

UNITED STATES NUCLEAR REGULATORY COMMISSION REGION II 245 PEACHTREE CENTER AVENUE NE, SUITE 1200 ATLANTA, GEORGIA 30303-1257

April 12, 2012

Mr. Peter J. Miner Director Regulatory and Quality Assurance USEC Inc. 6903 Rockledge Drive Bethesda, MD 20817

SUBJECT: USEC INC. (LEAD CASCADE) – NRC INSPECTION REPORT NO. 70-7003/2012-006 AND NOTICE OF VIOLATION

Dear Mr. Miner:

This letter refers to the inspection conducted from January 30 through March 30, 2012, at the USEC Inc. Lead Cascade Facility in Piketon, Ohio. The purpose of the inspection was to perform a followup review of an event that occurred on June 11, 2011, which resulted in multiple centrifuge failures and to determine whether activities authorized under the license were conducted safely and in accordance with Nuclear Regulatory Commission (NRC) requirements. At the conclusion of the inspection on March 30, 2012, the findings were discussed with members of your staff.

The inspection consisted of an examination of activities as they relate to safety and compliance with the Commission's rules and regulations and with license conditions. Within these areas, the inspection consisted of a selective examination of procedures and representative records, observations of activities, and interviews with personnel.

The NRC identified five violations of regulatory requirements during the inspection. The violations involved failure to identify and analyze a potential accident sequence, implementing a change without analyzing the safety impact, failure to establish operating procedures to be used to directly control off-normal operations, failure to determine the specific generic implications for the event, and failure to determine the cause of the condition and corrective actions to preclude recurrence. All of these violations were determined to be Severity Level IV violations which are considered as those that are less serious, but are of more than minor concern, that resulted in no or relatively inappreciable potential safety or security consequences.

These violations were evaluated in accordance with the NRC Enforcement Policy. The current Enforcement Policy is available on the NRC's Web site at <u>www.nrc.gov/about-nrc/</u> <u>regulatory/enforcement/enforce-pol.html</u>. These violations are cited in the enclosed Notice of Violation (Notice), and the circumstances surrounding them are described in the subject inspection report. The violations are being cited in the Notice because they were identified by the NRC.

If you contest the violations or the significance, you should provide a response within 30 days of the date of this inspection report, with the basis for your denial, to the Nuclear Regulatory Commission, ATTN: Document Control Desk, Washington, DC 20555-0001, with copies to the Regional Administrator, Region II, and the Director, Office of Enforcement, United States Nuclear Regulatory Commission, Washington, DC 20555-0001.

You are required to respond to this letter and should follow the instructions specified in the enclosed Notice when preparing your response. For your consideration in presenting the corrective actions, the guidance from NRC Information Notice 96-28, Suggested Guidance Relating to Development and Implementation of Corrective Action, is available on the NRC website and may be helpful. The NRC will use your response, in part, to determine whether further enforcement action is necessary to ensure compliance with regulatory requirements.

In accordance with 10 CFR 2.390 of NRC's "Rules of Practice," a copy of this letter and its enclosure will be made available electronically for public inspection in the NRC Public Document Room or from the NRC's document system (ADAMS), accessible from the NRC Web site at http://www.nrc.gov/reading-rm/adams.html.

If you have any questions, please contact me at (404) 997-4418.

Sincerely,

/RA/

Joselito O. Calle, Chief Fuel Facility Inspection Branch 2 Division of Fuel Facility Inspection

Docket No. 70-7003 License No. SNM-7003

Enclosures:

- 1. Notice of Violation
- 2. NRC Inspection Report No. 70-7003/2012-006

cc w/encls: (See page 3)

If you contest the violations or the significance, you should provide a response within 30 days of the date of this inspection report, with the basis for your denial, to the Nuclear Regulatory Commission, ATTN: Document Control Desk, Washington, DC 20555-0001, with copies to the Regional Administrator, Region II, and the Director, Office of Enforcement, United States Nuclear Regulatory Commission, Washington, DC 20555-0001.

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cc w/encls: (See page 3)

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| ADAMS: x Yes | ACCESSION NUM | 1BER: ML12103A383 | x SUNSI REVIEW COMPLETE | K FORM 665 ATTACHED |

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| DATE | 4/11/12 | 4/11/12 | 4/11/12 | 4/ /2012 | 4/ /2012 | 4/ /2012 | 4/ | /2012 |
| E-MAIL COPY? | YES NO | YES NO | YES NO | YES NO | YES NO | YES N | O YES | NO |

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cc w/encls: Dan Rogers General Manager American Centrifuge Plant Operations USEC Inc. Electronic Mail Distribution

Terry Sensue Regulatory Manager American Centrifuge Plant USEC Inc. Electronic Mail Distribution

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Letter to Mr. Peter J. Miner from Joselito O. Calle dated April 12, 2012

SUBJECT: USEC INC. (LEAD CASCADE) – NRC INSPECTION REPORT NO. 70-7003/2012-006 AND NOTICE OF VIOLATION

Distribution w/encls: B. Smith, NMSS D. Hartland, RII J. Calle, RII

NOTICE OF VIOLATION

USEC Inc. American Centrifuge Lead Cascade Facility Docket No. 70-7003 License No. SNM-7003

During a Nuclear Regulatory Commission (NRC) inspection conducted on January 30 through March 30, 2012, five violations of NRC requirements were identified. In accordance with the NRC Enforcement Policy, the violations are listed below:

- A. 10 CFR 70.62(c) states, in part, that each licensee shall conduct and maintain an integrated safety analysis, that is of appropriate detail for the complexity of the process, including but not limited to:
 - 10 CFR 70.62 (c)(iv) potential accident sequences caused by process deviations or other events internal to the facility.
 - 10 CFR 70.62 (c)(v) the consequence and the likelihood of occurrence of each potential accident sequence identified pursuant to paragraph (c)(iv) of this section, and the methods used to determine the consequences and likelihoods.

Contrary to the above, as of June 11, 2011, the licensee failed to identify a potential accident sequence caused by an event internal to the facility and the consequence and the likelihood of occurrence of the potential accident sequence. Specifically, the licensee failed to evaluate in the integrated safety analysis the consequences and the likelihood of occurrence of multiple centrifuge casing breaches as a result of partial loss of power.

This is a Severity Level IV violation (Section 6.2).

B. 10 CFR 70.72 requires, in part, that any change to systems must be evaluated for impact to the integrated safety analysis prior to implementing the change.

Contrary to above, on June 11, 2011, the licensee implemented a change to a system which rendered the machine isolation valves, an item relied on for safety (IROFS), unable to perform its intended safety function without having evaluated for impact to the integrated safety analysis prior to implementing the change.

This is a Severity Level IV violation (Section 6.2).

C. License Condition No 10, in License Number SNM-7003, Amendment 5, dated October 30, 2008, states, in part, that the licensee shall conduct authorized activities in accordance with the statements, representations and conditions in the License Application dated February 11, 2006, and subsequent revisions.

Section 11.4.4.2 of the License Application, "Procedure Development," Revision (Rev.) 42, states, in part, that operating procedures are used to directly control process operations at the workstation and include, as necessary, direction for off-normal operations caused by failure of an IROFS or human error.

Contrary to the above, as of June 11, 2011, the licensee failed to establish operating procedures to be used to directly control process operations at the workstation and include direction for off-normal operations caused by failure of an IROFS or human error. Specifically, during the June 11, 2011 centrifuge failure event, there were multiple examples where operating procedures were not provided for off-normal operations including restoration of the uninterrupted power supply and guidance to override Secondary Isolation System logic without affecting Machine Isolation Valves.

This is a Severity Level IV violation (Section 6.2).

D. License Condition No 10, in License Number SNM-7003, Amendment 5, dated October 30, 2008, states, in part, that the licensee shall conduct authorized activities in accordance with the statements, representations and conditions in the License Application dated February 11, 2006, and subsequent revisions.

Section 11.6.4 of the License Application, "Conduct of Incident Investigations," Rev. 42, states, in part, that a reasonable, systematic, structured approach is used to determine the specific or generic root causes and generic implications of abnormal events.

Contrary to the above, during the root cause investigation for the June 2011 abnormal event, as documented in Special Inspection Report, SIR-2101-0002, "June 11, 2011 Event at the American Centrifuge Demonstration Facility (Lead Cascade)," Rev. 0, dated July 18, 2011, Rev. 1, dated January 11, 2012, and Rev. 2, dated March 21, 2012, the licensee did not determine the generic implications, specifically extent of cause reviews, for the root causes indentified.

This is a Severity Level IV violation (Section 6.2).

E. License Condition No 10, in License Number SNM-7003, Amendment 5, dated October 30, 2008, states, in part, that the licensee shall conduct authorized activities in accordance with the statements, representations and conditions in the Quality Assurance Program Description dated June 30, 2006, and subsequent revisions.

Section 16.0 of the Quality Assurance Program Description, "Corrective Action," Rev. 14, states, in part, that for a Significant Condition Adverse to Quality, the cause of the condition is determined, and corrective action is taken to preclude recurrence.

Contrary to the above, as of March 30, 2012, the licensee failed to determine the cause of the condition and take corrective action to preclude recurrence for a Significant Condition Adverse to Quality. Specifically, the licensee did not effectively determine the cause and take corrective action to prevent recurrence for the June 11, 2011 centrifuge failure event as documented in Special Inspection Report, SIR-2101-0002, "June 11, 2011 Event at the American Centrifuge Demonstration Facility (Lead Cascade)," Rev. 0, dated July 18, 2011, Rev. 1, dated January 11, 2012, and Rev. 2, dated March 21, 2012.

This is a Severity Level IV violation (Section 6.2).

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Pursuant to the provisions of 10 CFR 2.201, USEC Inc. is hereby required to submit a written statement or explanation to the U.S. Nuclear Regulatory Commission, ATTN: Document Control Desk, Washington, DC 20555, with copies to the Chief, Technical Support Group, Division of Fuel Cycle Safety and Safeguards, NMSS, and the Regional Administrator, Region II, within 30 days of the date of the letter transmitting this Notice of Violation (Notice). This reply should be clearly marked as a "Reply to a Notice of Violation; and should include for each violation: (1) the reason for the violation, or, if contested, the basis for disputing the violation or severity level, (2) the corrective steps that have been taken and the results achieved, (3) the corrective steps that will be taken to avoid further violations, and (4) the date when full compliance will be achieved. Your response may reference or include previously docketed correspondence, if the correspondence adequately addresses the required response. If an adequate reply is not received within the time specified in this Notice, an order or a Demand for Information may be issued as to why the license should not be modified, suspended, or revoked, or why such other action as may be proper should not be taken. Where good cause is shown, consideration will be given to extending the response time.

The NRC has concluded that information regarding the reason for Violations A and B, the corrective actions taken and planned to correct the violation and prevent recurrence, and the date when full compliance will be (was) achieved, are already adequately addressed. However, you are required to submit a written statement or explanation for Violations A and B pursuant to 10 CFR 2.201 if the description therein does not accurately reflect your corrective actions or your position. In that case, or if you choose to respond, clearly mark your response as a "Reply to a Notice of Violation," and send it to the U.S. Nuclear Regulatory Commission, ATTN: Document Control Desk, Washington, DC 20555-0001 with copies to the Chief, Technical Support Group, Division of Fuel Cycle Safety and Safeguards, NMSS, and the Regional Administrator, Region II within 30 days of the date of the letter transmitting this Notice of Violation (Notice).

If you contest this enforcement action, you should also provide a copy of your response, with the basis for your denial, to the Director, Office of Enforcement, United States Nuclear Regulatory Commission, Washington, DC 20555-0001.

Because your response will be made available electronically for public inspection in the NRC Public Document Room or from the NRC's document system (ADAMS), accessible from the NRC Web site at http://www.nrc.gov/reading-rm/adams.html to the extent possible, it should not include any personal privacy, proprietary, classified, or safeguards information so that it can be made available to the public without redaction. If personal privacy or proprietary information is necessary to provide an acceptable response, then please provide a bracketed copy of your response that identifies the information. If you request withholding of such material, you must specifically identify the portions of your response that you seek to have withheld and provide in detail the bases for your claim of withholding (e.g., explain why the disclosure of information will create an unwarranted invasion of personal privacy or provide the information required by

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10 CFR 2.390(b) to support a request for withholding confidential commercial or financial information). If safeguards information is necessary to provide an acceptable response, please provide the level of protection described in 10 CFR 73.21.

In accordance with 10 CFR 19.11, you may be required to post this Notice within two working days.

Dated at Atlanta, Georgia this12th day of April 2012

U. S. NUCLEAR REGULATORY COMMISSION

REGION II

| Docket No.: | 70-7003 |
|--------------|---|
| License No.: | SNM-7003 |
| Report No.: | 70-7003/2012-006 |
| Licensee: | USEC Inc. |
| Facility: | American Centrifuge Lead Cascade |
| Location: | Piketon, Ohio |
| Date: | January 30 - March 30, 2012 |
| Inspectors: | D. Hartland, Senior Fuel Facility Inspector O. Lopez, Senior Fuel Facility Inspector C. Jones, Senior Construction Inspector N. Coovert, Fuel Facility Inspector M. Romano, Fuel Facility Inspector |
| Approved by: | J. Calle, Chief Fuel Facility Inspection Branch 2 Division of Fuel Facility Inspection |

EXECUTIVE SUMMARY

USEC Inc. Lead Cascade Inspection Report 70-7003/2012-006

This report is a summary of the inspection of the followup to an event that occurred on June 11, 2011, which resulted in multiple centrifuge failures. The inspection was conducted from January 30 - March 30, 2012, and was a followup to the initial inspection performed from September 12 -15, 2011. The results of the inspection are contained in the details section of this report. The report details section was prepared to exclude the use of information the licensee identified as proprietary. The inspection was conducted through a review of selected records, interviews with personnel, and direct observation of activities in the area of plant operations.

Reactive Inspection for Events at Fuel Cycle Facilities

The inspectors confirmed through interviews with licensee personnel and reviews of operator logs, engineering evaluations, investigation reports, and condition notifications that the sequence of events for the June 2011 event documented by the licensee was accurate. (Section 2)

The inspectors determined the output circuit breaker for the auxiliary standby generator and the alternate supply feeder breaker to Essential Motor Control Center 13-A1-EMC1 had been demonstrated to function in accordance with design. The design for the breaker control circuitry, combined with the revised guidance of applicable operating procedures, was found to provide adequate protection for personnel and equipment. (Section 3)

The inspectors concluded that a release from multiple centrifuge casing breaches was a low consequence event. However, a violation was identified for the failure to identify a potential accident sequence caused by an event internal to the facility and the consequence and the likelihood of occurrence of the potential accident sequence as required by 10 CFR 70.62. The licensee implemented the appropriate corrective actions to address the violation. (Section 4)

The inspectors concluded that the failure of items relied on for safety (IROFS) related to the battery room (i.e., hydrogen monitoring and room ventilation) were not safety significant as 10 CFR 70.61 performance requirements were maintained. The inadvertent bypassing of the machine isolation valves (MIV) IROFS circuitry was also not safety significant as most of the process gas had previously been removed from the machines. However, one violation of 10 CFR 70.72 was identified when the licensee implemented a change which rendered the MIV IROFS unable to perform its intended safety function without having evaluated for impact to the integrated safety analysis prior to implementing the change. The licensee implemented the appropriate corrective actions to address the violation. (Section 5)

The inspectors reviewed the licensee's evaluation and corrective actions and determined that the licensee had taken the appropriate actions to address the unresolved item related to deficiencies in its training and procedures programs. However, a violation was identified for failure to have operating procedures to directly control process operations at the workstation and include, as necessary, direction for off-normal operations caused by failure of an IROFS or human error. (Section 6)

Two violations were identified during review of the licensee's investigation into the event. One was failure to perform an extent of cause review as required by Section 11.6.4 of the license application. The other was failure to determine the cause of the condition and take corrective action to preclude recurrence as required by Section 16.0 of the Quality Assurance Program Description. (Section 7)

Attachments Partial List of Persons Contacted Inspection Procedures Used List of Items Opened, Closed, and Discussed List of Documents Reviewed List of Acronyms Used

REPORT DETAILS

1. <u>Summary of Plant Status</u>

Centrifuges in the USEC Inc. Lead Cascade facility were being operated without process gas during the inspection period as the licensee was implementing corrective actions in response to the event that occurred on June 11, 2011, that resulted in the failure of multiple centrifuges. The inspectors conducted a safety walk down of the Lead Cascade facility, engaged in focused discussions with subject matter experts, and performed reviews of documentation.

2. <u>Review of Event Sequence (Inspection Procedure (IP) 88003)</u>

a. <u>Scope and Observations</u>

The inspectors performed a review to determine a sequence of events based upon interviews with licensee personnel and reviews of operator logs, engineering evaluations, investigation reports, and condition notifications.

On June 11, 2011, an operations shift supervisor initiated a routine start of a standby machine cooling water pump in order to transfer operation from the in-service pump. Upon closure of the pump breaker, a three phase electrical fault occurred on the bus of the essential motor control center (EMCC) that provided power to the pump motor. The normal supply breaker for the EMCC tripped on instantaneous overcurrent and interrupted the fault. The shift supervisor noted the pump had failed to start and observed that black smoke had accumulated over the EMCC. The on-site fire department responded and verified that the fire had self-extinguished.

Some of the loads affected by the loss of power to the EMCC included the diffusion pumps for Lead Cascade 1, the bypass transformer for the uninterruptible power supply (UPS), and the ventilation fan for the station battery room. The diffusion pumps were necessary to support operation of the centrifuge machines. The battery room fan was required to be operable as an Item Relied On For Safety (IROFS).

The control room operators implemented alarm response and off-normal procedures, in effect, which included the initiation of the removal of process gas from the centrifuge systems. As guided by procedure, operators also started the auxiliary standby generator (ASG). The operators then made repeated attempts to tie the generator to the faulted EMCC but were initially unsuccessful. Operators ultimately closed the alternate supply feeder breaker using the manual breaker control.

After reviewing licensee system drawings, the inspectors questioned whether the control circuitry for the generator output breaker and the alternate supply feeder breakers functioned in accordance with design. In addition, inspectors also questioned whether the design provided adequate protection for personnel and equipment. An unresolved item (URI 70-7003/2011-007-01) was identified during the previous inspection regarding further review of the control circuitry for the auxiliary standby generator breakers.

During the efforts to re-energize the EMCC, the shift supervisor at the scene responded to the UPS panel to acknowledge a general trouble alarm. However, instead of acknowledging the alarm, the individual mistakenly opened a protective cover and actuated the UPS shutdown pushbutton. Because the bypass transformer was still deenergized, power was lost to the 120 VAC loads served by the UPS.

Some of the vital loads powered by the UPS included centrifuge machine components and controls, the Distributed Control System (DCS), and the hydrogen concentration monitor for the battery room which was an IROFS. The loss of the DCS resulted in a loss of all process indications and operator controls in the main control room. Within a few minutes, four centrifuge machines crashed and one of the machine casings for a machine that did not contain process gas was breached.

During a review of the licensee's Integrated Safety Analysis (ISA) Summary, the inspectors noted the licensee assumed that, upon a loss of all electric power, the centrifuges could potentially wreck but that a breach of the casings would not result. The inspectors identified a potential unreviewed safety question since electrical power and centrifuge casings were not designated as IROFS and, therefore, the integrity of the casings could not be relied upon to remain intact as a result of a prolonged loss of power as demonstrated by the casing that was breached. URI 70-7003/2011-007-02 was identified during the previous inspection regarding the licensee's analysis of the potential unreviewed safety question involving multiple centrifuge casing breaches upon loss of electric power.

Due to an inadequate procedure and lack of familiarity with operation of the UPS, operators experienced a significant delay in re-powering the UPS loads. After the system was restored, operator unfamiliarity with the DCS system and a lack of procedural guidance also caused a further delay in resetting the DCS and gaining normal operational control of the centrifuge systems.

Due to the delay in restoring functionality of DCS controls, licensee personnel opened a local electrical panel at the centrifuge machines and manually bypassed some protective circuitry in order to apply logic permissives that opened machine isolation valves which were IROFS. This had the effect of disabling IROFS protective features for approximately 45 minutes. During this period, two additional centrifuges crashed due to factors not associated with the disabled IROFS features.

Approximately five hours into the event, functionality of DCS controls in the control room was fully restored and the faulted EMCC returned to service. Operators successfully proceeded to stabilize conditions in the Lead Cascade.

The inspectors reviewed the licensee's investigation into the event and determined that it took the appropriate corrective actions to address each of the procedure and operator training deficiencies individually. However, the inspectors noted that the licensee did not address in its investigation the apparent weaknesses in its procedure and training programs that resulted in the multiple deficiencies. URI 70-7003/2011-007-03 was identified during the previous inspection regarding the licensee's further review of the adequacy of its procedure and operator training programs.

b. Conclusion

The inspectors confirmed through interviews with licensee personnel and reviews of operator logs, engineering evaluations, investigation reports, and condition notifications that the sequence of events for the June 2011 event documented by the licensee was accurate. No findings of significance were identified.

3. <u>Review of Electrical Control Circuitry</u>

a. <u>Scope and Observations</u>

URI 70-7003/2011-007-01 was documented to review the electrical control circuitry for the output circuit breaker for the ASG and the alternate supply feeder breaker to EMCC 13-A1-EMC1. The review was to determine whether the control circuitry for the ASG output breaker and the alternate supply feeder breakers functioned in accordance with design during the June 2011 partial loss of power event. In addition, inspectors also evaluated whether the design provided adequate protection for personnel and equipment.

The licensee's investigation of the June 2011 event identified that operators made repeated unsuccessful attempts to tie the standby generator to the faulted EMCC. In each instance, the EMCC alternate supply breaker did not close automatically, and operators proceeded to attempt closure by actuating a manual close mechanism that was provided inside of the breaker as a maintenance feature. During the initial review, the inspectors determined that the failure to automatically close did not appear to be consistent with the design of the breaker control circuitry.

As followup, the inspectors interviewed licensee personnel and reviewed Condition Notification (CN) 4793 which indicated that the licensee had since conducted as-built verifications of electrical control circuitry, updated design drawings as needed, and implemented a special test of the breaker control circuitry to demonstrate proper functioning of equipment. The test results were documented in Test Plan TP-2201-0044, "Verify X-3001 Train 3 ASG Feeder Breaker Closing Control Circuit (ESO-2201-0047)."

The inspectors found that the operating configurations and test sequences of the test plan were sufficiently consistent with the current versions of the electrical control drawings. The record of the test results was ambiguous and did not indicate whether the breaker closure was accomplished manually or occurred automatically as required by design. However, an interview with licensee personnel indicated that the alternate supply breaker to EMCC 13-A1-EMC1 had, in fact, automatically closed when the standby generator output breaker was closed concurrent with the normal supply breaker to the EMCC being open.

Interviews with licensee personnel established that they were not certain why the alternate supply breaker did not automatically close during the June 2011 event as designed. However, the inspectors determined that the results of the special test sufficiently demonstrated proper functionality of the controls as of November 2011.

The inspectors noted that the use of the circuit breaker internal maintenance closure mechanism to close the breaker onto a faulted motor control center effectively bypassed protective features of the control circuit design. The inspectors also determined the bypassing of the breaker close interlocks and the repeated attempts to re-energize the

faulted bus introduced a workplace safety concern. Respectively, the actions were inconsistent with the guidance for safe work practices contained in Sections 130.3 and 130.6 of the industry consensus standard NEC/NFPA 70E, "Standard for Electrical Safety in the Workplace."

As a corrective action, the licensee revised Procedure AC4-OP-012, "Operation of the Lead Cascade Auxiliary Standby Generator (ASG)," to no longer permit the use of the internal maintenance closure mechanism. Procedure AC4-ON-009, "Loss of Power," was also revised to provide electrical switching guidance that was generally consistent with NEC/NFPA 70E. The inspectors determined that the workplace safety concern did not represent an issue of nuclear safety significance because the design and operation of the standby electrical supply was not relied on to accomplish the safety functions defined in the safety analysis.

b. Conclusion

The inspectors determined the output circuit breaker for the ASG and the alternate supply feeder breaker to EMCC 13-A1-EMC1 had been demonstrated to function in accordance with design. The design for the breaker control circuitry, combined with the revised guidance of applicable operating procedures was found to provide adequate protection for personnel and equipment. URI 70-7003/2011-007-01 is closed to this inspection. No findings of significance were identified.

4. Evaluation of Unreviewed Safety Question

a. <u>Scope and Observations</u>

The inspectors reviewed the licensee's response to URI 70-7003/2011-007-02, "Licensee's Analysis of the Potential Unreviewed Safety Question Involving Multiple Centrifuge Casing Breaches upon Loss of Electric Power." In response to the URI, the licensee added accident sequence CP3-8a to the ISA to document the potential consequence of multiple centrifuge casing breaches. The license performed a series of consequence calculations that demonstrated that after multiple centrifuge casing breaches, the resulting release would not exceed the 10 CFR 70.61 performance requirements.

The inspectors noted that in the calculation, the licensee assumed a release from all 240 machines with full inventory and also accounted for material in the interconnecting piping. In addition, the licensee assumed a constant temperature throughout the release, which was conservative because the temperature would decrease during the release due to heat losses to the environment and would slow the rate of release.

The inspectors noted that it would take a breach many times bigger than the breach that occurred on June 11, 2011, for the release to reach a consequence of concern. Based on documentation reviewed and interviews with licensee personnel, the inspectors determined that machines did not have the necessary internal components to cause a breach of the required size to exceed the low consequence threshold. The inspectors also determined that the licensee's evaluation did not rely on specific design features considered to be IROFS that would prevent such a release from occurring. Therefore, the inspectors concluded that a release from multiple centrifuge casing breaches was a low consequence event.

However, the inspectors determined that the licensee failed to analyze in the ISA a release from multiple centrifuge casing breaches prior to the June 2011 event. 10 CFR 70.62(c) requires, in part, that each licensee or applicant shall conduct and maintain an ISA that was of appropriate detail for the complexity of the process, including but not limited to potential accident sequences caused by events internal to the facility and the consequence and the likelihood of occurrence of each potential accident sequence identified. The failure to identify a potential accident sequence caused by an event internal to the facility and the consequence and the likelihood of occurrence of the potential accident sequence was considered a violation of NRC requirements (VIO 70-7003/2012-006-01).

b. Conclusions

The inspectors concluded that a release from multiple centrifuge casing breaches was a low consequence event. However, a violation was identified for the failure to identify a potential accident sequence caused by an event internal to the facility and the consequence and the likelihood of occurrence of the potential accident sequence as required by 10 CFR 70.62. The licensee implemented the appropriate corrective actions to address the violation.

5. <u>Review of IROFS Failures</u>

a. <u>Scope and Observations</u>

The inspectors also evaluated the adequacy of the licensee's ISA to determine whether 10 CFR 70.61 performance requirements were met for this and related accident scenarios. The loss of power to the EMCC resulted in the loss of an IROFS related to forced air ventilation in the battery room. In addition, when the UPS was inadvertently de-energized, the licensee lost the hydrogen concentration monitors for the battery room which was also an IROFS. The inspectors determined that mitigative IROFS related to emergency response actions during a release were maintained to ensure that the performance requirements were met.

The inspectors determined the failure of the IROFS to be of low safety significance. The inspectors reviewed calculations that demonstrated that the battery room would have to be operating at full capacity with no ventilation for more than a week before hydrogen levels could reach a concentration of concern. In addition, the inspectors noted that forced air ventilation was de-energized for only approximately 10 hours. The inspectors also noted that with the loss of power to the EMCC, the production of hydrogen was reduced significantly.

During its event investigation, the licensee determined that the failure of the hydrogen monitoring system was a reportable event (EN 47014) because there were no redundant equipment available to perform the required safety function. The licensee issued the event report because the failure criteria for the IROFS surveillance did not account for a momentary loss of power or monitoring for a period of time. As a corrective action, the licensee revised the IROFS technical basis to establish a compensatory measure if it was not available due to unplanned conditions (i.e. loss of power). In addition, the licensee developed lesson plans and provided training related to developing IROFS surveillances. This event report is considered closed.

During the event, licensee personnel opened a local electrical panel at the centrifuge machines with the intent to manually bypass non-safety related secondary isolation system (SIS) circuitry, open machine isolation valves (MIVs), and restore the ability to vent light gases from the machines. Instead, personnel inadvertently bypassed circuitry related to the machine isolation system (MIS) which rendered the MIV IROFS inoperable for less than an hour before the error was identified and corrected.

The inspectors identified that the error was not safety significant as most of the process gas had previously been removed from the machines. However, 10 CFR 70.72 requires, in part, that any change to systems must be evaluated for impact to the integrated safety analysis prior to implementing the change. Contrary to this, on June 11, 2011, the licensee implemented a change which rendered the MIV IROFS unable to perform its intended safety function without having evaluated the impact to the integrated safety analysis prior to implementing the change. This is a violation (VIO 70-7003/2012-006-02).

As corrective action, the licensee developed a lessons-learned for applicable staff to stress that, when determinations are made that new design configurations or procedures are needed, the changes are required to be routed through the review and approval process to ensure they are properly evaluated before implementation. The licensee also implemented a hard-wired modification which would allow operators to bypass the SIS circuitry in the future without impacting the MIV IROFS. The inspectors reviewed these actions and had no further issues.

b. Conclusion

The inspectors concluded that the failure of IROFS related to the battery room (i.e., hydrogen monitoring and room ventilation) were not safety significant as 10 CFR 70.61 performance requirements were maintained. The inadvertent bypassing of the MIV IROFS circuitry was also not safety significant as most of the process gas had previously been removed from the machines. However, one violation of 10 CFR 70.72 was identified when the licensee implemented a change which rendered the MIV IROFS unable to perform its intended safety function without having evaluated the impact to the integrated safety analysis prior to implementing the change. The licensee implemented the appropriate corrective actions to address the violation.

6. <u>Review of Procedure and Training Programs</u>

a. <u>Scope and Observations</u>

The inspectors reviewed the licensee's analysis and actions taken in response to URI 70-7003/2011-007-03. The inspectors reviewed the licensee's root cause investigation, Special Inspection Report (SIR)-2101-0002, Revision (Rev.) 0, dated July 18, 2011, and were concerned that the licensee was only addressing the individual procedure and operator training deficiencies and had not evaluated programmatic weaknesses with training and procedures as part of their root cause. The URI was opened to track the potential programmatic deficiencies existing in these two programs.

The inspectors evaluated the programs that existed prior to the June 2011 event, the corrective actions taken after the event, and the corrective actions taken after the URI was documented. As part of this inspection, the inspectors interviewed the following personnel: licensee management and staff who wrote, revised, and approved training

modules and procedures; select individuals in Operations and Maintenance on site the day of the event who attended training and used applicable procedures; and, the Operations and the Training and Procedures Managers.

The inspectors reviewed the licensee's performance-based training which was similar to Systematic Approach to Training used commonly in the industry. The inspectors discussed with the Training Manager and staff the tools the licensee had in place to analyze, design, develop, implement, and evaluate training modules. Additionally, the inspectors reviewed the methodology and requirements for specific procedure levels and training rigor that the licensee applied in four categories: no train, just in time train, train, and overtrain. The inspectors reviewed how the procedures flowed down to training in the Task-to-Train Procedure Matrix. The inspectors attended table top job analysis training held on site during the inspection.

The inspectors also interviewed two Shift Supervisors and several Operations and Maintenance personnel in the control room regarding their training for pre-qualification, initial qualification, routine, on-the-job, normal, off-normal, alarm, on-going training, and re-qualification. The inspectors reviewed the qualification records for each staff member interviewed. Since the previous followup inspection conducted in September 2011, the inspectors noted that additional training had been provided, including organized drills and critiques, human performance, and Failure Mode and Effects Analysis (FMEA) training.

The inspectors reviewed the procedure process for creating, reviewing, revising, and approving procedures and discussed it with the licensee's Procedure Manager. As followup to the June 2011 event, the licensee identified several examples of poor procedure development, incorrect information in procedures, and inadequate off-normal and alarm procedures. Many of these were cited in the licensee's evaluation of the unresolved item, "Conduct of Operations: Programmatic deficiencies including inadequate operator training and procedures," dated December 14, 2011.

The inspectors reviewed the corrective actions the licensee implemented to address the deficiencies documented in its evaluation. Several significant corrective actions that had been implemented since that time were: a review of all applicable procedures, specifically for off-normal and alarm conditions; a clarification of when cross-disciplined reviews were necessary in procedure changes; and the flow down of the program enhancements implemented, including the use of FMEA.

The inspectors reviewed the licensee's evaluation and corrective actions and determined that it had taken the appropriate actions to address the URI. However, Section 11.4.4.2 of the License Application, "Procedure Development," stated, in part, that operating procedures were used to directly control process operations at the workstation and include, as necessary, direction for off-normal operations caused by failure of an IROFS or human error. Contrary to this, the inspectors concluded that, prior to the June 2011 event, operating procedures were not used to directly control process operations at the workstation and include, as necessary, direction for off-normal operations could by failure of an IROFS of human error. This is a violation of Section 11.4.4.2 of the License Application (VIO 70-7003/2012-006-03).

b. Conclusion

The inspectors reviewed the licensee's evaluation and corrective actions and determined that the licensee had taken the appropriate actions to address the URI. However, a violation was identified for failure to have operating procedures to directly control process operations at the workstation and include, as necessary, direction for off-normal operations caused by failure of an IROFS or human error.

7. <u>Review of Root Cause Investigation</u>

a. <u>Scope and Observations</u>

The inspectors performed a review of the licensee's root cause investigation, generic implications, including extent of condition and extent of cause, and the licensee's corrective actions to prevent recurrence. In addition, the inspectors performed an independent root cause analysis (RCA) due to the complexity of the event.

Review of the Licensee's Root Cause Investigation

The licensee performed a root cause investigation using REASON methodology. Since the June 2011 event, the licensee performed three revisions to the investigation: SIR-2101-0002, "June 11, 2011 Event at the American Centrifuge Demonstration Facility (Lead Cascade)," Rev. 0, dated July 18, 2011, Rev. 1, dated January 11, 2012, and Rev. 2, dated March 21, 2012.

The licensee completed Rev. 0 of SIR-2101-0002 which was reviewed during the inspectors' initial followup inspection in September 2011. Following that inspection, the licensee revised its root cause investigation (Rev. 1) and submitted it to the NRC in January 2012. As part of this inspection, the inspectors reviewed both Rev. 0 and Rev. 1. As part of inspectors' request for additional information during the inspection, the licensee submitted Rev. 2 in March 2012. The changes in Rev. 2 are evaluated below and did not change the overall conclusions of the inspectors' findings.

The inspectors evaluated the licensee's root cause investigation for adequacy. For Rev. 0 and Rev. 1 of SIR-2101-0002, the licensee determined that the four root causes of the June 11, 2011 event were: (1) the enrichment operations organization had the opportunity to perform the preventative maintenance (PM) on the normal schedule; (2) the predictive maintenance (PdM) activity had the opportunity to identify the loose connections; (3) the procedure development process had an opportunity to identify this scenario; and (4) the design review process had the opportunity to identify this human factor issue. For Rev. 2 of SIR-2101-0002, the licensee revised the fourth root cause to read that the operations employee had the opportunity to make use of the stop, think, ask, act, review (STAAR) principle before taking action.

The inspectors determined that root causes (1) and (2) were not adequate. The root causes were based on the electrical fault that occurred on the EMCC bus during the routine swap of machine cooling water (MCW) pumps. As a result, the upstream feed breaker from the auxiliary substation to the EMCC tripped, de-energizing the entire EMCC and the associated system components.

The inspectors determined that root causes (1) and (2) were not adequate for two reasons. The first reason was that the failure of the bus and the subsequent loss of

EMCC was an initiating event as the inspectors concluded that the licensee was capable, in a timely manner, of restoring from the loss of an EMCC without the end result of crashing six centrifuges.

The second reason was that PM and PdM activities were defined as methods used for the purpose of maintaining equipment in satisfactory operating condition by providing for systematic inspection, detection, and correction of incipient failures either before they occurred or before they developed into major defects. However, generic to any industry, there were risks, such as equipment failure, active human error, or incorrect engineering judgment involved when performing these activities, just as in any maintenance operation.

As a result, if the PM had not been deleted and performed as originally required, or the PdM had used other inspection techniques, there was no certainty that the MCW bus would not have still developed an electrical fault. The opposite was also true. The licensee performed an extent of condition review for these two root causes and identified that there were a total of five EMCC and MCC inspections that were cancelled. However, the other four had not experienced an electrical failure. Performing PMs and PdMs were intended to minimize the likelihood of equipment failure but did not remove the possibility of all failures. As a result, the inspectors concluded that the failure to perform these two activities was not a root cause.

The inspectors determined that root cause (3) was also not adequate for two reasons. First, the inspectors agreed that inadequate procedures had a direct contribution to the event and that the procedure development program needed improvement. However, the licensee, prior to the event, had existing off-normal response procedures. Processes like Failure Modes, Effects, and Criticality Analysis (FMECA) did provide systematic approaches to considering off-normal scenarios and developing actions to address issues identified. For the licensee, the implementation of this process was considered a good enhancement, but the inspectors concluded that this alone would not be considered a root cause.

In addition, as part of the root cause investigation, the licensee identified that training needed improvement, but it did not include the lack of in-depth systems, component, or IROFS training as part of the systematic root cause for why the operators using existing procedures were ineffective in mitigating the severity of the event. The inspectors identified several examples of both training that was not performed and training that was inadequate.

Two examples of training not performed were electrical safety and human performance. Specifically, the inspectors identified that electrical safety associated with breaker operations was provided for initial training but was not included in requalification training or reinforced in the field. As a result, on the day of the event, the operators attempted to close in on a faulted bus at least three times while trying to close the ASG output breaker to supply power to the EMCC. This practice could have resulted in significant personnel injury, equipment damage, or fire.

The second example of training not performed was human performance. The inspectors identified that human performance was not incorporated in the initial or refresher training materials. Specifically, the use of error prevention tools and the emphasis on operators to utilize these tools in the field were not embedded into the systems and procedure

training. One of the direct causes of the event was the human error that resulted in the trip of the UPS. The lack of error prevention training was not evaluated in the licensee's root cause investigation.

Although several of the procedures that were used during the event were identified by the licensee as being inadequate, the inspectors also identified that the overall depth of systems, components, and IROFS training provided to the operators was insufficient. Examples included UPS internal wiring, DCS restoration, electrical plant configuration, ASG operations and associated breaker logic, and machine isolation valve system circuitry logic.

As a result, the inspectors determined that root cause (3) was inadequate because, while the procedure development process with respect to the quality of abnormal response guidance was one contributor to the operators' performance during the event, the operators also experienced difficulty addressing equipment, component, and logic failures in a timely manner due to lack of fundamental understanding of the systems. In some cases, the operators introduced errors or failures into the event scenario.

For root cause (3), although the licensee performed additional reviews, specifically documented in CATSWeb Subtask #15481, dated December 14, 2011, and created associated corrective actions, the licensee did not revise the root cause evaluation to consider the holistic impact that these new findings had on the overall root causes of the event. However, the licensee implemented the appropriate corrective actions to address the deficiencies in its training and procedures programs as documented in Section 6 above.

The NRC also determined that root cause (4) was not an adequate root cause. Based upon plant walkdowns, training and procedure reviews, and interviews with the supervisor, the inspectors determined that human factors, specifically panel labeling and height, did not influence the UPS shut off pushbutton being incorrectly manipulated. Specifically, the operator stated that he/she was trained on the UPS system and how to take the action of silencing alarms. The operator stated that he/she was confident in the action he/she was going to take; however, the operator also stated that he/she did not read the pushbutton label prior to taking the action and did not utilize human error prevention techniques to validate the correct button.

When asked, the operator also stated that changes made to the pushbutton label, as a result of the root cause corrective actions, would not necessarily have prevented the error from occurring on the day of the event. In addition, at the time of the event, the UPS shut off pushbutton had a distinctive plastic cover on it and all buttons on the panel were labeled, including the alarm silence button. As a result, the inspectors determined that human factoring of the UPS panel and associated pushbuttons was not a root cause in the event, nor was it considered a contributing cause.

The inspectors also reviewed SIR-2101-0002, Rev. 2, dated March 21, 2012. The first three root causes were the same as the previous revisions. The fourth root cause was changed in Rev. 2 to state, "the operations employee has the opportunity to make use of the STAAR principle before taking action." Although the revised investigation stated that analysis of the human errors was performed, no supporting details were included in the investigation.

As a result, the root cause appeared to be narrowly focused, specifically when the root cause explanation in the SIR stated that operations personnel did not follow the "recommended" STAAR principle before taking action. As a result, it was unclear to the inspectors what performance gap was being addressed and corrected with the newly generated corrective action associated with root cause (4) for Phase 2 Human Error Prevention training.

NRC Independent Root Cause Analysis

The inspectors performed an independent root cause analysis for the event. The inspectors utilized a combination of the Management Oversight and Risk Tree (MORT) and TapRoot® methodologies to evaluate the event and identified one root cause and one contributing cause. A root cause was defined as the basic reasons (e.g., hardware, process, or human performance) for a problem, which if corrected, would prevent recurrence of that problem. A contributing cause was a cause that by itself would not create the problem but was important enough to be recognized as needing corrective action. Contributing causes were sometimes referred to as causal factors. Causal factors were those actions, conditions, or events that directly or indirectly influenced the outcome of a situation or problem.

The inspectors identified the root cause as the lack of rigor by management in evaluating impacts and consequences regarding Lead Cascade (LC) to ensure Operations staff had adequate guidance, resources, and tools to conduct operations in a safe manner. As early as 2005, at the start of the LC test loop facility, the licensee did not apply adequate levels of rigor and appropriate risk identification in the management process. As a direct result, long-term impacts and consequences were not considered and consequently were not adequately managed to ensure that the Operations staff had guidance, resources, and tools to consistently conduct operations in a safe manner, specifically when responding to off-normal events.

Through interviews with management personnel, and the review of procedures, programs, and the licensee's root cause investigation, the inspectors identified that management oversight, as applied to the causal factors of this event, were conducted with a focus on production. Management was focused on proving operational capabilities for long-term commercial project funding and did not adequately assess the immediate safety implications for the short-term test loop project.

Examples to support this included the lack of electrical system design redundancy and the cancellation of planned PMs. In addition, hazards were not adequately analyzed or covered by the licensee, which included DCS design, abnormal operating procedures, training, and drills. In addition, assessments and audits that were performed of various programs (e.g., training, procedures, and corrective action) were not intrusive and were focused on program compliance rather than effectiveness.

As the original project timeframe expanded beyond the original end date, the inspectors noted that the management team did not review past practices for potential impact on current operations of the LC. In addition, the management team did not change the level of rigor applied as the duration of the project continued to extend.

The inspectors also identified that the existing LC programs, which would be more indepth for the commercial plant, were rationalized as not requiring the same level of rigor. This justification was based upon the collective presumption that complex events were unlikely due to the intended short duration and limited scale of the project.

The inspectors also identified a contributing cause for failure to utilize human error prevention tools that resulted in the trip on the UPS and directly contributed to the escalation of the severity and consequences of the June 11, 2011 event. The UPS directly supplied electrical power to components supporting the DCS system and centrifuges.

Review of the Licensee's Extent of Condition and Cause

The inspectors reviewed the licensee's extent of condition and determined that for the existing root causes identified in SIR-2101-0002, Rev. 0 and Rev. 1, the extent of condition was considered adequate. The licensee performed vertical slice reviews of operating systems to determine if vulnerabilities existed in maintenance, design, supporting equipment, training, procedures, and human factoring. Actions were assigned in the licensee's corrective action program to address the identified issues. The inspectors noted that for SIR Rev. 2, root cause (4), an extent of condition review was not documented in the investigation.

The inspectors identified that the licensee did not perform a generic implications review, specifically extent of cause, for the identified root causes in SIR-2101-0002, Rev. 0 and Rev. 1, as required by the License Application, Section 11.6.4, "Conduct of Incident Investigations." Specifically, Section 11.6.4 stated, in part, that a reasonable, systematic, structured approach was used to determine the specific or generic root causes and generic implications of abnormal events.

The licensee provided guidance in Procedure ACD2-RG-004, "Corrective Action Program," (CAP) specifically Step 4.3.5 and Attachment C, Significant Conditions Adverse to Quality (SCAQ) Investigation and Corrective Action Plan Development, to perform root cause investigations. The procedure did not include guidance on how to conduct and document generic implications reviews, specifically extent of cause.

Based upon a review of this procedure and interview with the CAP manager, the inspectors determined that the requirement in Section 11.6.4 of the license application was not flowed down into the licensee's procedure or utilized as part of the licensee's selected root cause methodology. The failure to perform an extent of cause review is a violation of Section 11.6.4. of the license application (VIO 70-7003/2012-006-04). During the inspection, the licensee acknowledged this deficiency and wrote corrective action tracking items, CN No. 5050, dated February 2, 2012, and CN No. 5057, dated February 3, 2012.

The NRC also reviewed SIR-2101-0002, Rev. 2, dated March 21, 2012, for generic implications, specifically extent of cause, and determined that for root causes (1) and (2), the licensee performed an adequate extent of cause review. However, for root causes (3) and (4), the extent of cause review was not documented as part of the report.

Review of the Licensee's Corrective Actions

The inspectors reviewed the licensee's corrective actions identified in SIR-2101-0002, Rev. 1. The corrective actions specifically for the identified root causes and associated extent of condition were adequate. However, there were no corrective actions identified for generic implications reviews, as discussed earlier. Rev. 0 did not list corrective actions as part of the investigation report.

For root cause (4) in Rev. 2, there were no corrective actions listed for extent of condition or extent of cause. As a result, corrective actions for root cause (4) were considered inadequate. In addition, the inspectors determined that the corrective actions listed were vague and both the analysis and the actions did not identify what performance gaps the licensee intended to correct with the three corrective actions, which were all associated with training. Specifically, two actions were human error prevention training (Phase 1) for all employees and the associated tracking of the attendance, which had been completed. The third action was to develop and complete human error prevention training (Phase 2) for Operations, Maintenance, and Engineers, which is ongoing.

Based upon the review of the licensee's root cause investigation and the independent root cause performed by the inspectors, the inspectors determined that the licensee's investigation performed for the June 11, 2011, was inadequate and did not identify the true root causes of the event. As a result, the corrective actions identified in the investigation were not developed to address the actual root causes of the event.

The inspectors acknowledged that extensive corrective actions had been created and, in multiple cases, implemented for the root causes identified by the licensee. The inspectors acknowledged that the proposed and completed corrective actions would potentially improve the staff's ability to conduct operations in a safe manner at the Lead Cascade facility. However, without understanding the true root causes and respective generic implications, which included extent of condition and extent of cause, there was no assurance that the corrective actions identified would prevent recurrence of the same or similar event.

License Condition No 10, of the license SNM-7003, states, in part, that the licensee shall conduct authorized activities in accordance with the statements, representations and conditions in the Quality Assurance Program Description. Section 16.0, Corrective Action, of the Quality Assurance Program Description, states, in part, that for significant conditions adverse to quality, the cause of the condition was determined, and corrective action was taken to preclude recurrence. Contrary to that, the inspectors concluded that the licensee failed to determine the cause of the condition and take corrective action to preclude recurrence. This is a violation (VIO 70-7003/2012-006-05).

b. Conclusion

Two violations were identified during review of the licensee's investigation into the event. One was failure to perform an extent of cause review as required by Section 11.6.4. of the license application. The other was failure to determine the cause of the condition and take corrective action to preclude recurrence as required by Section 16.0 of the Quality Assurance Program Description.

8. <u>Exit Meeting</u>

The inspection scope and results were presented to members of the licensee's staff on March 30, 2012. The licensee's staff acknowledged the findings discussed. No dissenting comments were received from the licensee. Although proprietary documents were reviewed during this inspection, the proprietary nature of these documents is not included in this report.

ATTACHMENT

1. PERSONS CONTACTED

Partial List of Licensee Personnel Contacted

- D. Roger, General Manger
- J. Bednarcysk, Engineering Manager
- G. Corzine, Nuclear Safety Manager
- F. Dawkins, Training and Procedures Manager
- S. Eilertson, Engineering Manager, Oak Ridge
- D. Fosson, Operations Manager
- S. Fout, Technical Services Manager
- M. MacCrae, Quality Assurance Manager
- J. Oppy, Enrichment Operations Manager
- T. Sensue, Nuclear Regulatory Affairs Manager
- D. Shaffer, System Engineering Manager

2. INSPECTION PROCEDURE USED

IP 88003 Reactive Inspection for Events at Fuel Cycle Facilities

3. LIST OF ITEMS OPENED, CLOSED, AND DISCUSSED

| VIO 70-7003/2012-006-01 | Open/Closed | Failure to identify a potential accident sequence caused by an event internal to the facility and the consequence and the likelihood of occurrence of the potential accident sequence. |
|-------------------------|-------------|---|
| VIO 70-7003/2012-006-02 | Open/Closed | The licensee implemented a change which rendered the MIV IROFS unable to perform its intended safety function without having evaluated for impact to the integrated safety analysis prior to implementing the change. |
| VIO 70-7003/2012-006-03 | Open | Operating procedures were not used to directly control process operations at the workstation and include, as necessary, direction for off-normal operations caused by failure of an IROFS or human error. |

| VIO 70-7003/2012-006-04 | Open | Failure to perform an extent of cause review as required by Section 11.6.4 of the license application. |
|-------------------------|--------|--|
| VIO 70-7003/2012-006-05 | Open | Failed to determine the cause of the condition and take corrective action to preclude recurrence. |
| URI 70-7003/2011-007-01 | Closed | Further review of the control circuitry for the auxiliary standby generator breakers. |
| URI 70-7003/2011-007-02 | Closed | The licensee's analysis of the potential unreviewed safety question involving multiple centrifuge casing breaches upon loss of electric power. |
| URI 70-7003/2011-007-03 | Closed | The licensee's further review of the adequacy of its procedure and operator training programs given the multiple deficiencies identified. |
| EN 47014 | Closed | Power outage causing loss of battery room ventilation and hydrogen monitor. |

4. LIST OF DOCUMENTS REVIEWED

Drawings

- X-3001-0603-E-OM, Rev. 3, Electrical One Line Diagram Overall Power Distribution, Train 3
- X-3001-0603-E-OW, Rev. 2, Electrical One Line Diagram Standby Generator Control Panel/Switchgear N-004A & N004B
- X-3001-0616-0.10D, Rev. 0, Electrical Standby Gen. Switchgear Elementary Diagrams, Engine Control & Circuit Breakers
- X-3001-0616-E-0.20, Rev. 0, 480V Auxiliary Substation and Diesel Generator Swgr. Circuit Bkr. Wiring Diagrams
- X-3001-0616-E-0B, Rev. 4, Electrical Switchgear Elementary Diagram Feeder Breaker & Automatic Transfer Scheme
- X-3001-0616-E-0C, Rev. 5, Electrical Standby Gen. Switchgear Elementary Diagrams -Engine Control & Circuit Breakers
- X-3001-0616-E-0D, Rev. 5, Electrical Standby Gen. Switchgear Elementary Diagrams Engine Control & Circuit Breakers

2

Procedures

- AC4-AR-001, Changes 24 and 25, Machine Alarms and Responses
- AC4-AR-006, Changes 14 and 15, Cascade Alarms and Responses
- AC4-AR-011, DCS System Alarms and Responses
- AC4-ON-009, Change 14, Loss of Power
- AC4-OP-012, Change 16, Operation of the Lead Cascade Auxiliary Standby Generator (ASG)
- AC4-ON-010, Changes 5 and 6, Loss of Distributed Control System
- AC4-ON-016, Response to Off Normal Portable Carts and Equipment Operations
- AC4-OP-12, Changes 1, 11, and 12, Operation of the Lead Cascade Auxiliary Generator
- AC4-OP-14, Changes 7 and 8, Operation of the Lead Cascade Uninterrupted Power Supply
- AC2-FO-001, Change Number 9 and 10, Conducts of Operations
- ACD2-RG-004, Change Number 5, Corrective Action Program
- ACD2-TP-001, Changes 7 and 8, Procedure Process
- ACD2-TP-002, Training Program
- ACD2-TP-004, Use of Procedures

ACD2-SH-014, Change Number 9 and 10, Electrical Safety Guidelines

Miscellaneous

- AC Condition Notification 4793, dated September 15, 2011, Determine whether ASG Feeder Breaker operated as designed
- DAC-2101-0030, "X-3001 Battery Room Hydrogen Generation," Rev. 3
- DAC-2901-0002, "(U) Release Rate for HF Following a Centrifuge Breach," Rev. 0
- DAC-2901-0003, "(U) Consequences Following the Breach of Multiple Centrifuge Casings," Rev. 0
- DAC-2901-0005, "(U) Consequences Following the Breach of 240 Centrifuge Casings," Rev. 0
- DAC-2901-001, "(U) Release Rate for UF6 Following a Centrifuge Breach," Rev. 0
- DAC-2901-004, "Airborne Concentration of UF6 Reaction Products Following a Centrifuge Breach," Rev. 0
- DAC-3601-0002, "Accident Analysis Consequences Multiplications Factors," Rev. 2
- EE-2901-003, Rev. 0, Evaluation of Reportability Regarding Bypass of the Lead Cascade Machine Isolation Item Relied On For Safety"
- EE-2901-0006, "(U) Engineering Evaluation to Determine Consequences for Multiple Casing Breached," Rev. 0
- EE-2901-0007, "(U) Engineering Evaluation Documenting Radiological Survey Results from a Wrecked Centrifuge," Rev. 0
- EE-2901-004, "Evaluation of Reportability Regarding Failure of the Battery Room Ventilation and Hydrogen Monitoring Items Relied on for Safety,' Rev. 1
- EE-2901-005, " Evaluation of the Lead Cascade Integrated Safety Analysis Regarding the June 11, 2011 Event," Rev. 0
- EE-3905-0004, "Evaluation of UF6 Source Term required to Produce only Low consequence from Post Fire Release," Rev. 0
- K/TS-11, 220, "Explosion Potential of P3a Materials (U)"
- K/TS-11, 786 "Final Report on the Safety of P3 Materials Parts I and II (U)" Qualification Journals for select staff

Quality Assurance Program Description, Rev. 14

TAR-1140-0002, "Study of the Lead Cascade Column as a Lower Restraint Device (U)," Rev. 2

Task-to-Training-to-Procedure-Matrix

Training Module U00016, Table Top Job Analysis Training

Training Module U00121, QAPD Indoctrination Training

Training Module TPP-2603-003, Training Requirements Limitations TER-00248, "Machine Failure Loads (U)," Rev. 0

TER-00325, "(U) Casing Breach Failure of LC3 Centrifuge 2-03 on June 11, 2011," Rev. 1

TER-00347, "(U) Evaluation of UF6 and UF6 Reaction Product Transport," Rev. 1

USEC/OR-04-0107, "Technical Basis USEC Production Machine Non-Nuclear Safety (U)," Rev. 2

Report 335-11-043, Management Assessment for Use of Procedures, dated July 29, 2011 "Conduct of Operations: Programmatic deficiencies including inadequate operator training and procedures" dated December 14, 2011

Special Inspection Report, SIR-2101-0002, "June 11, 2011 Event at the American Centrifuge Demonstration Facility (Lead Cascade)," Rev. 0, dated July 18, 2011, Rev. 1, dated January 11, 2012, and Rev.2, dated March 21, 2012

5. LIST OF ACRONYMS USED

| auxiliary standby generator |
|--|
| corrective action program |
| Code of Federal Regulations |
| condition notification |
| digital control system |
| essential motor control center |
| failure mode and effects analysis |
| failure modes, effects, and criticality analysis |
| items relied on for safety |
| integrated safety analysis |
| lead cascade |
| machine cooling water |
| machine isolation system |
| machine isolation valves |
| Management Oversight and Risk Tree |
| Nuclear Regulatory Commission |
| preventative maintenance |
| predictive maintenance |
| root cause analysis |
| revision |
| significant conditions adverse to quality |
| special inspection report |
| secondary isolation system |
| special nuclear material |
| stop, think, ask, act, review |
| |

| URI | unresolved item |
|-----|-----------------|
| | |

VIO violation