October 22, 2010

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

SUBJECT: INSPECTION REPORT NO. 70-1257/2010-203

Dear Mr. Perkins:

The U.S. Nuclear Regulatory Commission (NRC) conducted a routine announced criticality safety inspection at your Richland, Washington, facility from September 20-23, 2010. The purpose of the inspection was to determine whether activities involving licensed materials were conducted safely and in accordance with NRC requirements. An exit meeting was held on September 23, 2010, during which inspection observations and findings were discussed with your 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 nuclear criticality safety (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. Throughout this inspection, observations were discussed with your managers and staff.

In accordance with 10 CFR 2.390 of NRC's "Rules of Practice," a copy of this letter and the enclosure will be available in the public electronic reading room of the NRC's Agency-Wide 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 Dennis Morey, of my staff, at (301) 492-3112.

Sincerely,

/RA/
Patricia A. Silva, Chief
Technical 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 70-1257/2010-203

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

cc w/o enclosures:
Mr. Gary Robertson, Department of Health

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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/ 2010-203
Licensee:	AREVA NP, Inc.
Location:	Richland, WA
Inspection Dates:	September 20-23, 2010
Inspectors:	Dennis Morey, Senior Criticality Safety Inspector Christopher Tripp, Senior Criticality Safety Inspector
Approved by:	Patricia A. Silva, Chief Technical Support Branch Division of Fuel Cycle Safety and Safeguards Office of Nuclear Material Safety and Safeguards

Enclosure

EXECUTIVE SUMMARY

AREVA Nuclear Power, Inc.
U.S. Nuclear Regulatory Commission
Inspection Report No. 70-1257/ 2010-203

Introduction

Staff of the U.S. Nuclear Regulatory Commission (NRC) performed a routine and announced nuclear criticality safety (NCS) inspection of the AREVA Nuclear Power Inc. (AREVA NP) facility in Richland, Washington from September 20-23, 2010. The inspection included an on-site review of the licensee's NCS program; NCS analyses; plant operations; NCS inspections, audits and investigations; criticality accident alarm system; internal events; integrated safety analysis (ISA) methodology; and open item follow-up. The inspection focused on risk-significant fissile material processing activities in the Supercritical Carbon Dioxide (CO_2) extraction system, ammonium diuranate (ADU) process area, analytical laboratory, rod and bundle assembly areas, human performance laboratory, engineering laboratory operations (ELO) area, uranium hexafluoride(UF_6) cylinder wash, miscellaneous uranium recovery (MUR) tank gallery, neutron absorbing fuels (NAF) area, and outside storage areas.

Results

- No safety concerns were identified regarding the licensee's NCS program.
- No safety concerns were identified regarding the licensee's internal NCS audits or corrective action program.
- No safety concerns were identified regarding the licensee's identification and investigation of internal events.
- No safety concerns were identified regarding the licensee's criticality alarm system.
- No safety concerns were identified during walkdowns of plant operations.

REPORT DETAILS

1.0 Plant Status

The licensee manufactures light water reactor fuel at its Richland Washington facility. During the inspection, the licensee was conducting routine dry conversion, powder preparation, pelletizing and bundle fabrication operations. The licensee was also performing routine scrap recycle and waste management operations.

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 aspects of the following documents:

- E15-03-002, "Integrated Safety Analysis Program Standard," Revision 5, dated November 17, 2007
- SOP[Standard Operating Procedure]-40559, "Safety Rules," Revision 2, dated January 28, 2009
- SOP-40555, "Handling of Analytical Laboratory Waste," Revision 7 dated February 11, 2010
- SOP-40927, "Supercritical CO_2 Process Operations," dated September 14, 2010
- E04-NCSS[nuclear criticality safety specification]-G01, "NCS Guide Rules and Generic Program Requirements," Revision 8, dated August 25, 2010
- E04-NCSS-186, Version 1.0, "Supercritical Carbon Dioxide Extraction System," dated May 21, 2010
- E04-NCSS-385, Version 6.0, "BLEU [blended low-enriched uranium] Pellet Sintering," dated June 21, 2010
- E04-NCSS-790, "Development, Process Support and Analytical Labs," Revision 7, dated May 25, 2010
- E04-NCSS-800, Version 6.0, "General DCF [Dry Conversion Facility] Requirements," dated February 18, 2010
- E04-NCSS-830, Version 6.0, "Dry Conversion Powder Preparation," dated February 18, 2010
- E04-NCSA [nuclear criticality safety analysis]-070, "ADU Line, ADU Process," Revision 8, dated July 16, 2010
- E04-NCSA-080,"Line 2 uranium Recovery," Revision 6, dated July 7, 2010
- E04-NCSA-090, "Line 2 UO_2 [uranium dioxide] Powder Production," Revision 8, dated October 16, 2009
- E04-NCSA-065, "UF6 Cylinder Washing Operation," Revision3, dated June 16, 2010
- E04-NCSA-140, "ELO Pellet Dissolver," Revision 5, dated June 21, 2010
- E04-NCSA-150, "Miscellaneous Uranium Recovery (MURS," Revision 7, dated December 8, 2009
- E04-NCSA-180, "ELO Gad Scrap Uranium Recovery," dated August 31, 2010

- E04-NCSA-186, Version 2.0, “Supercritical Carbon Dioxide Extraction System,” dated September 20, 2010
- E04-NCSA-355, “BLEU Powder Storage,” dated September 21, 2010
- E04-NCSA-830, Version 12.0, “Dry Conversion Powder Preparation,” dated February 18, 2010

b. Observations and Findings

The inspectors reviewed new and revised analyses (NCSAs and NCSSs). The inspectors interviewed the licensee’s 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 performance requirements have been met for selected accident sequences. During walkdowns, the inspectors evaluated the adequacy of IROFS to assure subcriticality margin for normal and credible abnormal conditions. The inspectors observed that E04-NCSA-186 was changed to clarify that clean-out of the Supercritical CO_2 System should be done when a significant volume (described as “two softball-sized accumulations”) of material appeared to be distributed inside one of the enclosures, and questioned the basis for this limit. The licensee stated that this was not intended to represent a strict volume limit, but merely to initiate clean-out whenever a significant mass was starting to accumulate. Given the low-density, relatively dry material, a much greater quantity of material would be needed before criticality would be possible, and the inspectors therefore, had no safety concerns.

The inspectors observed that NCSA-355 was changed mainly to support the storage of 45-gallon drums in the BLEU vault. Because these drums have higher moisture content than the 55-gallon drums currently allowed (i.e., 2 wt% vs. 0.5 wt% water equivalent moisture), it became necessary to restrict the volume and type of hydraulic fluid in the forklift used to move drums in and out of the vault. The revised NCSA stated that the neutron absorbing elements present in the forklift hydraulic fluid were credited in the analysis. The inspectors reviewed the licensee’s calculations and determined that neutron absorption was mainly due to the presence of nitrogen and chlorine, but that it did not appear appropriate to credit these as neutron absorbers because the fluid would only be mixed with the fissile material following an upset. The licensee reviewed the description of this control in the NCSA and concluded that the control should be revised to be a limit on the volume of moderator. The inspectors determined based on a review of calculation that restrictions on the volume and type of hydraulic fluid were adequate controls to ensure subcriticality in the BLEU vault.

The inspectors reviewed approximately 100 accident sequences which had been designated “not credible” or “at least highly unlikely” without designating IROFS. Among these, the inspectors observed approximately 25 accident sequences where the licensee had determined that the sequence was not credible based on the presence of a funnel break (a siphon break) on an inlet line. The purpose of the siphon break was to prevent backflow of solution through the line to an unfavorable geometry vessel. Due to pending NRC review of industry concerns regarding design features, use of such an installed device to conclude that an accident sequence is not credible without designating it an

IROFS is noted as an observation only. The inspectors had no immediate safety concerns regarding the affected operations.

c. Conclusions

No safety concerns were identified regarding the licensee's NCS program.

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 inspectors reviewed selected aspects of the following documents:

- E04-04-007, Version 1.0, "2009 AREVA NP Inc. Richland Nuclear Criticality Safety Program Assessment," dated November 20, 2009
- E04-07-201006, Version 1.0, "NCS Audit/Inspection Report – June 2010," dated July 26, 2010
- E04-07-201007, Version 1.0, "NCS Audit/Inspection Report – July 2010," dated August 16, 2010
- E04-07-201008, Version 1.0, "NCS Audit/Inspection Report – August 2010," dated September 14, 2010
- E04-06-002, Version 3.0, "Routine Nuclear Criticality Safety Audit," dated May 28, 2010

b. Observations and Findings

The inspectors discussed the audit and inspection process with facility NCS personnel, reviewed the last three monthly audit reports, and reviewed audit procedure E04-06-002, to ensure that all operations in the facility were appropriately reviewed annually to verify compliance with criticality safety limits and controls. The inspectors observed that this process included reviewing infractions and IROFS failures and degradation, to determine if adequate corrective action were taken to prevent recurrence. The inspectors reviewed the 2009 program assessment, which reviewed reportable events, repeated infractions, and the follow-up of NRC Inspector Follow-up Items (IFIs) and Notice of Violations. The report observed a downward trend in the ratio of administrative to engineered IROFS from 2006 to 2009. The inspectors noted that the assessment examined repeated infractions involving the same IROFS. In particular, IROFS 1503, which requires the securing of lids on 5-gallon buckets as a moderation control, had failed 15 times from 2006 to 2009. (There have been a total of 20 failures, including those that occurred following performance of the program assessment.) The program assessment initiated Condition Report CR 2009-3953 to follow up on this, but determined that the failure rate was within that assumed in the ISA and was therefore acceptable.

The inspectors determined that the licensee had performed an Apparent Cause Analysis to determine the reason for the unsecured container lid failures, and determined that

some container tops were bent, and there were a variety of new and old container rings in use, such that operators were not always able to adequately secure the lids to the containers. In addition, the license believes that containers are jostled when they are stored together on pallets in the Drum Coning Room. The licensee provided instructions to its supervisors to get pictures of any safe batch containers (SBCs) discovered with unsecured lids, to download the fissile material to other SBCs, and to place the SBCs in question out of service. The licensee also included the attachment of lids to SBCs as a work station in its Human Performance Laboratory. This laboratory is an environment where operators and supervisors can practice operational tasks without the presence of fissionable material, and receive instruction on safety and risk in nuclear processes, so as to sensitize operators and their supervisors to operational issues. The inspectors reviewed the licensee's determination that the failure rate was within the ISA's assumed probability of failure on demand (PFOD) index of -3. For each of the past four years, between 8000 and 12,000 buckets had been handled in the facility. In each of the past four years, between 1 and 6 failures were observed, resulting in a PFOD of at most 0.0006. The inspectors agreed with the licensee's assessment of the causes and its corrective actions, and also that the failure rate did not challenge the licensee's ability to meet the performance requirements. The inspectors had no safety concerns regarding the licensee corrective action program, including tracking and trending of IROFS failures.

c. Conclusions

No safety concerns were identified regarding the licensee's internal NCS audits or corrective action program.

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

a. Inspection Scope

The inspectors reviewed the licensee response to internally-reported events. The inspectors reviewed the progress of investigations and interviewed licensee staff regarding immediate and long-term corrective actions. The inspectors reviewed selected aspects of the following documents:

- E18-01-001, "External Reporting of Safety, Environmental, MC&A [material control & accounting] and Security Related Events or Conditions," Revision 6, dated January 13, 2010
- E18-01-002, Safety, Environmental or MC&A Incident notifications," Revision 11, dated July 1, 2010
- 2010-6025-FA EHS&L Condition, "NCS Infraction 2010-027 Lab Bucket Hood," dated August 30, 2010
- 2010-3374-FA EHS&L Condition, "NCS Infraction 2010-016 Mislabeled Bucket," dated May 13, 2010
- 2010-6746-FA EHS&L Condition, "NCS Infraction 2010-030 Moderator Intrusion into MCA," dated September 20, 2010

b. Observations and Findings

The inspectors reviewed selected licensee internally-reported events. The inspectors observed that internal events were investigated in accordance with written procedures and appropriate corrective actions were assigned. The inspectors had no safety concerns regarding the licensee's reporting, investigation, and correction of internal NCS related events.

The inspectors reviewed an internal event involving a failed IROFS on a laboratory hood. The licensee conducts five-year reviews of ISA analyses which include review of IROFS implementation. During a five-year review of the Lab 3 Dump Hood, the licensee identified a failed IROFS. The Lab 3 Dump Hood is used to load material into five-gallon buckets and had two IROFS: IROFS 4616; a peer review to ensure that the buckets were on the scales and the lid was properly attached; and, IROFS 4617; a weekly inspection of the dump hood enclosure to ensure powder is not accumulating. The licensee determined that IROFS 4616 was not being done and had therefore failed. The licensee further determined that IROFS 4617 was not being done in accordance with procedure and was therefore degraded. Following discovery of this event, the licensee identified that IROFS 104, prompt cleanup of spills (which was not credited for the accident sequence), was effectively implemented in the area. The licensee determined that the performance requirements were therefore met and that the event was not reportable.

The inspectors reviewed the accident sequence with the failed IROFS 4616. The initiating event for a powder spill greater than 40 kilograms into the hood is that a bucket is not placed on the scale correctly, which was assigned a frequency index of -1. IROFS 4617 was assigned a probability of failure on demand (PFOD) index of -2. Therefore, the controlled event index (CEI) with IROFS 4616 failed would be -3 and the performance requirements would not be met. The PFOD for IROFS 104 was assigned a PFOD index of -3 (though it was not credited for this accident sequence, it was credited on other accident sequences). When added to the accident sequence index of -3, this would have resulted in a CEI of -6, resulting in the performance requirements being met. The inspectors observed that IROFS 104 affected the accident sequence in question and the resulting CEI of -6 correctly reflected the safety margin for the process. The inspectors noted that the licensee was investigating the event and that the equipment was not in service, and therefore the inspectors had no immediate safety concerns regarding the Dump Hood event.

c. Conclusions

No safety concerns were identified regarding the licensee's identification and investigation of internal events.

5.0 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:

- E04-09-001, Version 1.0, "HRR Criticality Accident Alarm System Coverage Demonstration," dated 8/9/2010
- AID-10194, Version 2.0, "Reference 300 Neutron Criticality Detectors"

b. Observations and Findings

The inspectors reviewed the description and placement of criticality alarms in document E04-09-001. There are 27 individual Neutron Criticality Detectors (NCDs) in 9 locations throughout the facility. The analysis provided coverage maps showing dual coverage of the facility with all detectors functioning, and with each set of detectors failed in turn. The licensee performed MCNP [monte carlo n-particle] calculations showing that each detector provided adequate coverage out to a radius of 300 feet with intervening shielding equivalent to less than 54 inches of concrete.

The inspectors also examined maintenance procedures in document AID-10194, which include installation and removal, calibration, annual testing of NCDs, and semi-annual testing of the entire alarm system (including source checking of the detectors, actuation of alarm circuitry, and annunciation of the howlers). The inspectors discussed the testing procedures with licensee personnel and reviewed recent testing records to verify that the alarm system was maintained as required.

c. Conclusions

No safety concerns were identified regarding the licensee's criticality alarm system.

6.0 Plant Activities (IP 88015)

a. Inspection Scope

The inspectors performed plant walkdowns to review activities in progress and to determine whether risk-significant fissile material operations were being conducted safely and in accordance with regulatory requirements. The inspectors interviewed operators, NCS engineers, and process engineers both before and during walkdowns. The inspectors reviewed selected aspects of the following documents:

- CSA-611,941, "Deionized Water Whole plant P&ID [piping and instrument diagram]," Revision 16, dated December 19, 1994
- CSA-611,140, "Pellet Dissolver System P&ID," Revision 10, dated February 28, 1995

b. Observations and Findings

The inspector performed walkdowns of the CO_2 extraction system, ADU process area, analytical laboratory, rod and bundle assembly areas, human performance laboratory, ELO area, UF_6 cylinder wash, MUR tank gallery, NAF area, and outside storage areas. The inspectors noted that observed operations were performed in accordance with written procedures.

c. Conclusions

No safety concerns were identified during walkdowns of plant operations.

7.0 Open Item Review

Inspection Follow-up Item IFI 70-1257/2009-201-02

During a previous inspection, inspectors observed an inconsistency in the description of moderator controls in the DCF. Specifically, a limit on the volume of spillable liquids was described inconsistently in NCSA-830, NCSS-800, and the ISA Summary. Although this was closed in Inspection Report 2009-202, the inspectors noted that the discussion in the report details indicated that it remained open. Therefore, the inspectors reopened this item in this report.

The inspectors confirmed that the limit on containers holding spillable liquids had been changed from 5.0 to 4.5 gallons, which made the control consistent with the analytically determined safe moderator limit. The inspectors noted, however, that there remained an apparent discrepancy in the description of this control in different places in NCSA-830, Version 12.0, "Dry Conversion Powder Preparation." The inspectors noted that IROFS 1114, as referenced in the previous inspection report, had been replaced by new IROFS 4712, as an attempt to clarify the control. Section 1.4.5 of NCSA-830 describes IROFS 4712 as limiting the total volume of spillable liquids in each processing area of the DCF to less than 4.5 gallons. However, the accident sequence tables of NCSA-830 describe the IROFS as limiting the volume of any single container to less than 4.5 gallons. The inspectors questioned this apparent discrepancy, and were told that it was a case of the operating limits being set more conservatively than the analytical limit. To resolve this, the inspectors examined NCSS-800, Version 5.0, "Dry Conversion Powder Preparation", which establishes the following controls on spillable liquid:

1. "The maximum nominal volume of <u>any liquid bearing container</u> allowed in the Moderation Control Areas of the DCF is a nominal 4.5 gallon container (17 liters)."

2. "<u>No more than one container</u> of liquid with a volume between 1 and 17 liters (0.26 to nominal 4.5 gallons) shall be permitted in each of the following process areas:
   a. UF_6 Vaporization Room
   b. Powder Production (4 areas, one per level)
   c. Powder Preparation (4 areas, one per level)"

3. "The number of liquid bearing containers with a volume less than one liter is not limited, but those containers shall not be stored in the process area."

The inspectors therefore, determined that the actual limit on volume of spillable liquids is implemented both by limiting the total volume per area and the volume in any individual container (i.e., by prohibiting more than one container greater than 1 liter) in the area. While the presence of many containers less than 1 liter in volume is allowed, exceeding the safe moderation limit through spills involving these containers would require multiple failures that go beyond what need to be considered in a criticality analysis. Although the NCSA is not entirely consistent regarding the description of IROFS 1247, the inspectors conclude that the control as implemented is adequate to ensure safety. This item is closed.

8.0 Exit Meeting

The inspector communicated the inspection scope and results to members of AREVA on September 23, 2010. The licensee's management acknowledged and understood the findings as presented.

SUPPLEMENTARY INFORMATION

1.0 List of Items Opened, Closed, and Discussed

Items Opened

None

Items Closed

70-1257/2009-201-02*	Tracks the correction of inconsistent dry conversion process moderator control descriptions in safety and implementation documents.

*This item was closed in Inspection Report 70-1257/2009-202, even though it was described as being open. IFI 2009-201-02 was reopened and closed during the current inspection.

Items Discussed

None

2.0 Inspection Procedures Used

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

3.0 Key Points of Contact

AREVA NP, Inc. - Richland

C. Perkins	Site Manager
C. Manning	Manager, NCS
W. Doane	NCS Team Leader
L. Maas	Manager, Regulatory Compliance
R. Link	Manager, Environmental, Health, Safety, and Licensing
K. Kulesza	NCS Engineer
J. Payne	Maintenance

NRC

D. Morey	Senior Criticality Safety Inspector
C. Tripp	Criticality Safety Inspector

All attended the exit meeting on September 23, 2010.

Attachment

4.0 List of Acronyms and Abbreviations

ADAMS	Agency-Wide Document Access and Management System
ADU	ammonium diuranate
AREVA NP	AREVA Nuclear Power, Inc. (current company name)
BLEU	blended low-enriched uranium
DCF	Dry Conversion Facility
ELO	Engineering Laboratory Operations
IFI	Inspector Follow-up Item
IP	inspection procedure
IROFS	item relied on for safety
MCNP	monte carlo n-particle (a neutron transport code)
NAF	neutron absorbing fuels
NCD	Neutron Criticality Detectors
NCS	nuclear criticality safety
NCSA	nuclear criticality safety analysis
NCSS	nuclear criticality safety specification
NRC	Nuclear Regulatory Commission
PFOD	probability of failure on demand
P&ID	piping and instrumentation diagram
SBC	safe batch containers
SNM	special nuclear material
SOP	standard operating procedure
U_3O_8	uranium oxide
UF_6	uranium hexafluoride
UO_2	uranium dioxide