitted a table consisting of a sequence of 18 events forming the

basis for its conclusion of incredibility (by letter dated November 11, 2011 [ML11319A198]). The licensee also referred to this table of events as part of its basis for License Amendment Request LAR-11-11 (by letter dated March 13, 2012 [ML12080A106]) for the installation of new TC21 centrifuge cascades. Prior to this inspection, the staff had provided the licensee a written response to its reply to the notice of violation (by letter dated February 8, 2012 [ML12018A149]), outlining areas for further review during the next inspection. After reviewing submitted information on the TC21 amendment request dated March 13, 2012, the staff provided the licensee an updated list of areas for further review, by email dated March 16, 2012 (Agencywide Documents Access and Management System [ADAMS] Accession No. ML121090088).

During the current inspection, the inspectors interviewed licensee personnel and attempted to review the licensee's documentation providing the technical basis for the unlikelihood and independence of the 18 events comprising the crux of its credibility argument (as outlined in the February 8, 2012, letter). As in the previous inspection, the licensee made Enrichment Technology Corporation (ETC) staff available to answer the inspectors's questions. The inspectors discussed the technical basis for the maximum air in-leakage rate allowed by each of three means mentioned in the event table—the annual sample of cascade gases, the monitoring of product cylinder vent cycles, and the Medium Frequency System (MFS)—with licensee and ETC staff. The maximum air in-leakage rate directly determines the rate at which uranium can build up in a failed or idled centrifuge. The inspectors determined that the licensee did not have any supporting documentation to justify assertions about the air in-leakage rate in the submitted event table.

The inspectors discussed actions taken in response to an indication of unacceptable air in-leakage with licensee and ETC staff. The licensee stated that, if the required annual sample could not be taken, or if operators found themselves performing more than a certain number of cylinder vent cycles, they would investigate the cause and attempt to locate the leak and correct it. However, the inspectors determined that there are no specific required response actions in plant operating or maintenance procedures, and therefore no assurance that there is anything to limit the total quantity of uranium that can accumulate. With regard to the "annual" sample, the inspectors were told by various plant personnel that it was required once a year, once every 2 years, or once every 3 years.

The inspectors discussed the independence of events in the table with licensee and ETC staff. In addition to a chronic source of atmospheric moisture, criticality requires an array of failed or idled centrifuges clustered together. The licensee's calculations indicate that four is the minimum number of machines that can form a cluster exceeding the license k_{eff} limit of 0.95. The existence of four such machines in a cluster with air in-leakage was treated as four independent events in the table. To justify this, the event table states that "operating experience shows no correlation that a crash leads to in-leakage." However, discussion with ETC staff revealed the existence of events that can cause the simultaneous failure of more than one centrifuge. The inspectors determined that the licensee did not have any detailed operating experience data to substantiate assertions about common-cause failures among centrifuges, nor did it address possible common-cause failures resulting from an air leak.

The inspectors reviewed instrumentation diagrams associated with the product cylinder pressure instrumentation (relied on to alert operators of the need to vent) and MFS and

discussed them with plant electrical engineers. The inspectors determined that these systems consisted of multiple redundant sensors going to redundant Programmable Logic Controllers before being fed to the Plant Control System (PCS). The inspectors determined that the redundant architecture of these control systems was such that there does not appear to be a single-point failure of instrumentation that would allow a large air leak to go undetected. The inspectors did however note that the event table's reliance on these control systems appears contrary to the commitment in Section 3.2.5.2 of the License Application that "[t]he fact that an event is not 'credible' must not depend on any facility feature that could credibly fail to function." For reasons stated above—the failure to demonstrate the unlikelihood and independence of events credited in the "sequence of many unlikely events or errors," the lack of proceduralized controls relied on the interrupt the slow accumulation of uranium, the lack of a documented technical basis for key parts of the incredibility argument, and the reliance on engineered facility features and human actions that could credibly fail to function—the inspectors note that additional understanding about the licensee's implementation of its ISA methodology is needed, and therefore violations 70-3103/2011-201-01 and 70-3103/2011-201-02 remain open.

The inspectors were nevertheless able to conclude that an immediate safety concern does not exist in the cascade, and were able to independently determine that the scenario of accumulating an unsafe mass of uranium in an array of failed machines during the facility lifetime is not credible. The inspectors discussed the scenario with ETC staff and reviewed documentation provided by ETC. In addition, the licensee undertook the development of a calculation document that would provide a technical basis for the time required to accumulate an unsafe mass in an array of failed centrifuges. Based on the discussions with ETC, it became apparent that an air leak in the cascade can either occur inside a centrifuge or in the associated equipment outside the centrifuge. The reaction of UF_6 with atmospheric moisture is vigorous, resulting in the nearly immediate formation of uranium deposits in the vicinity of the leak, by the reaction $UF_6 + 2H_2O \rightarrow UO_2F_2 + 4HF$. If the leak occurs in the centrifuge wall itself, the deposit will occur in the centrifuge. If the leak occurs outside the centrifuge, the deposit will tend to form there, in geometrically safe equipment where it is not a criticality concern. Thus, only leaks that occur in the centrifuge wall are a concern. In this case, the failure will be confined to a single centrifuge. There are no postulated events causing a breach in the walls of several adjacent centrifuges, and therefore the occurrence of an air leak in a cluster of four or more failed machines would involve independent failures. (It must be noted that the failure of such clusters of adjacent machines is not unlikely, but the failure combined with concurrent air leaks is.) However, the majority of the water reacting with UF_6 to form the deposit will be removed as gaseous hexafluoride (HF) (four moles to every mole of uranium). Only with a sufficiently large leak could a hydrated deposit ever form. Under normal atmospheric conditions, UO_2F_2 is hygroscopic; but under a high vacuum condition as exists in the cascade, water will evaporate from the surface of the deposit and it will not be possible to achieve the hydration levels assumed in the licensee's calculations. ETC staff provided the inspectors with two papers studying the hydration level of uranyl fluoride (UO_2F_2) (in terms of the hydrogen-to-uranium ratio, or H/U) as a function of vapor pressure to show the conservative nature of its safe mass calculations (Lychev *et al.*, "Crystalline Hydrates of Uranyl Fluoride at 20°C," Journal of Soviet Radiochemistry, 32, p. 567 (1990), and Garner, "The Hydrates of Uranyl Fluoride," United Kingdom Atomic Energy Authority (UKAEA), 1961). The inspectors reviewed these documents and concluded that under high vacuum conditions, the assumed hydration level cannot be

attained. Not only will the low pressure environment cause water to evaporate from the deposit, but HF and water vapor pressure will cause pressure to rise in the vicinity of the deposit, impeding the ability of additional UF_6 to reach the deposit, as it does not have any motive force to enter a failed machine. This argument does not even take into account the additional dehydrating effect of the fluorinating environment, which will further impede hydration of the deposit. The inspectors therefore determined that the formation of large deposits in an array of failed or idled centrifuges, with sufficient hydration to result in criticality, is not credible during the facility lifetime. This is based on consideration of the high vacuum and fluorinating environment within the cascade, consideration of pressures and flow of gas within the cascade, and the physical properties of hydrates of UO_2F_2.

As an additional demonstration, the inspectors also reviewed the licensee's newly-developed analysis of the rate of mass accumulation in an array of failed centrifuges. CALC-S-00137, Rev. 0, "Cascade In-Leakage Determination (U)," dated March 26, 2012, provides a justification for the air in-leakage rate for each of the three means discussed above. The inspectors checked the equipment setpoints in document UPD02010630, Issue 5, "Cascade System Description," Appendix 2, as well as other input parameters, including supporting operating data, verifying the appropriateness of the calculation inputs and methodology. The highest leak rate from the three methods was then used by the licensee to determine a conservative mass and moderator influx rate. This was based on further conservative process assumptions, such as assuming that any water entering the cascade is retained as hydration in the deposit, rather than being reacted away as volatile HF, and on conservative calculation parameters, such as conservative relative humidity and a safe mass value based on an unrealistic H/U of 7. With these conservative assumptions and parameters, the analysis demonstrated a minimum time to exceed the subcriticality condition well in excess of the term of the license. The inspectors asked the licensee to repeat the calculation with more realistic inputs, which resulted in a time period several times longer still. Based on this, the inspectors determined that criticality from this scenario is not credible during the facility lifetime.

URI 70-3103/2011-201-03 concerned the licensee's extent of condition to determine if similar accident sequences to the one above had been improperly omitted from the ISA Summary on the basis of not being credible. The inspectors reviewed the licensee's Detailed Apparent Cause Evaluation (DACE) CA-3-1000-02-F-02, "Detailed Apparent Cause Evaluation CR Number: 2011-3336," which contained a summary of the licensee's extent of condition review. The licensee's DACE uncovered only one example where an incredibility argument was not consistent with the definition in SAR Section 3.2.5.2. This was in Section 3.4.9.2.6 of the ISA Summary for the Cylinder Receipt and Dispatch Building (CRDB) Gaseous Effluent Vent System. However, the example is consistent with the broader revised definition of "not credible" in SAR Section 3.2.5.2. The licensee also discovered some cases in which it determined that the methodology was properly followed, but where the justification was not as clear as it could be. The licensee initiated Condition Reports to clarify the discussion of these events in applicable nuclear criticality safety analyses. Because the licensee performed an extent of condition review and took appropriate actions, the item is closed.

IFI 70-3103/2011-201-04 concerned inaccurate language in Section 3.4.3.8.1 regarding the scenario of criticality in an array of failed machines. The inspectors reviewed the revised discussion and determined that it was adequate. This item is therefore closed.

The inspectors note that technical issues remain with the licensee's implementation of its methodology for concluding that events are not credible, and with the documented basis for incredibility for the scenario discussed above. However, as the URI and IFI above involve the same underlying issues as the two violations, they are therefore being closed to the violations, which will remain open.

URI 70-3103/2011-201-05

During a previous inspection the inspectors examined the licensee's evaluation of the ventilated storage room (VSR) CR 2010-2211 event for reportability in accordance with Title 10 of the *Code of Federal Regulations* (10 CFR) 70 Appendix A. The licensee had found a non safe-by-design container with parts that had been exposed to enriched material being stored outside the UF_6 Handling Area VSR. The licensee's evaluation had determined that neither IROFS14b nor the requirements of NCS-CSE-022 were violated. IROFS14b establishes restrictions on the movement of waste containers in the vicinity of storage arrays, and is not applicable to this event. NCS-CSE-022 is the NCSE for the VSR in the UF_6 handling area. The analysis demonstrates that this process will remain subcritical even with the most reactive equipment stored outside the room. The only requirement limiting the material stored outside the VSR is the NCS posting. Therefore, the inspectors questioned whether this event should have been reported under 10 CFR 70 Appendix A.

The licensee reevaluated the event for reportability in CR-2011-0774 and restated the performance requirements were not exceeded. This determination was based on the bounding model of NCS-CSE-022 that demonstrated subcriticality even with the most reactive equipment outside the room. While this addresses the requirements of 10 CFR 70.61(d), the performance requirements also require that engineered or administrative controls be established to ensure that criticality will be highly unlikely. The licensee's evaluation of whether the performance requirements were exceeded did not consider whether controls were in place to ensure that the process would be subcritical under normal and credible abnormal conditions.

During this inspection the inspectors discussed the VSR event with the licensee. The licensee in the discussions again pointed to the NCSE for the VSR but also pointed to its recent event notification (EN 47131), which is discussed above. The licensee had taken the correct approach for the event in the mass spec room. The licensee had recently changed its approach on evaluating reportable events to consider meeting all aspects of 10 CFR 70.61 and not just limit the evaluation to 10 CFR 70.61(d). The inspectors determined that the VSR event involved material being stored outside of the VSR and that there were controls in place to ensure that when material was entering the VSR that checks would have happened to ensure that no material was stored outside of the VSR. Due to the other controls (IROFS 14b, operator training on handling of SNM, and controls on operating the cascade) being in place, the inspectors determined that the licensee was not required to report the event under 10 CFR 70 Appendix A. This item is closed.

URI 70-3103/2011-005-01

During a previous inspection the inspectors observed that the licensee had in place an "operator work-around" log that implemented compensatory actions after identifying some areas outside SBM-1001 but within the CAAS IEZ that did not meet the audibility requirement using the existing system alarms. As a compensatory action, in the event of a CAAS actuation, operators in the control room would have used the public announcement system to alert personnel to evacuate the affected areas.

The inspectors questioned whether the compensatory measure met the requirements of the licensee's commitment to Regulatory Guide 3.71. The licensee performed some audibility testing and implemented some additional compensatory actions to restrict access to the affected areas. The licensee also intended to expedite the implementation of a plant modification to augment the CAAS to provide audibility in those areas.

During this inspection, the inspectors verified that the licensee had updated its calculations for the IEZ around the CRDB. The licensee had also performed testing of the audibility of the CAAS to ensure it was meeting the requirements of ANSI/ANS-8.3-1997, CAAS. The standard states that the audio generators should produce an overall sound pressure not less than 10 dB above the ambient noise level. 10 CFR 70.24 states in part that the licensee will use gamma- or neutron-sensitive radiation detectors which will energize clearly audible alarm signals if accidental criticality occurs. During the testing of the CAAS the licensee demonstrated that the sound pressure was less than 10 dB above the ambient noise level but was clearly audible. The 10 dB above ambient noise level is a recommendation in ANSI/ANS-8.3-1997 and is not a requirement. The licensee was in compliance with 10 CFR 70.24 when it was able to demonstrate that the CAAS was clearly auditable in the IEZ during testing. This item is closed.

7.0 Exit Meeting

The inspectors communicated observations and findings to the licensee's management and staff throughout the week of the inspection and presented the final results to management during an exit meeting held on March 22, 2012. The licensee's management acknowledged the results of the inspection and understood the findings presented.

SUPPLEMENTARY INFORMATION

1.0 Items Opened, Closed, and Discussed

Items Opened

None

Items Closed

URI 70-3103/2011-201-03	Tracks the licensee's extent of condition for determining if there are accident sequences that have been omitted from the ISA summary.
IFI 70-3103/2011-201-04	Tracks the licensee's commitment to update Section 3.4.3.8.1 of the ISA Summary to remove inconsistencies.
URI 70-3103/2011-201-05	Tracks the licensee's use of subcriticality as the sole screening criterion for determining whether the performance requirements were met for the purposes of determining reportability.
URI 70-3103/2011-005-01	Further review of the adequacy of the licensee's compensatory measures and implementation of the plant modification to address areas in the plant where CAAS audibility was not provided.

Items Discussed

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

2.0 Event Reports Reviewed

EN 47131	**CLOSED**	Potentially contaminated wasted being stored in an unmarked container in the mass spec room.

3.0 Inspection Procedures Used

IP 88015	Nuclear Criticality Safety Program
IP 88016	Nuclear Criticality Safety Evaluations and Analyses

4.0 Key Points of Contact

LES

A. Bridges	HS&E CSO
J. Dahlin	HS&E
J. Geiger	ETUS
G. Higgs	Plant Engineering
R. Kohrt	Plant Engineering Supervisor
D. Lakin	Performance Assessment
R. Lehman	Plant Engineering Supervisor
P. McCasland	Licensing
J. Muth	Quality Assurance
E. Parkes	Plant Engineering
O. Parry	ETC UK
Z. Rad	Licensing Manager
J. Rollins	Licensing
J. Weaver	Licensing
R. Williams	Operations Manager

NRC

T. Hiltz	Branch Chief
T. Marenchin	Criticality Safety Inspector
C. Tripp	Criticality Safety Inspector
S. Whaley	Criticality Safety Inspector

5.0 List of Acronyms and Abbreviations

ACE	apparent cause evaluation
CAB	Centrifuge Assembly Building
CAAS	criticality accident alarm system
CR	Condition Report
CRDB	Cylinder Receipt and Dispatch Building
CSO	Criticality Safety Officer
CTF	Centrifuge Test Facility
DACE	detailed apparent cause evaluation
ETC	Enrichment Technology Corporation
ETUC	Enrichment Technology US
GEVS	gaseous effluent ventilation system
HS&E	health, safety, and environment
IEZ	immediate evacuation zone
IFI	Inspection Follow-up Item
IROFS	items relied on for safety
ISA	integrated safety analysis
LAR	license amendment request
MFS	Medium Frequency System
NCS	nuclear criticality safety

NCSA	nuclear criticality safety analysis
NCSE	nuclear criticality safety evaluation
NSR	nuclear safety release
ORR	operational readiness review
PCS	plant control system
PLC	programmable logic controller
QA	quality assurance
SAR	Safety Analysis Report
SBD	Safe-by-Design
SBM	separation building module
SNM	special nuclear material
URI	Unresolved Item
VSR	ventilated storage room