November 6, 2012

EN47908, EN48287

Mr. Dominique Grandemange
Site Manager
AREVA NP, Inc.
2101 Horn Rapids Road
Richland, WA 99352-5102

SUBJECT: INSPECTION REPORT NO. 70-1257/2012-202

Dear Mr. Grandemange:

The U.S. Nuclear Regulatory Commission (NRC) conducted a routine, announced nuclear criticality safety (NCS) inspection at your facility in Richland, Washington, September 10-13, 2012. The purpose of the inspection was to determine whether activities involving special nuclear material were conducted safely and in accordance with your license and regulatory requirements. Throughout the inspection, observations were discussed with your staff. An exit meeting was held on September 13, during which inspection observations and findings were discussed with your management and staff.

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. Based on the inspection, your activities involving nuclear criticality hazards were found to be conducted safely and in accordance with regulatory requirements.

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 Dr. Christopher S. Tripp of my staff at (301) 492-3214, or via e-mail to Christopher.Tripp@nrc.gov.

Sincerely,

/RA/

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

Docket No. 70-1257
License No. SNM-1227

Enclosure:
Inspection Report 70-1257/2012-202

cc: L.J. Maas, AREVA NP
C.D. Manning, AREVA NP
R.E. Link, AREVA NP

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Richland, WA 99352

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DATE	11/01/12	10/26/12	11/06/12	11/06/12

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U.S. NUCLEAR REGULATORY COMMISSION

OFFICE OF NUCLEAR MATERIAL SAFETY AND SAFEGUARDS

Docket No.:	70-1257
License No.:	SNM-1227
Report No.:	70-1257/2012-202
Licensee:	AREVA NP, Inc.
Location:	Richland, WA
Inspection Dates:	September 10-13, 2012
Inspectors:	Christopher Tripp, Senior Criticality Safety Inspector Timothy Sippel, Criticality Safety Inspector
Approved by:	Sheena Whaley, Acting Chief Programmatic Oversight and Regional Support Branch Division of Fuel Cycle Safety and Safeguards Office of Nuclear Material Safety and Safeguards

Enclosure

AREVA NUCLEAR POWER, INC., - RICHLAND, WA

INSPECTION REPORT NO. 70-1257/2012-202

EXECUTIVE SUMMARY

INTRODUCTION

Staff of the U.S. Nuclear Regulatory Commission (NRC) performed a routine, announced nuclear criticality safety (NCS) inspection of AREVA Nuclear Power, Inc. (AREVA NP or licensee), facility in Richland, Washington, September 10-13, 2012. The inspection included an onsite review of the licensee's NCS program, NCS training, NCS analyses, NCS audits and investigations, internal NCS event review and follow-up, the criticality accident alarm system (CAAS), and plant operations. The inspection focused on risk-significant fissile material processing activities and areas including the uranium hexafluoride (UF_6) cylinder receiving pad, the Dry Conversion Facility (DCF), the Line #2 Ammonium Diuranate (ADU) conversion area, the Uranium Dioxide (UO_2) Building–including scrap recovery processes, the blended low-enriched uranium (BLEU) facility, the BLEU powder storage area, the Uranyl Nitrate Building (UNB), the Volume Reduction Area, Engineering Laboratory Operations (ELO), and the I3A Powder Storage Warehouse.

Results

- No safety concerns were identified regarding the licensee's NCS program.
- No safety concerns were identified during review of the NCS event review and follow-up, with the exception of a discrepancy in firefighting restrictions for moderator control in the I3A Powder Storage Warehouse.
- No safety concerns were identified regarding NCS training.
- No safety concerns were identified regarding NCS audits.
- No safety concerns were identified during a review of the licensee's CAAS.
- No safety concerns were identified during walkdowns of plant operations.
- An Unresolved Item (URI) was identified concerning construction of the UNB facility without obtaining a license amendment.

REPORT DETAILS

1.0 Summary of Plant Status

The licensee manufactures light-water reactor fuel at its Richland, Washington facility. During the inspection, the licensee was conducting routine powder preparation, pelletizing, and bundle fabrication operations. However, the ceramics area of the UO_2 building was shut down for routine maintenance, the Supercritical Carbon Dioxide ($SCCO_2$) area was shut down for cleaning during part of the inspection; and a number of areas in the UO_2 building were under firewatch due to the recent fire. The licensee was also performing routine scrap recycle and waste management operations. Construction was underway at the UNB.

2.0 Nuclear Criticality Safety Program (IP 88015 & 88016)

a. Inspection Scope

The inspectors reviewed the licensee's NCS program and analyses. The inspectors evaluated the adequacy of the program and analyses to assure the safety of fissile material operations. The inspectors reviewed selected NCS analyses to determine that criticality safety of risk-significant operations was assured through engineered and administrative controls, with adequate safety margin and preparation and review by qualified staff. The inspectors interviewed AREVA NP managers and engineers in the safety and production departments, operations engineers, and selected operators. The inspectors reviewed selected NCS-related items relied on for safety (IROFS) to determine that the performance requirements had been met for selected accident sequences. The inspectors accompanied NCS and other technical staff on walkdowns of NCS controls in selected plant areas. The inspectors reviewed selected aspects of the following documents:

- E04-05-01, "Nuclear Criticality Safety Standards," Version 11, dated 8/29/11
- E04-NCSA-000, "UF_6 Cylinder Receiving and Storage," Version 7, dated 3/26/12
- E04-NCSA-080, "Line 2 Uranium Recovery," Version 9, dated 3/1/12
- E04-NCSA-090, "Line 2 UO_2 Powder Production," Version 12, dated 5/24/12
- E04-NCSA-120, "UNH Reprocessing," Version 14
- E04-NCSA-130, "Conversion of UO_2 Pellets to U_8O_3 Powder," Version 10, dated 8/8/12
- E04-NCSA-135, "BLEU Scrap Recovery," Version 13
- E04-NCSA-186, "Supercritical Carbon Dioxide (CO_2) Extraction System," Version 4
- E04-NCSA-186, "Supercritical Carbon Dioxide (CO_2) Extraction System," Version 5
- E04-NCSA-190, "UO_2 Pellet Dissolution," Version 9, dated 8/9/12
- E04-NCSA-325, "BLEU Powder Production," Version 15, dated 5/24/12
- E04-NCSA-350, "Powder Drum Warehouse (I3A)," Version 8, dated 5/24/12
- E04-NCSA-360, "Lube Blend Press Feed," Version 11
- E04-NCSA-380, "Pellet Sintering Area," Version 4
- E04-NCSA-385, "BLEU (Line-6) Pellet Sintering," Version 6, dated 3/22/12
- E04-NCSA-540, "Bundle Assembly & Storage," Version 8, dated 8/15/12
- E04-NCSA-550, "Bundle Disassembly," Version 4
- E04-NCSA-761, "Between Building Transfer," Version 13
- E04-NCSA-780, "Waste Handling," Version 17, dated 5/24/12

- E04-NCSA-840, "Dry Conversion Liquid Effluent & HF Recovery," Version 3
- E04-NCSA-2670, "Software Validation Document – PC-Scale 4.4A Validation," Version 2, dated 6/15/12
- E04-NCSS-130, "Conversion of UO_2 Pellets to U_8O_3 Powder," Version 11, dated 8/8/12
- E04-NCSS-325, "BLEU Powder Production," Version 12, dated 5/24/12
- E04-NCSS-540, "Bundle Assembly & Storage," Version 8, dated 8/15/12
- E04-NCSS-941, "Deionized Water Service System," Version 1, dated 3/1/12
- E04-NCSS-G86, "Vacuum Cleaners & Mop Water Pails in Controlled Areas," Version 6
- E04-NCSS-G90, "Use of Natural & Depleted Uranium," Version 6, dated 6/18/12
- E04-NCSS-G92, "Moderation Control," Version 7
- E04-NCSS-G93, "Designation for Marking of Storage Areas," Version 5
- EMF-1926, "Dry Conversion Process Hazards Evaluation"
- SOP-40234, "Dry Powder Blending, Handling, and Labeling of Poisoned 45-Gallon Drums and Safe Batch Containers," Version 10
- SOP-40520, "UO_2 (Room 104A) Drum Tumbler and Bucket Tumbler Operation," version 6, dated 5/24/12
- SOP-40791, "Maintenance Work Permit (MWP) of Pre-Job Briefing (PJB)," Version 9

b. Observations and Findings

The inspectors reviewed new and revised analysis that was issued since the previous NCS inspection. The inspectors observed the construction of new bulk uranyl nitrate tanks at the UNB. The inspectors walked down the UNB and surrounding area with an NCS engineer and discussed the control strategy currently envisioned for providing for double contingency, specifically with regard to the scenarios of rupture of one or more uranyl nitrate tanks, overflow of the tanks, backflow from the main process areas to the unfavorable geometry tanks, and excessive flow from the tanks to the main process. The main control for criticality safety of the tanks themselves is concentration control, which must be maintained by circulation and temperature controls. The inspectors observed that there are scenarios resulting in the rupture of multiple tanks, most notably a seismic event. In the event a single tank ruptures, the contents will be maintained in a safe slab geometry within the footprint of the building. If two or more tanks rupture, uranyl nitrate solution could exit the building and flow downhill. The inspectors noted several areas where solution could accumulate and eventually concentrate, including a truck ramp, a recessed stairwell, storm drain, and exposed soil covered by gravel. The licensee stated that it was evaluating the topography surrounding the UNB against such scenarios, and that transfer piping carrying solution to other buildings would be double-sleeved and equipped with leak detection. The licensee stated that it did not need NRC's approval to construct the UNB because the facility is a smaller version of a similar process it had familiarity with at Nuclear Fuel Services in Erwin, Tennessee. The inspectors determined that the NCS analysis for the UNB had not been completed at the time of the inspection. There is no safety concern because currently no special nuclear material (SNM) is being handled in the new facility. However, additional review is needed to determine whether the facility creates "new types of accident sequences" not previously evaluated in the Integrated Safety Analysis (ISA) (as stated in Title 10 of the *Code of Federal Regulations* (10 CFR) 70.72(c)(1)(i)), which will be tracked as **URI 70-1257/2012-202-01**.

The inspectors reviewed recent changes to the $SCCO_2$ process made in response to Condition Report (CR) 2012-2009 (as noted by Region II). In CR 2012-2009, a leak from the extractor vessel resulting from improper maintenance was vented to the process hood enclosure and nearby room. It was later determined that 6 out of 24 valves had not been leak tested as required. While the CR had only chemical consequences, changes made to the process hoods affected two criticality drains (IROFS 6958 and IROFS 6977) credited with maintaining a safe slab in the event of a leak. Currently, IROFS 6958 is a criticality drain in the extractor vessel hood; and IROFS 6977 is a criticality drain in the process column hood. A crossover duct is being installed between the two hoods under Engineering Change Notice (ECN) 8632C, blocking off IROFS 6958. Therefore, the licensee has revised E04-NCSA-186 to remove IROFS 6958 and rely only on IROFS 6977. The inspectors reviewed the change package and revised NCSA and determined that the licensee had performed flow calculations showing that IROFS 6977 will maintain adequate drainage. The inspectors noted that the remaining drain had been equipped with a diffuser plate to prevent a direct jet of CO_2 gas into the room. Although this plate is directly in front of the drain, the drain is of sufficiently large cross section that plugging is very unlikely, and is subject to annual surveillance. The inspectors determined that the changes to the $SCCO_2$ enclosures and corresponding IROFS were acceptable.

E04-NCSA-385, “BLEU (Line-6) Pellet Sintering,” was revised to add an interaction study. The NCS engineer stated that the reason for this was to incorporate interaction studies from another document (E04-NCSA-135, “BLEU Scrap Recovery”) and update those studies because some equipment had been moved. The inspectors noted that the licensee applied a combined bias and uncertainty of 0.0193 its calculated k_{eff} value. The validation report (E04-NCSA-2670, “Software Validation Document – PC-Scale 4.4A Validation”) determines a bias and uncertainty applicable to three homogeneous and two heterogeneous area(s) of applicability (AOA[s]); but none of them are exactly equal to 0.0193. The inspectors noted that this bias and uncertainty is approximately equal to the value for low-moderated UO_2 powder (0.0196), and greater than the value for any AOA except hydrocarbon-moderated (uranium oxide [U_3O_8] and uranium tetraflouride) homogeneous systems. The use of a bounding bias is therefore not safety significant. However, the inspectors noted that the validation report does not define the parameter ranges corresponding to the five AOAs; so there is no consistent guidance to analysts as to what bias and uncertainty to use.

The inspectors reviewed several other new and revised analyses as listed above. The inspectors noted that, in most cases, it was not apparent why the NCSA was revised or how it differed from previous versions. While new text is in general highlighted, it is often not clear from the discussion in the text or list of changes why the revision was made. The inspectors discussed changes in specific analyses with NCS engineers and noted an overall trend towards greater clarity and consistency. For example, there has been a movement towards identifying equipment whose failure constitutes an initiating event in an accident sequence as an IROFS (first defense), crediting more passive IROFS, and more thorough discussion of defense-in-depth measures.

The inspectors observed that the licensee had an NCS program which was independent from production and was implemented through written procedures. The inspectors also observed that the licensee's NCS program reviewed process changes affecting criticality safety. The inspectors determined that, for the NCS analyses reviewed, the analyses were performed by qualified NCS engineers, that independent reviews of the evaluations were completed by qualified NCS engineers, and that the analyses provided for subcriticality of the systems and operations through appropriate limits on controlled parameters, and double contingency was assured for each of the credible accident sequences leading to inadvertent criticality that was selected for review. The inspectors reviewed selected NCS IROFS and determined that the IROFS corresponded to the assumptions used in the NCSA, were designated controls, and were adequate to meet performance requirements for the selected accident sequences. NCS analyses and supporting calculations demonstrated adequate identification and control of NCS hazards to assure operations within subcritical limits.

c. Conclusions

No safety concerns were identified regarding the licensee's NCS program. The inspectors observed that it is often difficult to follow changes between versions of NCSAs, and that there is some ambiguity about whether calculations fall within a particular AOA. The proposed control strategy for the UNB appears to comply with the double contingency principle. The inspectors did not identify any safety concerns relative to the changes to the $SCCO_2$.

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

a. Inspection Scope

The inspectors reviewed licensee's internal audit procedures, records of previously completed audits of fissile material operations, and records of NCS Infractions. The inspector reviewed selected aspects of the following documents:

- E04-06-002, "Routine Nuclear Criticality Safety Audits," version 4, dated 6/29/12
- E04-07-201203, "NCS Audit/Inspection Report—March 2012," dated 4/19/12
- E04-07-201204, "NCS Audit/Inspection Report—April 2012," dated May 2012
- E04-07-201205, "NCS Audit/Inspection Report—May 2012," dated 6/28/12
- E04-07-201206, "NCS Audit/Inspection Report—June 2012," dated 8/02/12

b. Observations and Findings

The inspectors observed that NCS audits were conducted every month in accordance with written procedures. The audits are scheduled to ensure that each fissile material processing system is audited biennially. The inspectors noted that NCS audits were focused on determining that plant operations requirements conform to those listed in the applicable NCS specification documents. E04-06-002, the NCS Audit procedure, was recently revised to include instructions to NCS staff to review plant modifications that could have impacted the basic inputs or assumptions the NCSA was based on. However, the results of NCS Audit/Inspections conducted under the revised procedure are not yet available.

The NCS Audit/Inspection Reports are also used to track and trend the total number of NCS Infractions; and the number of repeat infractions. The number of infractions occurring in the different process areas is tracked. The inspectors observed that the frequency of infractions has been steadily decreasing, which appears to be largely in response to its emphasis on human performance.

c. Conclusions

No safety concerns were identified regarding NCS audits.

4.0 Nuclear Criticality Safety Training and Qualification (IP 88015)

a. Inspection Scope

The inspectors reviewed the content of training, and the training and qualifications procedures for NCS staff and general workers to determine if they met specified qualification requirements. The inspectors evaluated the effectiveness of the licensee's NCS training through interviews; and reviewed qualification records to verify completion of training. The inspectors reviewed selected aspects of the following documents:

- "Instructor Guide Nuclear Criticality Safety Training for New Fissile Workers," Revision 3, dated June 2007

b. Observations and Findings

NCS engineers have a series of requirements and tasks that must be completed before being considered a qualified NCS engineer. The inspectors determined that the licensee's NCS training program adequately addressed NCS aspects of facility hazards affecting fissile material operations. The inspectors also determined that only qualified NCS staff authors or reviews new and revised safety analyses and reviews new operating procedures. In addition, the inspectors reviewed the qualification requirement for NCS staff and the training records for a selection of the licensee's NCS personnel. The licensee's approach to NCS engineer qualification allows the qualifying engineer to perform those activities for which the qualification requirements have been met.

The inspectors determined that NCS staff was actively involved in review and oversight of NCS training and that NCS training was updated as needed. The inspectors reviewed the content of basic NCS training for general workers. The inspectors observed that operators must complete the general NCS training course with annual refresher training. Only operators that have completed their training requirements are permitted to report for work.

One aspect of training is the use of pre-job briefings (PJB) for planned maintenance and other short-duration activities. The inspectors noted that a contributing factor in CR 2012-2009 (see discussion of $SCCO_2$ under Section 1.0 above) was the failure of all personnel involved in maintenance of the system to participate in the PJB. Rather, it is left up to those attending the PJB to convey the information to their colleagues. The inspectors reviewed SOP-40791, "Maintenance Work Permit (MWP) of Pre-Job Briefing (PJB)," noting that PJBs were required for non-routine activities with significant safety (radiological, chemical, criticality, etc.) implications or activities requiring equipment isolation. Step 3.3.11 of SOP-40791 requires all personnel involved in such work to be included in the PJB. If the job is suspended or new personnel assigned, the MWP and PJB are to be reviewed. The inspectors determined that the PJB requirements in SOP-40791 appeared adequate, and noted that CR 2012-2009 identified failure to formalize conduct of the PJB as one of the causes of the event.

c. Conclusions

No safety concerns were identified regarding the licensee's NCS training and qualification program. The licensee self-identified a concern with the conduct of PJBs in connection with CR 2012-2009.

5.0 Nuclear Criticality Safety Event Review and Follow-up (IP 88015 & 88016)

a. Inspection Scope

The inspectors reviewed the licensee's response to a selection of recent internally reported events that relate to NCS (NCS Infractions) and the recent NCS-related 'event' reported to NRC. The inspectors reviewed the progress of the associated investigations and interviewed licensee's staff regarding immediate and long-term corrective actions. The inspectors reviewed selected aspects of the following documents:

- CR-2012-2009-FA Environmental Health, Safety, and Licensing (EHS&L) Condition, dated 3/7/12
- CR 2012-5606-FA EHS&L Condition, dated 7/24/12
- E04-NCSS-G06, "Fire Prevention and Fire Fighting," Version 18
- E18-01-001, "External Reporting of Safety, Environmental, MC&A, and Security Related Events or Conditions," Version 7
- ECN 8632C
- NCS Infraction 12-004 (CR 2012-1383), dated 2/20/12
- NCS Infraction 12-008 (CR 2012-3342), dated 4/20/12
- NCS Infraction 12-009 (CR 2012-3582), dated 4/29/12
- NCS Infraction 12-012 (CR 2012-3798), dated 5/7/12
- NCS Infraction 12-014 (CR 2012-4501), dated 6/1/12
- NCS Infraction 12-017 (CR 2012-4747), dated 6/11/12
- NCS Infraction 12-020 (CR 2012-5326), dated 7/11/12
- NCS Infraction 12-021 (CR 2012-5454), dated 7/17/12
- NCS Infraction 12-022 (CR 2012-5526), dated 7/18/12
- "Thirty-day Follow-up Report to May 8, 2012 Incident Reported Under 10 CFR 70 Appendix A Criterion (b)(1) (NRC Event No. 47908); AREVA NP Inc. Richland Facility; License No. SNM-1227; Docket No. 70-1257," Agencywide Documents Access and Management System (ADAMS) Accession Number ML12160A365, dated June 7, 2012

b. Observations and Findings

The inspectors reviewed Event Reports EN47908, EN48287, and selected licensee internally reported events (NCS Infractions) that had occurred since the last inspection.

Event Report 47908 (Licensee Event Report 2012-002)

On May 8, 2012, the licensee reported an improperly analyzed condition to the NRC as a 24-hour report under 10 CFR 70 Appendix A Criterion (b)(1), due to the May 7, 2012 letter from John D. Kinneman to Janet R. Schlueter (ADAMS Accession Number ML113420462) discussing the use of "design features" (passive geometry features with no identifiable pathway to criticality) as part of a licensee's ISA methodology. Based on that letter, the licensee determined that its ISA was inadequate due to its failure to identify such features as IROFS. The licensee identified corrective actions, including increased NCS attention to plant modifications and design changes. The inspectors determined that there were no identified instances in which geometry controls were found inadequate to meet the performance requirements. In accordance with Interim Staff Guidance ISG-12, “10 CFR Part 70, Appendix A – Reportable Safety Events,” the mere failure to identify controls as IROFS is not a reportable event or condition. Event Report 47908 is therefore closed.

Event Report 48287

A fire occurred in the Volume Reduction Facility (part of the UO_2 Building) on September 7, 2012, at about 3:20 PM. The licensee was on day three of performing plasma arc cutting in a ventilated hood when the filter medium in the ventilation pre-filters caught fire. The fire resulted in the licensee declaring an alert, evacuating the UO_2 Building, and taking other appropriate mitigative actions. Due to the fire the fire alarm system was temporarily unavailable in a number of areas, including ADU, $SCCO_2$, Lube Blend, Powder Storage, Waste Processing, U_3O_8, and the Dissociator Building. These areas were placed on a fire watch as a compensatory measure. The inspectors arrived onsite the following Monday, September 10, 2012, while the licensee was still conducting its preliminary review of the event. Follow-up of the circumstances surrounding occurrence of the fire will be deferred to a future Regional inspection.

The inspectors focused on those issues that related to the impact of firefighting activities on NCS, i.e., the use of water by the fire department in extinguishing the fire. Initially, the responders attempted to fight the fire by chemical means. This proved ineffective due to the size and location of the fire; therefore, a water fog (produced by a water hose equipped with a ‘fogging nozzle’) was used to extinguish the fire. The decision to use a water fog was made in consultation with the Incident Commander, and the NCS Manager was also consulted. At the time of the fire, only a small quantity of SNM was contained in the Volume Reduction Facility, in the form of several HEPA filters in a corner of the room away from the arc cutting hood. In addition, contamination quantities of Uranium were on the metal being cut. The total quantity of uranium was estimated by the inspectors as a few grams. Residual uranium in the ventilation system was considered negligible, as the system had been cleaned out only a few days before the fire. The cleanout included replacing the pre-filters and HEPA filters. The inspectors reviewed the decision to use a water fog and determined that response activities were appropriate from the standpoint of NCS, and in accord with the postings on the room.

A small amount of the firefighting water entered an adjacent room, the I3A Powder Drum Warehouse, which is a moderator controlled area. The door had been opened during the fire to clear the smoke so as to enable the firefighters to better fight the fire. The licensee stated that the amount of water involved was only enough to create a puddle near the doorway of about 8 ft^2. The inspectors noted that the doorway included a raised sill or dyke that limited the amount of water that entered the warehouse. However, the licensee did not rely on or credit the features on the doorway as a moderator control.

The licensee imposes two types of restrictions on the use of firefighting water. In one case, the use of water is prohibited except when needed to save a life. In the other case, firefighters are required to use a fogging nozzle; and use of a focused water stream is prohibited. In both cases, postings are placed on area entrances to indicate the types of firefighting measures allowed. The inspectors noted that there was a discrepancy between the restriction on firefighting water listed in E04-NCSA-350, “Powder Drum Warehouse (I3A),” and the posted restrictions on the door to I3A. The posting indicated that a water fog could be used, while the list of controls in the NCSA stated that all water was prohibited. Further examination revealed that E04-NCSA-350 was internally inconsistent about which restriction was to be applied; and was inconsistent with the corresponding NCS Specification, E04-NCSS-G06, “Fire Prevention and Fire Fighting.” The posting, E04-NCSS-G06, and the text of E04-NCSA-350 correctly identified the area as requiring the use of a ‘fog’ nozzle; while the list of controls in E04-NCSA-350 incorrectly listed the control as prohibiting firefighting water. The inspectors raised this issue with the licensee, which was already aware of the discrepancy and was tracking it as CR 2012-5606.

Because the licensee’s investigation of the fire is in the early stages, this event remains open, and will be reviewed further in a subsequent inspection.

Internal NCS Infractions

The inspectors reviewed several NCS infractions that occurred since the previous NCS inspection to determine whether the licensee had taken adequate corrective action and correctly characterized event reportability. In each case reviewed, the licensee appeared to take appropriate immediate-and long-term corrective action. During their review of the licensee’s reportability determination, the inspectors observed that, in several instances, the licensee was taking full credit for IROFS deemed to be ‘degraded.’ Several of the reporting criteria in Appendix A of 10 CFR Part 70 involve assessing whether an event “results in failure to meet the performance requirements” of 10 CFR 70.61. To make this determination, the licensee determines whether an applicable accident sequence exists, and then adds up the likelihood indices for the initiating event and any preventive IROFS to determine an overall controlled event index (CEI). If the CEI ≤ -4, the sequence is still considered highly unlikely and the performance requirements still considered met. The inspectors observed that, in instances in which an IROFS is considered ‘lost’ (by virtue of having met the failure condition stated in the accident sequence table), its probability of failure on demand (PFOD) index is not included in calculation of the CEI. However, if an IROFS is considered ‘degraded,’ its full PFOD index is included in the calculation of the CEI. The inspectors questioned this practice because it appears that degradation of an IROFS would result in a reduction of its reliability and availability.

The inspectors examined the 25 internal events that occurred this year to determine if there were any cases in which this apparently non-conservative practice could have led to an improper reportability determination. In most instances, the calculated CEI for the accident sequence exceeded the acceptable minimum of -4 by a sufficient margin that inclusion or exclusion of the degraded IROFS would not alter the outcome. The table below provides a breakdown of these events by category:

Description of Incident	Number
No IROFS failure/degradation involved	11
IROFS failed	3
IROFS degraded and… Some credit for degraded IROFS needed (for CEI ≤ -4): No credit for degraded IROFS needed (for CEI ≤ -4): Specific sequence not identified/scored in incident discussion: Total incidents with IROFS degraded	 4 5 2 11
Total Incidents	**25**

The inspectors examined the four incidents where complete removal of the degraded IROFS would have resulted in not meeting the performance requirements. In NCS Infraction 12-002, a small quantity of water dripped down the wall in a power prep area in the Specialty Fuels Building. The IROFS that degraded was IROFS 1614, consisting of the piping/roof integrity. Besides the degraded IROFS, IROFS 104 required operators to promptly spread out any powder that happens to get wet. The initiating event was a powder spill, which is required along with moderation before criticality is possible. The initiating event was given an index of 0, IROFS 104 was given -3, and IROFS 1614 was given -3, for a total CEI = -6. The inspectors determined that complete failure of IROFS 1614 would be required to produce a CEI > -4. While the amount of water needed for criticality was not determined, it certainly exceeds the small amount reported in 12-002. The inspectors determined the slight degradation resulting from a small roof leak would not be sufficient to prevent the performance requirements from being met.

In NCS Infraction 12-006, the locking bar on a powder drum tumbler in ADU was found to be out of adjustment, such that it would not prevent drums from being tumbled more than once. The locking bar and associated tumbler interlock was credited as an NCS control to prevent the spilling of potentially moderated powder during tumbling. In the event the lid of a potentially moderated drum is not properly secured and the drum is tumbled a second time, such a spill could occur. The IROFS that degraded was IROFS 1513, consisting of the locking bar and tumbler interlock. Besides the degraded IROFS, IROFS 1512 required the lid and clamp to be reaffixed after moisture sampling. The initiating event was the presence of a drum having greater than an allowable mass of powder with 7 wt% moisture. The initiating event had an index of -1, IROFS 1512 had -2, and IROFS 1513 had -3. The inspectors determined that complete failure of IROFS 1513 would be required to produce a CEI > -4. The inspectors initially walked down the area and discussed operation of the tumbler interlock with operators and NCS staff, and could not initially determine why the IROFS was considered degraded instead of failed. The locking bar was installed so that, even when it was lowered, it would not engage the switch that prevented the tumbler from operating a second time. Following discussions with the cognizant engineer, and confirmation by review of operating procedures SOP-40234 and SOP-40520, it became apparent that uncredited administrative overchecks have been put in place to control drum movement and handling. A Criticality Control Key Custodian (CCKC) must accompany any moderated or potentially moderated[1] drums when they are not locked up (e.g., in approved storage locations or the drum tumbler enclosure). Only one such drum may be transported in the building at a time. The CCKC also has the responsibility for unlocking the locking bar and resetting the interlock. The inspectors determined that the procedural controls associated with the CCKC's oversight of potentially moderated drums provide added assurance against the accident sequence, and concurred that the performance requirements were still met.

In NCS Infraction 12-008, overflow from a deionized water (DIW) tank migrated into a safe batch container (SBC) storage area below the DIW area. The IROFS that was degraded was IROFS 1614, as in Infraction 12-002 discussed above. Besides the degraded IROFS, IROFS 2214 consisted of SBC integrity. The initiating event was the storage of an SBC with the lid off or damaged. The initiating event had an index of -1, IROFS 2214 had -2, and IROFS 1614 had -3. The inspectors determined that complete failure of IROFS 1614 would be required to produce a CEI > -4. The overflow involved a spill of approximately 15 gallons of DIW on the Lube Room floor, of which only 1 gallon made it to the SBC storage area. Based on this, the inspectors determined that the roof of the SBC storage area was not completely degraded, because only a small proportion of the spilled liquid made it into the area. (In addition, although IROFS 2214 does not appear to be independent from the initiating event, criticality calculations indicate that it would take three adjacent compromised containers before criticality is possible.) The inspectors therefore determined that the partial degradation of IROFS 1614 would not prevent the performance requirements from being met.

In NCS Infraction 12-021, the electrical connection to a high-level probe on TK-320C was found corroded through. The IROFS that was degraded was IROFS 504, the high-level interlock. Besides the degraded IROFS, IROFS 426 consisted of a criticality drain in the off-gas line. The initiating event was leaving a supply valve open. The initiating event had an index of 0, IROFS 426 had -3, and IROFS 504 had -3. The inspectors determined that complete failure of IROFS 504 would be required to produce a CEI > -4. The inspectors noted that the high-level alarm would not function if disconnected, and so could not initially determine why the IROFS was considered degraded instead of failed. Discussions with NCS staff indicated that there were a total of four redundant high-level interlocks, of which three continued to function. The remaining three were not IROFS, but were considered defense-in-depth. The inspectors therefore determined that failure of one out of four interlocks would not prevent the performance requirements from being met.

From this sample, the inspectors determined that there were no cases identified in which taking full credit for a degraded IROFS led to an improper reportability determination. In all cases there was sufficient margin the calculated CEI, or sufficient other controls, such that the performance requirements continued to be met. However, the inspectors noted that taking full credit for a degraded IROFS was non-conservative and could result in an improper reportability determination in the future.

[1] The historic concept of "potentially moderated" drums is being replaced by considering all drums that have not been moisture-sampled to be moderated. This is a recent revision in facility NCSAs.

c. Conclusions

The inspectors determined that the licensee's response to the fire in the Volume Reduction Facility was appropriate. An inconsistency was noted in the firefighting restrictions for the I3A Powder Drum Warehouse. The inspectors determined that the condition reported in Event Report 47908 was not reportable. With regard to internal NCS infractions, the inspectors determined that the licensee adequately evaluated whether or not these events were reportable to the NRC. The inspectors observed that the licensee was taking full credit for degraded IROFS, a non-conservative practice that could lead to improper reportability determinations. The inspectors also observed that internal events were investigated in accordance with written procedures and appropriate corrective actions were assigned and tracked.

6.0 Criticality Alarm Systems (IP 88017)

a. Inspection Scope

The inspectors reviewed documentation of criticality accident alarm detector coverage, interviewed engineering and maintenance staff, and performed facility walkdowns to determine the adequacy of the licensee criticality alarm system. The inspectors reviewed selected aspects of the following documents:

- PM 004551, "NCD's Alarm System 12Mo EL," Revision 4, dated 12/17/09
- PM 003887, "Criticality Howlers 6Mo EL," Revision 8, dated 12/17/09
- E04-09-001, "HRR Criticality Accident Alarm System Coverage Demonstration," Version 2
- E04-09-003, "Analysis of Detector 5 Response to a Criticality Accident in the Uranyl Nitrate Building," dated August 2012

b. Observations and Findings

The inspectors observed that the licensee's CAAS had been changed to cover the UNB, which is currently under construction. The licensee's analysis (E04-09-003) shows that the two nearest CAAS clusters are able to provide coverage of the UNB. The inspectors reviewed this analysis to determine the adequacy of mo.dels, assumptions, and results; walked down the UNB, the area between the UNB and the nearest cluster; and visually inspected the location of the cluster. In between the UNB and one of these two clusters is a complex arrangement of tanks and piping, which the licensee did not model, but instead surrounded with a 'box' and killed any particles entering the box, which is conservative. The licensee used a source term normalized to produce 20 rad/min at a distance of 2 meters (minimum accident of concern). A sphere with the corresponding number of fissions/second was placed in each of the bulk uranyl nitrate tanks in turn, and the resulting dose rate calculated at the detector whose line of sight was obstructed by the kill box. The calculated dose exceeded the detector's set point by a considerable margin in all cases. The inspectors therefore determined that the coverage of the UNB has been established in accordance with the criteria described in the license and 10 CFR 70.24.

The inspectors also reviewed the procedures that govern the preventative maintenance (PM) that is applied to the CAAS and discussed them with NCS and process engineers.

The inspectors noted that the PM does not include consideration of detector response time. The inspectors discussed this with the licensee's engineers who indicated that the licensee has not experienced problems with inappropriately long response times. There is no requirement in NRC regulations or the license to limit the response time to within a certain value. ANSI/ANS-8.3-1997, Section 5.5, "Response Time" states that "The system shall be designed to produce the criticality alarm signal within one-half second of detector recognition of a criticality accident." However, the licensee has not committed to this provision in the standard. The inspectors discussed this issue with licensee engineers. The engineer responsible for overseeing CAAS maintenance and reliability was cognizant of appropriate response times.

c. Conclusions

The inspectors identified a weakness during the review of the licensee's criticality alarm system; in that the licensee's procedures do not provide for explicit consideration of response time. This weakness does not constitute a violation of NRC requirements or represent a significant safety issue.

7.0 Plant Activities (IP 88015)

a. Inspection Scope

The inspector 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 inspectors interviewed operators, NCS engineers, and process engineers both before and during walkdowns.

b. Observations and Findings

The inspector performed walkdowns of the UF_6 cylinder receiving pad, the DCF, the Line 2 ADU conversion area, the UO_2 Building including scrap recovery processes, the BLEU facility, the BLEU powder storage area, the UNB, the Volume Reduction Area, ELO, and the I3A Drum Storage Warehouse. The inspector noted that observed operations were performed in accordance with postings and written procedures.

c. Conclusions

No safety concerns were noted during walkdowns of plant operations.

8.0 Exit Meeting

The inspectors communicated the inspection scope and results to members of AREVA NP on September 13, 2012. The licensee's management acknowledged and understood the findings as presented.

SUPPLEMENTARY INFORMATION

1.0 List of Items Opened, Closed, and Discussed

Items Opened

URI 70-1257/2012-202-01	Construction of Uranyl Nitrate Building without a license amendment.

Items Closed

None

Items Discussed

None

2.0 Event Reports Reviewed

EN 47908	**Closed**	Failure to identify passive geometry controls for incredible sequences as IROFS
EN 48287	**Open**	AREVA NP Richland declared an alert due to a fire in the Volume Reduction Facility in the UO_2 Building

3.0 Inspection Procedures Used

IP 88015	NCS Program
IP 88016	NCS Evaluations and Analyses
IP 88017	Criticality Alarm Systems

4.0 Key Points of Contact

AREVA NP - Richland

C. Manning	Manager, NCS
W. Doane	NCS Team Leader
R. Link	Manager, Environmental, Health, Safety, and Licensing
K. Kulesza	NCS Engineer
J. Kreitzberg	NCS Engineer
C. Kahambwe	NCS Engineer
L. Hope	Manager, Training

NRC

Christopher Tripp	Senior Criticality Safety Inspector
Timothy Sippel	Criticality Safety Inspector

5.0 List of Acronyms and Abbreviations

ACA	apparent cause analysis
ADAMS	Agencywide Documents Access and Management System
ADU	ammonium diuranate
AOA	area of applicability
AREVA NP	AREVA Nuclear Power, Inc. (current company name)
BLEU	blended low-enriched uranium
CAAS	criticality accident alarm system
CCKC	criticality control key custodian
CEI	controlled event index
CR	condition report
DIW	deionized water
DCF	Dry Conversion Facility
ECN	engineering change notice
EHS&L	Environmental Health, Safety, and Licensing
ELO	Engineering Laboratory Offices
HEPA	high efficiency particulate air
IP	inspection procedure
IROFS	item relied on for safety
ISA	integrated safety analysis
MWP	maintenance work permit
NCS	nuclear criticality safety
NCSA	nuclear criticality safety analysis
NCSS	nuclear criticality safety specification
NRC	U.S. Nuclear Regulatory Commission
PFOD	probability of failure on demand
PJB	pre-job briefing
PM	preventive maintenance
SBC	safe batch container
$SCCO_2$	supercritical carbon dioxide
SNM	special nuclear material
SOP	standard operating procedure
U_3O_8	uranium oxide
UNB	uranyl nitrate building
UF_6	uranium hexafluoride
UNH	uranyl nitrate hexahydrate
UO_2	uranium dioxide
URI	Unresolved Item