March 20, 2013

EA-13-048

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

SUBJECT: INSPECTION REPORT NO. 70-1257/2013-201 AND EXERCISE OF ENFORCEMENT DISCRETION

Dear Mr. Grandemange:

The U.S. Nuclear Regulatory Commission (NRC) conducted a routine, announced nuclear criticality safety (NCS) inspection at your Horn Rapids Road facility in Richland, Washington, from February 11-14, 2013. The purpose of the inspection was to determine whether activities involving special nuclear material were conducted safely and in accordance with regulatory requirements. An exit meeting was held on February 14, 2013; a re-exit was held on March 8, 2013.

The inspection, which is described in the enclosure, focused on risk-significant activities and plant conditions, the controls relied on for safety and their analytical bases, and management measures for ensuring controls are available and reliable to perform their safety functions. The inspection consisted of a selected review of safety basis documents, related procedures and records, examination of safety-related equipment, interviews with plant personnel, and facility walkdowns. The inspection observations and findings were discussed with members of your staff and management throughout the inspection.

Based on the results of this inspection, the NRC has determined that two Severity Level IV violations of NRC requirements occurred. The violations involve changes associated with the construction and operation of the Uranyl Nitrate Building (UNB). The first Severity Level IV violation is the construction and operation of the UNB without obtaining a license amendment as required under Title 10 of the *Code of Federal Regulations* (10 CFR) 70.72(d). 10 CFR 70.72(d) requires that you submit an amendment request for changes that require prior approval under 10 CFR 70.72. 10 CFR 70.72(c)(1)(i) states that you may make changes without prior approval if the changes do not create new types of accident sequences not previously identified in the ISA Summary. 10 CFR 70.72(c)(1)(ii) further states that you may make such changes if the changes do not use new processes, technologies, or control systems for which you have no prior experience. We have determined that the changes did create new types of accident sequences and did use processes and control systems for which you have no prior experience.

The second Severity Level IV violation is the failure to perform and document an adequate evaluation of the changes as required under Title 10 of the *Code of Federal Regulations* (10 CFR) 70.72(f). 10 CFR 70.72(f) requires that records of changes to your facility be maintained, including a written evaluation that provides the basis for a determination that the changes do not require prior NRC approval. The checklist included in your change package did not provide any documented justification for why the change did not require prior approval.

We have concluded that the violations resulted from matters not reasonably within your control due to lack of clarity of the requirement and associated guidance. Specifically, in your letter dated August 29, 2011, you informed the NRC of your intent to construct the UNB and provided a preliminary evaluation stating the reasons you believed that it did not require a license amendment request. The NRC responded to you by letter dated October 24, 2011, indicating that your proposed changes, as described in your letter, did not exceed the criteria in 10 CFR 70.72(c), and therefore did not require an amendment. For the reasons as stated in the subject inspection report, we have determined that an amendment request was required. However, the guidance provided by the NRC lacked sufficient clarity. Moreover, we have reviewed the safety basis for the UNB and concluded that the process as constructed is being operated safely and in accordance with regulatory requirements, so the safety significance of the violations is low. Using the NRC's Enforcement Policy, the violations met the criteria for enforcement discretion. I have been authorized, after consultation with the Director, NRC Office of Enforcement, to exercise enforcement discretion in accordance with Section 3.5 of the Enforcement Policy, and will refrain from taking enforcement action for the violations. However, it is our expectation that you will take all necessary steps to restore compliance and prevent recurrence, including steps to ensure that any future changes implemented without prior NRC approval will be based on a written evaluation that clearly documents your reasoning for why the change does not require a license amendment, in accordance with 10 CFR 70.72(f). Your corrective actions will be subject to inspection at a future date.

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

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

Sincerely,

/RA/

Larry Campbell, 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:
NRC Inspection Report 70-1257/2013-201

cc w/encl: (See page 3)

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

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Larry Campbell, Acting Chief
Programmatic Oversight and
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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/ 2013-201
Licensee:	AREVA NP, Inc.
Location:	Richland, WA
Inspection Dates:	February 11-14, 2013
Inspector:	Christopher S. Tripp, Criticality Safety Inspector
Approved by:	Larry Campbell, Acting Chief Programmatic Oversight and Regional Support Branch Division of Fuel Cycle Safety and Safeguards Office of Nuclear Material Safety and Safeguards

Enclosure

EXECUTIVE SUMMARY

AREVA Nuclear Power, Inc., - Richland
U.S. Nuclear Regulatory Commission
Inspection Report No. 70-1257/2013-201

Introduction

The inspector performed a routine, announced nuclear criticality safety (NCS) inspection of the AREVA Nuclear Power Inc. (AREVA NP) facility in Richland, Washington, from February 10-14, 2013. The inspector reviewed the licensee's NCS Program, analyses, criticality accident alarm system, internal events and follow-up, plant operations, and open items. Areas examined included ammonium diuranate (ADU) conversion, the uranium dioxide (UO_2) building and its associated scrap recovery processes, the blended low-enriched uranium (BLEU) facility, and the Uranyl Nitrate Building (UNB). A primary focus of the inspection was the construction and operation of the UNB, including receipt of uranyl nitrate solution, storage, and eventual transfer to the UO_2 Building.

Results

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

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

- No safety concerns were identified during review of internal NCS events and follow-up.

- A minor violation was identified during walkdowns of plant operations. Specifically, the inspector noted a partially blocked criticality drain in the UO_2 Building South Tank Gallery.

- No safety concerns were identified regarding operation of the UNB. However, two Severity Level IV violations were identified regarding performance of your 10 CFR 70.72 evaluation for the changes and failure to obtain a license amendment. These violations are not being cited due to the presence of special circumstances. The previous Unresolved Item (URI 70-1257/2012-202-01) is being closed to the violations.

REPORT DETAILS

1.0 Summary of Plant Status

The plant was operating normally during the inspection. The UNB was receiving and processing uranyl nitrate solution from the Erwin facility.

2.0 Nuclear Criticality Safety Program (IP 88015 & 88016)

a. Inspection Scope

The inspector reviewed nuclear criticality safety analyses (NCSAs) to verify that criticality safety was ensured through engineered and human controls with adequate double contingency and safety margin, and prepared and reviewed by qualified staff. The inspector reviewed selected aspects of the following documents.

- E04-NCSA-720, "Uranyl Nitrate Storage Building," Version 5.0, February 4, 2013
- E04-NCSS-720, "Uranyl Nitrate Storage," Version 5.0, January 28, 2013
- E04-NCSA-080, "Line 2 Uranium Recovery," Version 11.0, December 13, 2012
- E04-NCSA-120, "UNH Reprocessing," Version 15.0, February 12, 2013
- E04-NCSA-186, "Supercritical Carbon Dioxide (CO_2) Extractor System," Version 6.0, February 12, 2013
- E04-NCSA-205, "Mop Powder Dissolver Facility," Version 16.0, October 28, 2011
- E04-NCSA-490, "Rod and Pellet Vault Downloading," Version 9.0, April 3, 2012
- E04-NCSA-540, "Bundle Assembly & Storage," Version 8.0, August 8, 2012
- E04-NCSA-773, "UNH Warehouse," Version 4.0, December 17, 2012
- E04-NCSA-777, "Planar Array Storage of SNM in Sea-Land Containers and Warehouses," Version 12.0, January 23, 2013
- E04-NCSS-777, "Planar Array Storage of SNM in Sea-Land Containers and Warehouses," Version 11.0, January 23, 2013
- E14-01-022, "Uranyl Nitrate Building," Version 2.0, November 30, 2012
- CSA-607,590, "HRR Site Plan General Arrangement Uranyl Nitrate Storage Building," Rev. 0, September 2012
- CSA-611,720:
  - "Sheet 1: UN Storage Building Offload and TK-10 Receipt Tank P&ID," Rev. 0X, October 2012
  - "Sheet 2: UN Storage Building TK-11A & TK-11B P&IDs," Rev. 0X, November 2012
  - "Sheet 3: UN Storage Building Process Feed TK-11C P&ID," Rev. 0X, November 2012
  - "Sheet 4: UN Storage Building TK-12A & TK-12B P&ID," Rev. 0X, November 2012
  - "Sheet 5: UN Storage Building Feed TK-12C P&ID," Rev. 0X, November 2012
  - "Sheet 6: UN Storage Building TK-10U Utility Tank P&ID," Rev. 0X, November 2012
- CSA-611,080, "ADU Process Uranium Recovery P&ID," Rev. XH, July 1995
- ECN 8636C, "UN Storage Facility – Process Equipment," August 3, 2012
- MCP-30777, "UN Building Baseline Design Criteria," Version 1.0, September 29, 2012

- MCP-30131, “Safety/Licensing Evaluation of Facility Changes,” Version 8.0, March 23, 2012
- MCP-30774, “UN Storage Facility (System 720) Controls Design Description,” Version 4.0

b. Observations and Findings

The inspector reviewed NCSAs that had been developed or revised since the previous inspection, focusing mainly on those associated with the UNB and connected processes (see “Open Item Review” below) and those for which “prior experience” was claimed as part of the assessment done under 10 CFR 70.72. The inspector also reviewed those NCSAs for operations affected by internal events, and participated in discussions with the Regional inspectors on-site about the on-going replacement of the fluidized-bed reactors in Dry Conversion and changes to the Supercritical CO_2 system criticality drains. In all cases, the licensee provided for adequate protection against criticality hazards, in accordance with the performance requirements and double contingency principle. Evaluations were performed and reviewed by qualified NCS staff.

c. Conclusions

No safety concerns were identified regarding the licensee NCS program.

3.0 Criticality Alarm System (IP 88017)

a. Inspection Scope

The inspector reviewed records associated with audibility and functional testing of the criticality accident alarm system. The inspector interviewed licensee staff involved with testing of the criticality alarm horns and performing evacuation drills.

b. Observations and Findings

The inspector discussed criticality alarm audibility testing with licensee staff. The criticality alarm system is tested quarterly—twice a year for overall system functionality and twice a year by performing an evacuation drill. The licensee stated that it does not quantitatively measure alarm sound levels, except upon installation of a new alarm horn, but the evacuation drills provide a real-world test of audibility. The inspector reviewed the pre-test memo sent to site personnel in October 2012 for the last drill, requesting personnel to report any malfunctioning alarm howlers or areas where it was difficult to hear the horns. The inspector also reviewed the results for the last two drills, in April and November 2012. After the April drill, one malfunctioning howler was reported and fixed. There were no malfunctions in the November drill. In both drills, evacuation of all areas (except for a few individuals held back to test the accountability process) was completed within minutes and all evacuation procedures completed satisfactorily.

c. Conclusions

No safety concerns were identified during a review of the licensees’ criticality alarm system. The testing of the criticality alarm howlers by means of semiannual evacuation drills was acceptable.

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

a. Inspection Scope

The inspector reviewed several internally reported NCS infractions to determine whether they were appropriately resolved and assessed for reportability. There were no NCS event reports since the last NRC inspection. The inspector reviewed selected portions of the following documents:

- NCS Infraction 2012-025 through 2012-037 and 2013-001

b. Observations and Findings

The inspector reviewed records of 14 internal (non-reportable) NCS infractions that occurred since the previous NCS inspection and selected a cross-section of infractions to discuss with NCS staff. The inspector noted several repeated infractions, including the discovery of unlabeled UO_2 drums, the discovery of an unattended Nilfisk vacuum cleaner, and discovery that the pellet vault door was unlocked. No loss of criticality control resulted from these administrative infractions, which were of minor safety significance. A few infractions involved the degradation or failure of an item relied on for safety (IROFS). NCS Infraction 2012-28 involved leakage of rainwater onto a fuel bundle, in which the roof integrity was degraded. Infraction 2012-33 involved the over-stacking of pellet sheets, an administrative requirement that was degraded (because it violated the administrative limit but not the analyzed safety limit). Infraction 2012-34 involved the failure of an in-line monitor self-test on an IX (ion exchange) column after improper maintenance, which was considered degraded (because the actual monitor was still operational). Infraction 2012-35 involved the leakage of a level control valve when in the closed position, which was considered degraded (because no material was spilled as a result). The inspector examined the applicable NCSA for each process, as well as the licensee's reportability assessment, and concluded that in all cases, the licensee had correctly determined that the infraction was not reportable. The reportability assessment identifies the applicable accident sequence and determines based on the controls in place whether the licensee continues to meet the performance requirements. To determine whether a control has failed or is degraded, the licensee uses the failure condition for that IROFS in the Integrated Safety Analysis (ISA) Summary. The inspector noted that wherever an IROFS was considered degraded, the failure condition for the IROFS in the applicable accident sequence was not met. There was also a large safety margin in the overall likelihood index for most of the sequences (for example, sequences with a Controlled Event Index (CEI) of -6, -7, etc.), such that in the failure or significant degradation of the IROFS was tolerable. However, the inspector reiterated the observation from the previous inspection (Report 70-1257/2012-202) that taking full credit for a degraded IROFS (i.e., not reducing its probability of failure on demand (PFOD) index commensurate with the degree of degradation) could lead to a non-conservative reportability determination. The inspector identified no cases in which full credit for a degraded IROFS led to an improper determination that an infraction was not reportable.

c. Conclusions

No safety concerns were identified during a review of recent internal events. The inspector observed that the licensee was taking full credit for degraded IROFS, which could lead to an improper reportability determination. No internal events reviewed had been improperly characterized.

5.0 Plant Activities (IP 88015)

a. Inspection Scope

The inspector performed walkdowns to review activities in progress and determine whether fissile material operations were being conducted safely and in accordance with regulatory requirements.

b. Observations and Findings

During a Region II inspection examining plant modifications associated with the criticality drains used throughout the facility, the criticality inspector and a Regional inspector noted a criticality drain that had been installed nearly flush with the floor. This will be discussed in a Regional Inspection Report (Report 70-1257/2013-001). No other safety concerns were identified.

c. Conclusions

A criticality drain was discovered nearly flush with the floor in the UO_2 Building South Tank Gallery that was subsequently determined to not restrict the flow below what was required. No other safety concerns were noted during walkdowns of plant operations.

6.0 Open Items Review

URI 70-1257/2012-202-01

Criticality Safety of the UNB

This item tracked construction of the UNB without prior NRC approval. During a previous inspection, the inspectors identified the installation of bulk uranyl nitrate storage tanks in the new building, and determined that additional review was needed to determine whether “new types of accident sequences” not previously evaluated in the ISA Summary had been created, which would require an amendment under 10 CFR 70.72(c)(1)(i).

During the current inspection, the inspector reviewed the criticality safety analysis (E04-NCS-720), hazards analysis, and supporting documentation, walked down the building, and discussed the analysis with NCS staff, to determine whether it was being operated safely and in accordance with regulatory requirements. (The building had been under construction as of the previous NCS inspection.) The UNB contains six large storage tanks and a somewhat smaller receiving tank (TK-10R). Tank TK-10R is filled from the incoming LR-230 shipping containers on a truck bed in the truck staging area. Solution can be transferred from the receiving tank to the any of the six storage tanks, and from one storage tank to another. Tanks TK-11C and TK-12C transfer solution from the UNB to favorable geometry storage tank TK-207-4 in the UO_2 Building. The licensee’s NCSA demonstrated that an infinite sea of uranyl nitrate enriched up to 5 wt% ^{235}U will remain adequately subcritical with a concentration up to ~300 gU/l. The established safety limit for this process is 240 gU/l, and the normal concentration will be substantially less than that. Therefore, criticality safety for the UNB relies entirely on control of concentration. The inspector focused on reviewing the controls on the tanks to prevent concentration of uranyl nitrate *in situ*, as well as controls to prevent the transfer of solution from the tanks to areas without those controls.

The inspector reviewed the hazards analysis and piping and instrumentation diagrams (P&IDs) for the process, and determined that there are two mechanisms for transferring over-concentrated solution into the tanks: (1) receipt of highly-concentrated solution in LR-230 shipping containers from the Erwin facility, and (2) flow of concentrated solution from tanks in the UO_2 Building. Transfer of concentrated solution from LR-230 shipping containers is prevented by means of dual in-line density interlocks that close separate isolation valves between the containers and TK-10R. Transfer of concentrated solution from the UO_2 Building is prevented by a high-high level alarm and redundant criticality drains. Overflow of the tanks to the UO_2 Building would not be a concern because the tanks in ADU are analyzed safe at any concentration.

There are three primary means of concentrating uranyl nitrate while it is in the tanks: (1) precipitation, (2) evaporation, and (3) freezing. Precipitating agents are prohibited from being introduced into the tanks. The tank hatches are normally closed and sealed, and there is no reason or motive for anyone to open the tanks and add chemicals to them. The only area where precipitating agents might inadvertently be introduced is mop sink, where liquid that has leaked onto the floor can be cycled back to the tanks. The mop sink is equipped with an in-line pH monitor, and given the large volume of the tanks it would take a large quantity of precipitating chemicals to significantly concentration the contents. Evaporation is prevented by a combination of high-temperature and density interlocks, as well as by annual sampling of the tanks. The inspector reviewed the licensee's analysis of the evaporation rate in Appendix B of the NCSA. This analysis demonstrates that evaporation will be a very slow process, especially given the large volume of liquid and that the tanks are normally tightly sealed. Evaporation to the point that it exceeds the criticality limit of 240 gU/l would take at least several months for the smallest tank (TK-10R). Operators are required to dilute the solution if the annual sample exceeds a limiting concentration. Freezing is a concern because water in the solution tends to freeze first, resulting in a heightened concentration in the remaining liquid portion of the solution. The inspector determined that the licensee's analysis of the freezing rate was very conservative, in that it assumed a constant outside temperature of 0°F for the entire time required to freeze the solution. The licensee's calculations determined that it would take 9 days for TK-10R to reach the freezing point of uranyl nitrate at its normal concentration (~27°F). Once the water begins to preferentially freeze the solution will concentrate, which will further depress the freezing point, and the latent heat of freezing will be transferred to the remaining liquid. Both of these effects will slow down the rate of freezing once ice crystals being to form.
The result of the licensee's analysis in Appendix B of the NCSA is that it would take at least 42 days for the solution to freeze completely solid at the eutectic temperature (~14°F), at which point the uranyl nitrate would still be subcritical at ~200 gU/l. Controls present to prevent low-temperature conditions include tank and building low-temperature alarms, as well as emergencies heaters connected to diesel generators. The inspector confirmed that the temperature alarms are not interlocked equipment, but rather rely on operator response to take appropriate action. Some of these alarms sound in the central guard station and some only activate local horns and strobe lights outside the building,

but given the long time period required to evaporate or freeze the solution to an unsafe concentration, the inspector determined they would be adequate to ensure a timely response.

The final scenario of concern is rupture of the tanks or transfer piping, resulting in a spreading pool of solution that would gradually concentrate through evaporation if not promptly cleaned up. The building catch basin is sufficient to contain the contents of a single large storage tank. The licensee analyzed an infinite slab of uranyl nitrate and determined that it would take a 30 inch slab of uranyl nitrate at ~300 gU/l to reach the abnormal condition k_{eff} limit of 0.97, which significantly exceeds the height of the catch basin. The contents of a single large storage tank would fill the catch basin to a depth of 8.1 inches, at a concentration substantially less than the criticality limit of 240 gU/l, and there is therefore a large safety margin in the event of rupture of a single tank. If liquid were allowed to remain on the floor of the UNB for a long period of time (not calculated but presumed short compared to the months or longer to evaporate a sealed tank), it would eventually become concentrated through evaporation, but the slab height would correspondingly decrease. The licensee performed a sensitivity study of the k_{eff} of an infinite slab of solution as a function of concentration and slab height, and determined that the contents of a single storage tank spread across the catch basin would remain subcritical at any depth. The inspector reviewed this sensitivity analysis and found it to be adequate. The single-parameter limit for the minimum critical slab height of 5 wt% enriched uranyl nitrate is 6.7 inches, which is only slightly less than the slab height that results from the rupture of a single storage tank. The inspector determined that if the catch basin were filled to a depth of 8.1 inches (corresponding to a single storage tank) at the maximum allowed concentration of 240 gU/l, and liquid allowed to evaporate till it reached the minimum critical depth of 6.7 inches, the solution would concentrate to 290 gU/l. This is less than the minimum 300 gU/l required to exceed a k_{eff} of 0.97. Thus, the spillage of solution inside the building is not a criticality concern.

In the unlikely event that two or more storage tanks rupture, the licensee stated that the capacity of the catch basin would be exceeded and solution would exit the building. The inspector noted that the licensee commissioned a topographical survey of the terrain that surrounds the UNB. The UNB sits near the top of a hill, and solution that exits the doors would tend to flow over asphalt down between the UNB, the UO_2 Building, and the Engineering Laboratory Offices(ELO) Building. Based on the topographical survey, the licensee divided the surrounding terrain into three regions of irregular shape but with constant elevation. The volume of solution that would overflow the height of the catch basin was then presumed to flow to the lowest point in the area surveyed, which is the storm drain at the bottom of the hill, and begin filling up the three regions. Based on the shape of the terrain, it was determined that the volume of solution overflowing the catch basin from the rupture of two large storage tanks would accumulate over a wide area to a maximum depth of ~3 inches, which is well below the minimum critical slab depth. The inspector reviewed the calculation of the volume of the storage tanks and capacity of the catch basin, and reviewed the topographical map and associated calculations of solution depth for the surrounding terrain. The inspector determined that the overflowing solution will not accumulate to greater than a safe depth. The ELO truck ramp and recessed set of stairs are protected from the pool of solution by the geographic contours. The only accumulation point of potential concern is the storm drain itself, which lies at almost the lowest point in the footprint of the spreading pool. The licensee stated that in the event of a major spill, it will immediately cover any storm drains for environmental reasons. In the event of a rupture of tanks in the UNB, the solution will first overflow the catch basin and then run out underneath the doors. Even in a sudden catastrophic rupture, the swell will crest at most a few inches above the level of the basin, generating only a small static head. Thus, solution is expected to trickle rather than flood under the normally-closed building doors. The inspector therefore determined that there should be sufficient time to respond to such a catastrophic leak and cover the storm drain.

In addition to considering the spreading of a solution pool on asphalt, some areas in the footprint of the pool are composed of gravel over rocky soil. The licensee performed a sensitivity analysis in Appendix A of the NCSA of the effect of solution penetration into soil. Local soil composition for the Hanford area from ARH-600, "Criticality Handbook," was used for this study. Because the soil-rock matrix was presumed to act as a filter, concentrations up to 1200 gU/l were considered. The bounding case was determined to be a homogeneous mixture of uranyl nitrate at the maximum concentration and soil at a conservative volume fraction of 40%. The calculations showed that such a mixture will remain subcritical with a large margin, even to a penetration depth of 24 inches.

The only other concern for leakage of solution outside the catch basin in a leak from the transfer line between the UNB and UO_2 Buildings. The transfer line is double-sleeved with leak detectors strung out along its length. In addition, there are passive barriers in place wherever the transfer line is routed through high-traffic areas.

Based on a review of the hazards analysis and NCSA, systems drawings, P&IDs, and associated supporting analyses, a walkdown of the facility, and discussions with the NCS engineer, the inspector determined that the process as designed and conducted in the UNB provides for adequate protection against criticality hazards, and specifically all credible means of concentrating the solution beyond safe limits.

Change Process for Construction of the UNB

The inspector also reviewed the licensee's 10 CFR 70.72 change evaluation for the construction and operation of the UNB. This was documented as part of Engineering Change Notice (ECN) 8636C, on the included EHS&L (Environmental, Health, Safety, and Licensing) Change Impact Evaluation Form – Evaluation of NRC Pre-Approval. The evaluation form contains a checklist of the 70.72(c) criteria to determine whether prior approval is required. Answering "no" to all questions means that prior approval is not needed; a single "yes" answer means prior approval is needed in the form of a license amendment. The inspector noted that the form requires justification for a "yes" answer, but no justification for a "no" answer, which could result in a presumption that changes do not need prior approval. In ECN 8636C, the licensee answered "no" to all of the checklist questions. The licensee had informed the NRC of its intent to construct and operate the UNB, by letter dated August 29, 2011. By letter dated October 24, 2011, the NRC concluded that construction of the UNB did not exceed the criteria in 70.72(c), but also emphasized that "We would point out that the change must receive a full evaluation by your staff as required by 10 CFR 70.72(b)." 10 CFR 70.72(b) requires that any changes to the site, structures, processes, systems, equipment, components, computer programs, and activities of personnel be evaluated to determine, before the change is implemented, if an amendment to the license is required. 10 CFR 70.72(f) further requires that the licensee maintain records of changes to its facility that include a written evaluation that provides the basis for a determination that the changes do not require prior NRC approval. Contrary to the above, the licensee's procedures did not require a written justification documenting the basis for why construction and operation of the UNB did not need prior NRC approval. The licensee's checklist, without such a justification, did not demonstrate that a "full evaluation" of the change had been performed. The failure to perform or document an evaluation of the construction of the UNB as required in 10 CFR 70.72(b) and 70.72(f) is **Violation (VIO) 70-1257/2013-201-01**. The guidance provided by the NRC for 10 CFR 70.72(b) and 70.72(f) lacked sufficient clarity, however. Using the NRC's Enforcement Policy, the violation met the criteria for enforcement discretion in accordance with Section 3.5 of the Enforcement Policy, and the NRC will refrain from taking enforcement action for this violation. **VIO 70-1257/2013-201-01** is closed.

The inspector performed an independent evaluation of the change against the criteria in 10 CFR 70.72(c) to determine whether a license amendment was required. Only two of the criteria in 70.72(c) are relevant to this determination. A licensee may make changes without prior approval if the change does not:

> "Create new types of accident sequences that, unless mitigated or prevented, would exceed the performance requirements of §70.61 and that have not previously been described in the integrated safety analysis summary." [10 CFR 70.72(c)(1)(i)]
>
> "Use new processes, technologies, or control systems for which the licensee has no prior experience." [10 CFR 70.72(c)(1)(ii)]

The inspector determined that the remaining criteria from 70.72(c) do not apply to the UNB, and reviewed the available safety documentation and discussed the change with licensee staff to determine whether the above criteria were met.

The inspector observed that E04-NCSA-720 contains numerous accident sequences leading to a loss of concentration control in the UNB tanks, catch basin, connected processes, and outside environment. These accident sequences rely on a combination of administrative, active engineered, and passive engineered IROFS as described above. The UNB relies heavily on active interlocks and alarms on process variables such as temperature, density, solution level, and pH. Phenomena that can lead to concentration of solution include precipitation, evaporation, and freezing, and may involve leaks, rupture, backflow, and transfer of solution. The inspector discussed these scenarios with the NCS staff to determine whether there were sequences of these types discussed elsewhere in the ISA Summary.

Procedure MCP-30131 contains the following guidance with regard to types of accident sequences:

> The change creates a new type of accident sequence if the change results in potential consequences of concern from causes that are of a different type than previously analyzed.
>
> A new initiating event or accident sequence does not necessarily create a new type of accident sequence. For example, if a criticality accident could be caused by a flood, explosion, fire, overbatch, precipitation, etc., and these causes have been previously evaluated, any criticality accident resulting from these conditions would not constitute a new type of sequence.

The licensee also verbally elaborated that it considers two accident sequences to be of the same "type" if they have similar initiating events (e.g., resulting from fire, explosion, flooding, etc.) and lead to the same consequence (such as criticality). Thus, there is no consideration given to the specific control systems or subsequent events in the accident sequence in determining the "type" of accident sequence. While the license application does not define what is meant by a "type" of accident sequence, the inspector reviewed the applicable guidance from NUREG-1520, "Standard Review Plan for the Review of a License Application for a Fuel Cycle Facility," Rev. 1, and Regulatory Guide 3.74, "Guidance for Fuel Cycle Facilities Change Processes," and determined that the above guidance in MCP-30131 does not appear to be consistent with the NRC's stated position on what constitutes a "new type of accident sequence." In addition, there are sequences that do not meet the guidance in MCP-30131. Although concentration control is used in various processes throughout the facility, the presence of such large quantities of uranyl nitrate in unfavorable geometry tanks introduces new hazards and causes of accidents not encountered elsewhere in the facility. In particular, concentration of solution due to freezing is not a concern that has been evaluated elsewhere in the facility. In the UNB, freezing is a credible hazard that is prevented by means such as active temperature and density interlocks and the presence of emergency heaters.

MCP-30131 also contains guidance on what constitutes "new processes, technologies, or control systems for which the licensee has no prior experience":

> Past examples of changes that involved new processes, technologies, or control systems for with AREVA previously had no prior experience are: Dry Conversion, supercritical CO_2 extraction, and initial use of computer control systems to replace electrical relays. Future changes of this magnitude will most likely need NRC pre-approval.

The inspector determined that the bulk uranyl nitrate storage is a new processes that has not previously been conducted at the facility. The licensee stated that it stores uranyl nitrate in columns elsewhere, and in 55-gallon drums in the UNH Warehouse. The inspector noted that where uranyl nitrate is stored in columns—such as those receiving solution from the UNB in the UO_2 Building—the columns rely on geometry control, and therefore the same hazards that occur in the UNB will not lead to criticality. The inspector also reviewed the UNH Warehouse NCSA (E04-NCSA-773) to determine its applicability to the UNB. The inspector determined that the UNH Warehouse and the UNB have several significant differences, even though both rely on controlling solution concentration: (1) the Warehouse stores solution in individual containers, each having an insufficient mass to attain criticality; (2) there are no active engineered controls on the drums in the Warehouse, while the UNB tanks rely on multiple such control systems, and (3) there are no hard-piped connections between the drums in the Warehouse and other process areas that could lead to concerns over leakage in transit and backflow. Based on these significant differences, the inspector concluded that storage in 55-gallon drums in the UNH Warehouse is not equivalent to bulk storage in the UNB, and no other processes were could be identified that could be considered equivalent to the UNB. The inspector concluded that the UNB did not involve new technologies. However, nowhere else in the facility is a similar system of active engineered controls used in combination to maintain the concentration of stored solution in unfavorable geometry vessels.

The inspector also notes that the licensee informed the NRC of its intent to construct the UNB by letter dated August 29, 2011. Based on the technical discussion of the criteria of 10 CFR 70.72(c) contained in that letter, the NRC replied on October 24, 2011, to the effect that "The reviewers determined that the proposed changes, as described in the letter, do not exceed the criteria in…70.72(c), which would require an amendment," and further stated that "We would point out that the change must receive a full evaluation by your staff as required by 10 CFR 70.72(b). We have no further questions at this time. However, an inspection may be performed at a future date…". Because the licensee's determination, and the NRC response to it, pre-dated completion of the UNB ISA, the inspector reviewed the technical basis in the August 29, 2011 letter against the current facility design to determine if assertions in the letter were still valid. The discussion of the "new types of accident sequences" criterion in the letter mentions storage of uranyl nitrate in the UNH Warehouse and mentions evaporation and precipitation specifically, but the consequence of these events in the Warehouse will not lead to criticality, due to having an insufficient mass in each drum and the way the solution is stored, whereas in the UNB, these causes represent hazards that must be prevented by multiple barriers. In addition, in the UNB, there are hazards not present in the UNH Warehouse, and not mentioned in the letter, such as concentration due to freezing. The discussion of the "new processes, technologies, or control systems" criterion in the letter enumerates the control systems used by AREVA at the Erwin facility, and attempts to show that the licensee has prior experience with these control systems in other applications at its Richland facility. The inspector discussed each of these control systems with licensee staff and management. With regard to "low temperature interlocks prevent accidental concentration of uranium due to freezing," the licensee acknowledged that while it has experience with temperature interlocks (e.g., for preventing condensation in the Dry Conversion Facility), it does not have experience using them to prevent solution from freezing. While "airflow monitoring to detect increased airflow in tank vent lines as an indication that they have lost the 'closed system' protection against liquid evaporation" is discussed, this is not relied on as a control in the final design of the UNB storage tanks. Similarly, "building temperature control systems including HVAC and insulation" and a "back-up building heating system" are discussed, but they are not relied on for safety elsewhere in the facility. "Sump and sink transfer line pH interlock" is mentioned; the letter also states that the licensee has a long history of using pH monitors and interlocks, though it could not point out where else this type of control system is used to prevent precipitation for criticality safety. The inspector concluded that although the licensee had experience with the individual components used throughout the UNB process, it did not demonstrate prior experience using those components for criticality control, or to control the same process parameters, or in the same combination as a system of controls that function together to perform a discrete safety function. 10 CFR 70.72(c)(1)(i) states that the licensee may make changes to the site, structures, processes, systems, equipment, components, computer programs, and activities of personnel without prior NRC approval if the change does not create new types of accident sequences that, unless mitigated or prevented, would exceed the performance requirements of 10 CFR 70.61 and have not previously been described in the ISA Summary. 10 CFR 70.72(c)(1)(ii) states that the licensee may make such changes if the change does not use new processes, technologies, or control systems for which it has no prior experience. 10 CFR 70.72(d) further requires that the licensee submit an amendment request to the NRC in accordance with 10 CFR 70.34 and 70.65 for changes that require pre-approval under 10 CFR 70.72. Contrary to the above, the licensee's construction and operation of the UNB implemented a change that created new types of accident sequence, and which constituted a new process using new control systems for which the licensee had no prior experience, without first submitting an amendment request. Construction and operation of a process involving new types of accident sequences and new processes and control systems for which the licensee does not have prior experience, without prior NRC approval, is **VIO 70-1257/2013-201-02**. The guidance provided by the NRC for 10 CFR 70.72(c)(1)(i) and 70.72(c)(1)(ii) lacked sufficient clarity. Using the NRC's Enforcement Policy, the violation met the criteria for enforcement discretion in accordance with Section 3.5 of the Enforcement Policy, and the NRC will refrain from taking enforcement action for this violation. **VIO 70-1257/2013-201-02** is closed.

7.0 Exit Meeting

The inspector presented results of the inspection to the licensee during an exit meeting on February 14, 2013. The licensee stated that it understood the findings as presented.

SUPPLEMENTARY INFORMATION

1.0 List of Items Opened, Closed, and Discussed

Items Opened

VIO 70-1257/2013-201-01	The failure to perform or document a written evaluation justifying that construction of the UNB did not require prior NRC approval as required by 10 CFR 70.72(f)
VIO 70-1257/2013-201-02	Construction and operation of a process involving new types of accident sequences and new processes and control systems for which the licensee does not have prior experience, as stated in 10 CFR 70.72(c)(1), without prior NRC approval

Items Closed

URI 70-1257/2012-202-01	Construction of Uranyl Nitrate Building without a license amendment
VIO 70-1257/2013-201-01	The failure to perform or document a written evaluation justifying that construction of the UNB did not require prior NRC approval as required by 10 CFR 70.72(f)
VIO 70-1257/2013-201-02	Construction and operation of a process involving new types of accident sequences and new processes and control systems for which the licensee does not have prior experience, as stated in 10 CFR 70.72(c)(1), without prior NRC approval

Items Discussed

None

2.0 Inspection Procedures Used

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

3.0 Key Points of Contact

AREVA NP, Inc. - Richland

B. Doane	NCS Engineer
D. Grandemange	AREVA Plant Manager
C. Kahambwe	NCS Engineer
J. Kreitzberg	NCS Engineer
K. Kulesza	NCS Engineer
R. Link	Manager, Environmental, Health, Safety, and Licensing

L. Maas	Manager, Licensing and Compliance
C. Manning	Manager, NCS
K. Olsen	Project Engineer
S. Powers	Manager, Project Engineering
L. Stephens	Manager, Operations
T. Tate	Manager, Site Security and Emergency Planning

NRC

C. Rivera	Fuel Facility Inspector
M. Thomas	Fuel Facility Inspector
C. Tripp	Criticality Safety Inspector

5.0 List of Acronyms and Abbreviations

ADAMS	Agencywide Documents Access and Management System
ADU	ammonium diuranate
AREVA NP	AREVA Nuclear Power, Inc.
BLEU	blended low-enriched uranium
CEI	controlled event index
CO_2	carbon dioxide
DCF	dry conversion facility
ECN	engineering change notice
EHS&L	environmental, health, safety, and licensing
ELO	engineering laboratory offices
HA	hazards analysis
HVAC	heating, ventilation, and air conditioning
IP	inspection procedure
ISA	integrated safety analysis
IX	ion exchange
IROFS	item relied on for safety
MCC	minimum critical concentration
MCP	management control procedure
NCS	nuclear criticality safety
NCSA	nuclear criticality safety analysis
NCSS	nuclear criticality safety specification
NOV	notice of violation
NRC	Nuclear Regulatory Commission
P&ID	piping and instrumentation diagram
PFOD	probability of failure on demand
pH	acidity (Ger: *Potenz* + *H* (hydrogen))
$SCCO_2$	supercritical carbon dioxide
SNM	special nuclear material
UN	uranyl nitrate
UNB	uranyl nitrate building
UNH	uranyl nitrate hexahydrate
UO_2	uranium dioxide
URI	unresolved item
VIO	violation