August 23, 2013

Mr. Amir Vexler
FMO Facility Manager
Global Nuclear Fuel - Americas, LLC
P.O. Box 780, Mail Code J20
Wilmington, NC 28402

SUBJECT: GLOBAL NUCLEAR FUEL – AMERICAS, L.L.C. NUCLEAR REGULATORY COMMISSION INSPECTION REPORT NUMBER 70-1113/2013-202

Dear Mr. Vexler:

The U.S. Nuclear Regulatory Commission (NRC) conducted a routine, announced Nuclear Criticality Safety (NCS) inspection at your facility in Wilmington, North Carolina, from July 22-25, 2013. 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 July 25, 2013, 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 Document 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 Timothy Sippel, of my staff, at (301) 287-9151, or via e-mail to Timothy.Sippel@nrc.gov.

Sincerely,

/RA/

Michael X. Franovich, Chief
Programmatic Oversight
and Regional Support Branch
Division of Fuel Cycle Safety
and Safeguards
Office of Nuclear Material Safety
and Safeguards

Docket No. 70-1113

Enclosure:
NRC Inspection Report No. 70-1113/2013-202
w/Attachment: Supplementary Information

cc w/enclosure:

Scott Murray, Manager
Facility Licensing
Global Nuclear Fuels Americas, L.L.C.
Electronic Mail Distribution

Lee Cox, Chief
Radiation Protection Section
N.C. Department of Environmental
Commerce and Natural Resources
Electronic Mail Distribution

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U.S. NUCLEAR REGULATORY COMMISSION
OFFICE OF NUCLEAR MATERIAL SAFETY AND SAFEGUARDS

Docket No:	70-1113
License No:	SNM-1097
Report No:	70-1113/2013-202
Licensee:	Global Nuclear Fuel - Americas, LLC
Location:	Wilmington, North Carolina
Inspection Dates:	July 22–25, 2013
Inspectors:	Christopher S. Tripp, Sr. Criticality Safety Inspector Timothy Sippel, Criticality Safety Inspector
Approved:	Michael X. Franovich, Chief Programmatic Oversight and Regional Support Branch Division of Fuel Cycle Safety and Safeguards Office of Nuclear Material Safety and Safeguards

Enclosure

EXECUTIVE SUMMARY

Global Nuclear Fuel - Americas, LLC Fuel Fabrication Facility
NRC Inspection Report 70-1113/2013-202

Introduction

Staff of the U.S. Nuclear Regulatory Commission (NRC) performed a routine, announced Nuclear Criticality Safety (NCS) inspection of the Global Nuclear Fuel – Americas (GNF-A), LLC's, fuel fabrication facility in Wilmington, North Carolina, from July 22-25, 2013. The inspection included an onsite review of the licensee's NCS program, NCS analyses, NCS related audits and investigations, internal NCS event review and follow-up, criticality warning system, plant operations, and open items follow-up. The inspection focused on risk-significant fissile material processing activities and areas including the Dry Conversion Process (DCP), dry scrap recovery, pellet pressing operations, bundle assembly areas, sintering furnaces, waste recovery, and ceramics.

Results

- A weakness was identified during review of the licensee's NCS program and NCS analyses, concerning a disagreement between the analyses and Integrated Safety Analysis (ISA) Summary regarding the independence of administrative controls. This did not represent an immediate safety concern.

- No safety concerns were identified during review of NCS administrative and operating procedures.

- No safety concerns were identified during review of NCS audits.

- No safety concerns were identified during review of the NCS event review and follow-up.

- No safety concerns were identified during a review of the licensee's criticality warning system (CWS).

- No safety concerns were identified during walk downs of plant operations.

REPORT DETAILS

1.0 Summary of Plant Status

GNF manufactures uranium dioxide (UO_2) powder, pellets, and light water reactor fuel bundles at its Wilmington, North Carolina facility. During the inspection, the facility was converting uranium hexafluoride to UO_2 in DCP and performing normal powder, UO_2 and gadolinia pellet and fuel fabrication operations. Waste operations consisted primarily of packaging and storage of dry waste and processing of wet sanitary waste. The licensee was also installing the wiring and conduits for the new criticality accident alarm system (CAAS).

2.0 Nuclear Criticality Safety Program (IP 88015 & 88016)

a. Inspection Scope

The inspectors reviewed new and revised analysis, including a sample of the eleven new and revised criticality safety analysis (CSA), as well as the newly completed balance-of-plant ISA Summary. The inspectors evaluated the adequacy of the program and analyses in order 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 licensee 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 have been met for selected accident sequences. The inspectors accompanied NCS and other technical staff on walk downs of NCS controls in selected plant areas. A list of the key documents reviewed is in Section 3.2 of the Attachment.

b. Observations and Findings

The inspectors reviewed aspects of the licensee's recently completed "balance of plant" ISA, in coordination with a Regional inspection. The Regional inspectors noted that the licensee had established a number of 'sole IROFS' in its recently issued ISA Summary (dated June 28, 2013), and therefore the criticality inspectors reviewed these IROFS to determine how the licensee met the double contingency principle. In every instance the inspectors reviewed, the 'sole IROFS' was one of several credited controls and events needed before criticality would be possible. The inspectors reviewed the event sequences and event trees and determined that there were no instances in which a 'sole IROFS' was the sole item preventing an accident. In several sequences, three or more 'sole IROFS' would be required to fail before a criticality is possible. However, the licensee had chosen to consider these IROFS as 'sole IROFS' due to independence and human factor concerns that will be discussed below.

Several of the balance-of-plant operations that the inspectors reviewed, especially decontamination, are hands-on and rely heavily on administrative controls. Criticality safety in the decontamination area relies almost exclusively on administrative controls, and is based primarily on upstream controls designed to prevent bringing equipment containing an unsafe mass into the area. Due to this area's reliance on administrative rather than engineered controls, reliance on single-parameter control of mass, and the fluctuating nature of materials processed in the area and the effect of human factors, the potential for common-mode failures is substantially increased over other processing areas. The inspectors therefore selected several of these accident sequences in the decontamination area for detailed review. The sequences of interest all involve introducing an unsafe mass into the area, because contaminated equipment and high efficiency particulate air (HEPA) filters are washed to remove any residual fissile material (so controls on moderator and geometry can't always be applied).

Section 5.18.4.1 of the ISA Summary involves placing bulk quantities of uranium in a trash receptacle, which bounds the subsequent placement into a waste cart (Section 5.18.4.2) because for the accident sequence in 5.18.4.2 to occur uranium must first be placed in a trash receptacle, which is then placed in a waste cart. Placement of bulk uranium into a trash receptacle is prevented by two IROFS: IROFS 701-01, restriction on placing uranium in the trash, and IROFS 701-02, trash collection program. The inspectors reviewed the discussion of these controls in the Quantitative Risk Analysis (QRA) and relevant CSA (documents QRA-701 and CSA 7010-0512-03). In addition to the administrative requirement in IROFS 701-01 not to place items known to contain uranium and liquids into trash bags, the licensee stated that the bags are designed to tear away from their wire frame supports if their weight exceeds 25 kg. The inspectors questioned how the bags are produced, and reviewed the purchase specification (Manufacturing Material or Services Purchase Instruction MMSPI 1-FMO-073). This document specifies the color, thickness, length of tear-away perforations, and tear-away weight of the bags. Procedures specify that operators can only use these specific bags and specify how they are to be installed; they are prohibited from placing any additional material into bags that have torn away from their supports. An additional control is applied to the waste carts, which are equipped with an active control that is set to alarm if the total mass in the cart exceeds a safe quantity.

Section 5.18.4.5 of the ISA Summary involves placing bulk uranium onto the sort table in decontamination. Operators in upstream processes are required to clean out items to the extent practical before transporting to decontamination, which is designed to handle only low levels of contamination. The most likely items that could contain bulk uranium are overloaded HEPA filters from the heating, ventilation, and air conditioning (HVAC) system and removed process equipment. Most of the discussion in Section 5.18.4.5 involved transporting an overloaded HEPA filter to decontamination and subsequent washing on the sort table. For HEPA filters, the relevant controls are IROFS 701-09, HVAC filter weighing, and IROFS 701-10, sort table mass control. There are other controls for other items that are brought into the area and their associated sequences. Operators are required to weigh or to scan HEPA filters to ensure they contain less than a safe mass of 18.1 kg prior to transporting them to decontamination (IROFS 701-09). Once in decontamination, operators there are required to place items on the sort table only if they contain less than 18.1 kg (IROFS 701-10). Discussions with the NCS staff and review of the procedures indicated that decontamination operators were not required to weigh the filters, though they had to comply with the mass limit. As a result the operators had been weighing the filters in order to meet IROFS 701-10, even though they were not specifically instructed to do so. The ISA Summary discussion for these sequences considered IROFS 701-09 and 701-10 as 'sole IROFS' despite at least two IROFS being present.

In the sequence in Section 5.18.4.1 (bulk uranium placed into a trash receptacle), IROFS 701-01 and 701-02 were treated as independent, but 701-02 was assigned a likelihood of failure of 0.5 because of concerns the ISA Team had with reliability of the trash collection program. The failure of IROFS 701-02 has not been demonstrated sufficiently unlikely to be used as one leg of satisfying the double contingency principle, which requires that at least two *unlikely* and *independent* changes in process conditions must have to occur before a criticality is possible (though the inspectors were able to independently determine that additional controls were present, such as active gamma monitoring, as discussed below). The failure of IROFS 701-01 was not provided separately but was included in the frequency of the initiating event: the combination of having sufficient uranium available to be disposed of as trash and disposing of bulk uranium in the trash. In the sequence in Section 5.18.4.5, all the IROFS (including 701-09 and 701-10) were included in the frequency of the initiating event, which is the occurrence of a double-batched HEPA filter which is subsequently placed on the sort table. Thus, for both sequences, multiple controls were present but a likelihood score was developed that was either very low or was an overall score for the combined failure.

The licensee stated that during development of the balance-of-plant ISA, it had brought in Probabilistic Risk Assessment experts from General Electric (GE) Hitachi Nuclear to address human factors considerations. Licensee staff stated that the GE Hitachi Nuclear experts brought in to assist with the ISA used a combined score and categorized controls as ‘sole IROFS’ because they had concerns that the IROFS could not be treated as truly independent. Both the ISA Summary and QRA contain statements for several of the decontamination sequences that they are scoring and categorizing IROFS as ‘sole IROFS’ because there is a high degree of dependency between them. When asked how they meet double contingency for such sequences, the NCS staff stated that from their standpoint the controls are independent. The inspectors determined that there is no documented basis for how double contingency is met, or why the ISA/QRA and CSA drew contradictory conclusions. CSA 7010-0512-03 describes these sequences as ‘incredible’, based on the administrative controls (the IROFS mentioned above) in place to prevent the introduction of an unsafe mass. However, the CSA does not contain a discussion of control independence or justify how the sequences meet double contingency. Licensee staff stated that there was a disagreement between some of the human factors experts on the ISA Team and the NCS staff as to whether the controls were truly independent. The licensee appointed a mediator to decide between the two groups, but was unable to reach consensus because the licensee had committed to complete its ISA Action Plan and issue the balance-of-plant ISA by April 2013.

In areas of hands-on operation that rely primarily on administrative controls, the demonstration of double contingency necessitates careful consideration of the potential for common mode failure. Industry practices for ensuring independence typically involve selecting diverse controls to the extent practical, developing procedures that require that actions be performed by different operators, and the use of other means (independent verification, supervisory over checks, control keys, etc.) to minimize the potential for common mode failure. The inspectors find that in the case of the decontamination area, there is no documented justification of the independence of controls to demonstrate compliance with double contingency, and the operating procedures do not contain the restrictions normally used to ensure such independence. The results of the ISA Summary and QRA are in conflict with the conclusions in the CSA.

Despite the weaknesses with documentation and consistency between the different types of safety analyses, the inspectors do not consider there to be an immediate safety issue. With regard to trash, the nature of the process is such that the licensee is unlikely to generate and dispose of significant quantities of uranium in low-level trash. Although the licensee stated that a removed filter containing approximately 8 kg of material had once been improperly disposed of in a trash bag this is far less than the mass needed for a criticality even assuming all the material is 5 wt% enriched uranium oxide. The nature of the process and controls, including the subsequent gamma monitoring while in the waste cart prior to entry into decontamination, provide for adequate double contingency protection for this sequence. With regard to HEPA filters, the licensee staff discussed the procedures with operators in decontamination, and determined that the operators in the decontamination room did weigh the filters to ensure they complied with the sort table limit (IROFS 701-10). Previously this was being done as a good practice and hadn't been required by procedure. As part of the licensee's ongoing evaluation of the area, the requirement to weigh HEPA filters prior to placing them on the sort table was recently added to the operating procedure (OP 1080.20, "Decon Facility Operations," Rev. 36). Double contingency is therefore now being ensured by virtue of two required weight measurements by different individuals (i.e., those inside and outside decontamination). Prior to Rev. 36, the weight limit was theoretically based on operators noticing that the HEPA filters were far heavier than usual while lifting the filters onto the table. Although the weight needed to violate the mass limit would be significant (and the mass limit is more than a factor of two below the minimum critical mass to allow for double batching), the possibility that operators would trust the weight printed on the label from the upstream measurement rather than their own subjective perception of the weight when lifting the filters could not be discounted. However, the nature of the upstream processes, the second procedurally required weight measurement by an independent operator that was recently added to the procedure, and the margin to allow for double batching, and the human performance shaping factors associated with operators lifting a very heavy filter, are the basis for concluding that the process as actually performed though not as currently documented in the CSA has sufficient margin for safety and adequately provides for double contingency protection. The licensee recognizes the above deficiencies in its ISA and CSA, and discussed plans to reduce the number of 'sole IROFS' and revise its evaluation of the decontamination area during the inspection. In the short term, the licensee plans to revise the ISA Summary and CSA to be consistent with recent changes to its operating procedure. In the longer term, the licensee stated during the exit meeting that it will revise its analysis to clarify the basis for double contingency and clearly demonstrate independence. Revision of the CSA and ISA Summary to demonstrate double contingency in the decontamination area will be tracked as **Inspection Follow-up Item (IFI) 70-1113/2013-202-01**.

The inspectors reviewed training documents for position-specific IROFS training. The training documents were generated as part of the ISA improvement program and support the 'training' management measure for IROFS. The operators that use the IROFS get the training. The inspectors focused the review on the training for the IROFS related to the decontamination area discussed above. A training document was generated for each IROFS. The document provides the safety function of the IROFS, states the IROFS type (Administrative, etc.), whether or not the licensee considers the IROFS to be a 'sole IROFS,' lists the roles and responsibilities associated with the IROFS, and provides examples of IROFS failure. For example the roles and responsibilities for IROFS 701-10 state that the operator is to "(1) Comply with approved procedure to inspect and control items on the Sort Table. (2) Ensure no other waste items are on the sort table when waste carts are being processed. (3) Operator is to ensure the total uranium content of waste items on the Sort Table is less than a safe batch" (TD 701-10, "Sort Table Mass Control," Rev. 0).

c. Conclusions

The inspectors reviewed the recently completed ISA Summary, QRA, and CSA for the balance-of-plant. The inspectors determined that operations as conducted in the field appear to provide for adequate safety, but identified a programmatic weakness with the consistency between the ISA and CSA. Specifically, the CSA did not clearly document the basis for double contingency and disagreed with the ISA in regard to independence of administrative controls.

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

a. Inspection Scope

The inspectors reviewed the licensee's internal audit procedure, and records of previously completed audits of fissile material operations to assure that appropriate issues were identified and resolved. The inspectors accompanied a licensee audit team on an audit of the Power Receipt area, K-Powder Conveyors, DSR, SPF, and Laundry. A list of the key documents reviewed is in Section 3.3 of the Attachment.

b. Observations and Findings

The inspectors found that NCS audits were conducted according to written procedural requirements. The inspectors noted that NCS audits were focused on determining that plant operational requirements conform to those listed in the applicable NCS specification documents. The inspectors observed that licensee staff carried a copy of the applicable NCS requirements; examined NCS postings, labels, and other controls; interviewed operators to verify understanding of controls; and identified appropriate NCS-related deficiencies. The inspectors confirmed that deficiencies identified during the audit were screened and captured in the licensee's corrective action program when appropriate. Corrective actions were resolved in a timely manner. When possible the licensee's NCS engineer directed operators or maintenance personnel to take action to correct the situation immediately.

WI-18-104-02, "Internal Nuclear Safety Audits," requires that findings and potential non-compliances be entered into the corrective action program. The definition of a finding and of a potential non-compliance is stated in WI-18-104-02-F01, "Nuclear Safety Quarterly Audit Form," which is used to document the nuclear safety audits. The form defines a finding as "A nonconformance, a deficiency, or a potential violation of an internal requirement…" The form defines a potential non-compliance as a significant non-compliant regulatory condition (e.g. a potential violation of license requirements). This was summed up by an NCS engineer who stated that anything that requires an action goes into the corrective action program.

The inspector also reviewed EHS Compliance Auditor Certification Forms to assure that NCS engineers were appropriately trained and qualified to preform audits. The inspector also noted from the review of records of previous audits that trainee NCS engineers would accompany qualified auditors on audits before being qualified to conduct audits themselves. This was verified via discussion with licensee personnel and through review of the Certification Forms.

c. Conclusions

No safety concerns were identified during review of NCS audits.

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

a. Inspection Scope

The inspectors reviewed the licensee response to a selection of recent NCS related internally-reported events. Most of these events were suggested improvements or minor fixes related to the balance-of-plant ISA improvement project and the previous IROFS verification that was associated with that project. The inspectors determined that the licensee adequately evaluated whether or not these events were reportable to the NRC. There have been no NCS related reportable events since the last inspection. The inspectors reviewed the progress of investigations and interviewed licensee staff regarding immediate and long-term corrective actions. A list of the key documents reviewed is in Section 3.4 of the Attachment.

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 and tracked.

One NCS related event occurred while the inspectors were onsite, and the inspectors observed the licensee's response to this event. An operator discovered a can with less than two kilograms of uranium powder in a storage location for empty cans. A number of licensee personnel and managers were notified of the incident. An NRC inspector accompanied the NCS manager when the NCS manager went to observe the can and deal with any NCS concerns. The can was also stacked on top of an empty can. Stacking empty cans is allowed in empty can storage locations, while stacking cans containing fissile material is not allowed. However, because the other can was empty it didn't impact the significance of the condition or constitute an unanalyzed condition. After recording the condition of the can the NCS manager directed that it be moved to an approved storage location. The NCS manager questioned operators, and determined that the can had been moved about seven hours before it was discovered. The operator who moved the can was believed to have not verified that the can was completely empty after dumping its contents. As part of their investigation into the event the licensee planned to interview the operator after his shift started. The NCS manager also directed operators to check the other empty can storage locations to verify that the cans in these locations didn't contain fissile material, and he checked some locations himself.

The licensee also provided a list of sixteen NCS-related open condition reports (CRs) and their descriptions. Most were identified as part of the ISA improvement program and verification. Most of the CRs appeared to be of low safety significance, such as suggested improvements to safety, operations, or procedures. The inspector selected the CRs which appeared to be more significant for further review. No safety significant issues were identified.

However, the inspector noted that the new system appears to be cumbersome, including having requirements for multiple layers of review and concurrence before an item can be closed. The inspector observed that this is imposing an administrative burden on the licensee's staff, which may result in issues not being formally reported, and the use of workarounds to avoid the effort associated with the formal corrective action tracking system. The NCS manager reported that changes to the system had been proposed that would make it easier to deal with low safety significance items (including suggested improvements) and allow them to be closed sooner.

c. Conclusions

No safety concerns were identified during a review of recent licensee investigation of internal events, and corrective actions were adequately tracked by the licensee.

5.0 Criticality Alarm Systems (IP 88017)

a. Inspection Scope

GNF-A is in the process of/ replacing its CWS with a new CAAS: Pajarito Scientific's Criticality Incident Detection and Alarm System (CIDAS). During the inspection, the wiring and electronics for CIDAS were being installed. The inspectors reviewed technical descriptions of the new system and the licensee's detector coverage calculations used to determine detector placement. A list of the key documents reviewed is in Section 3.5 of the Attachment.

b. Observations and Findings

As described in DRF Section 0000-0161-5561 R0, "Criticality Accident Alarm System Coverage in GNF-A Facilities: Executive Summary," and PowerPoint presentations "CAAS Replacement Project: Criticality Detector Placement Overview" (June 2012) and "Transitioning from CWS to CAAS" (July 2013), the currently existing CWS system is being replaced with a more modern and more reliable system designed to minimize the number of false alarms and outage times, to reduce the sensitivity to lightning and power fluctuations, and to alleviate the difficulty of obtaining spare parts. The CIDAS system will use a different detector placement approach, deploying three individual detectors at each cluster location rather than utilizing overlapping zones of coverage. The system uses majority (two-out-of-three coincidence) logic to reduce the occurrence of false alarms. In addition, the new CIDAS system has a higher alarm set point than the old CWS system (100 mR/hr versus 10 mR/hr), which will further reduce the incidence of false alarms. As a result of deploying three detectors at each detector location and having a higher alarm set point, the total number of detectors will be increased.

The inspectors reviewed the licensee's detector coverage calculations, which were done for Fuel Manufacturing Operations (FMO/FMOX), the DCP, the Shipping Warehouse, and storage pads and outlying areas. The licensee plans to remove coverage from the Wilmington Field Service Center and surrounding storage pads. These areas have been reduced to less than the mass limits in Title 10 of the *Code of Federal Regulations* (10 CFR) 70.24(a) and the licensee stated it will install a fence to prevent the movement of special nuclear material between the covered and uncovered portions of the facility.

Coverage for the existing CWS system was determined using a simple but conservative point-kernel method. For the CIDAS system, the licensee performed calculations using the MCNP neutron transport code. A source term normalized to produce a dose equal to the threshold in 10 CFR 70.24 (20 rad of combined neutron and gamma radiation in soft tissue in one minute at a distance of one meter) was used. The licensee determined that a steady state criticality, in which the required dose is spread evenly over the entire minute, is the most conservative and was used as the minimum accident of concern. The licensee performed a series of MCNP (which is a computer code for criticality safety and shielding) calculations with six different fissile material compositions and used the composition resulting in the lowest gamma response (CIDAS only detects gamma radiation). The licensee modeled this most conservative of the source types in a large number of source locations (25 in FMO/FMOX, 18 in DCP, and 5 in the Shipping Warehouse) and calculated doses at numerous detector locations to establish a coverage "map" used to optimize detector placement. The licensee also made conservative assumptions with regard to shielding, including only prompt gammas in its dose calculations and neglecting the production of secondary gammas. This can cause the gamma dose to be significantly underestimated when shielding is very thick. The licensee also made conservative assumptions regarding the amount of shielding assumed to be present, modeling the walls and permanent structures explicitly and cloaking the source in one inch of stainless steel and eight inches of concrete to account for transient and non-structural shielding. For walls of a hollow cinderblock design, the licensee modeled them with a reduced density shown to be conservative. The inspectors reviewed the licensee's methodology for determining detector coverage and determined that it was conservative and appropriately accounted for uncertainties in the excursion dynamics, source type and location, and shielding.

c. Conclusions

No safety concerns were identified concerning the licensee's detector coverage analysis for the new CAAS.

6.0 Open Items

VIO 70-1113/2012-201-01

This violation concerned the licensee's failure to maintain double contingency for the Gad Rotary Press Valve. During a previous event, improper maintenance following an enrichment cleanout resulted in the valve not seating properly and allowing powder in excess of the mass limit to accumulate in the feed tube. This resulted in a loss of mass control and loss of double contingency protection. During previous inspections, inspectors reviewed completion of the licensee's corrective actions. This item remained open because the licensee had not yet completed its long-term corrective actions to enhance the Gad Rotary Press mass and feed tube geometry controls.

During this inspection, the inspectors walked down the gad press operation, reviewed the licensee's documentation of its corrective actions, and discussed the operation with NCS staff. The inspectors observed that the licensee had installed a plunger switch that used a conductivity measurement to determine whether the valve assembly had been reassembled correctly.

The plunger switch activates a flashing alarm light to alert operators if the valve assembly is improperly seated. The inspectors determined that this enhancement appeared sufficient to prevent recurrence. During initial review of this event in a previous inspection, the inspectors had identified a potential accident sequence involving a fire in the gad press area. The Tygon feed tube that extends from the ceiling to the top of the gad press enclosure could melt in the event of a large lube oil fire. There are sprinkler heads located near the gad press, and therefore a fire could result in the simultaneous loss of both geometry and moderator control, defeating double contingency protection. During the current inspection, the inspectors reviewed the licensee's installation of a heat sensor near the ceiling interlocked to a knife valve between the feed hopper and feed tube. The licensee stated that it had considered replacing the Tygon tube with a metal tube, but it was infeasible due to having to be supported by the plastic top of the enclosure. The inspectors questioned the location of the heat sensor near the ceiling, since the feed tube extends from the ceiling to the top of the enclosure. The licensee stated that the heat sensor, which had been relocated right next to the feed tube and directly over the gad press oil reservoir, has a set point significantly below the melting point of the Tygon tube. The licensee stated that it had not done any analysis to determine the temperature gradient resulting from a lube oil fire. However, there are several factors that provide additional uncredited conservatism. The gad press operation is a batch operation in which cans of dry powder are added to the feed hopper on the upper level. It does not seem credible that an operator would continue to batch powder to the feed hopper while a major fire is underway below. The licensee's mass calculations also do not credit the gadolinia in the powder. It is also unlikely that the powder would mound together in a geometry conducive to criticality. The powder is initially dry and has a tendency to slab out, and the effect of the sprinklers would likely be to disperse the material further. While some uncertainty about the efficacy of the heat sensor remains, the combination of controls on the gad press operation (criticality would require a loss of mass, geometry, and moderator) ensures double contingency protection is maintained. Therefore, **VIO 70-1113/2012-201-01** is closed.

7.0 Exit Meeting

The inspector communicated observations and findings to the licensee's management and staff throughout the week of the inspection and presented the final results to the licensee's management, including Amir Vexler, during an exit meeting held on July 25th, 2013. The licensee's management acknowledged the results of the inspection and understood the findings presented.

SUPPLEMENTARY INFORMATION

1.0 Items Opened, Closed, and Discussed

Items Opened

IFI 70-1113/2013-202-01	Tracks the licensee's revision of the CSA and ISA Summary to clarify the basis for double contingency in the decontamination area and to clearly demonstrate independence.

Items Closed

VIO 70-1113/2012-201-01	The licensee's failure to maintain double contingency control for the Gadolinia Rotary Press Valve

Items Discussed

None

2.0 Event Reports Reviewed

None

3.0 Key Documents Reviewed:

Inspectors reviewed selected aspects of the following documents. Documents that apply to multiple sections are listed in the section that is most applicable.

3.1 Plant Status

Not Applicable

3.2 Nuclear Criticality Safety Program (IP 88015 & 88016)

- CSA, "Non-Combustible Radioactive Waste Repackaging," Rev. 0, dated April 2013.
- CSA No. 801.00, "General Can Storage," Rev. 0, dated March 2013.
- CSA No. 1080.20, "New Decon Interaction Analysis," Rev. 4, dated March 2013.
- CSA No. 1910.02, "FMO Radwaste Permeate Tanks," Rev. 3, dated March 2013.
- CSA No. 1930.01, "FMO Radwaste Slab Tanks T-7030/T-7040," Rev. 6, dated March 2013.
- CSA No. 4040.01, "Vertical Beaker Rack," Rev. 0, dated May 2013.
- CSA 7010-0512-03, "Criticality Safety Analysis for Combustible and Non-Combustible Radioactive Trash," Rev. 3, dated July 2012.
- ISA Summary, "Integrated Safety Analysis Summary," Rev. C, dated June 28, 2013.
- OP 1080.20, "Decon Facility Operations," Rev. 36, dated March 29, 2013.
- MMSPI 1 FMO-073, "Manufacturing Material or Services Purchase Instruction," Rev. 0, dated August 1, 2007. Nuclear Safety Release/Requirements (NSR/R) #: 01.11.10, Area: Chemical, Subarea: FMO-RW, Unit: Bag-Filter, Rev. 5, approved

June 5, 2007. NSI E-3.0, “Nuclear Safety Reviews,” Rev. 37, dated November 16, 2011.
- NSR/R #: 01.16.03, Area: Chemical, Subarea: Radwaste, Unit: Slabtank, Rev. 7, approved April 4, 2013.
- NSR/R #: 01.16.11, Area: Chemical, Subarea: Radwaste, Unit: Bag-Filter, Rev. 5, approved May 21, 2002. QRA-701, “Decon,” Rev. 0, dated April 2013.
- TD 201-04, “Cold Trap Temperature and Pressure Control System,” Rev. 0.
- TD 701-01, “Trash Uranium Restrictions,” Rev. 0.
- TD 701-02, “Trash Collection Program,” Rev. 0.
- TD 701-03, “Waste Item Uranium Restrictions,” Rev. 0.
- TD 701-09, “HVAC Filter Weighing,” Rev. 0.
- TD 701-10, “Sort Table Mass Control,” Rev. 0.
- TOP-10966, “Handling of Noncombustible Waste Boxes in URU Controlled Area,” Rev. 0.

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

- “Power Receipt, K-Powder Conveyors, DSR, SPF, Laundry,” dated July 23, 2013.
- “Fuel Support: Stg.Pads, E-gun, HF Neutralization, Residue Scan, WTF, Lagoons, NFS Shipping Area,” dated June 28, 2013.
- “Chemet Lab, Environmental Lab,” dated June 5, 2013.
- “Bundle Assembly,” dated May 28, 2013.
- “UO_2 Fab,” dated May 21, 2013.
- “GAD,” dated May 14, 2013.
- “HF Building,” dated May 14, 2013.
- CP-18-104, “EHS Regulatory Compliance Audits,” Rev. 1, dated July 19, 2013.
- CR # 6879, dated June 5, 2013.
- EHS Compliance Auditor Certification Form, dated March 19, 2012.
- EHS Compliance Auditor Certification Form, dated June 4, 2013.
- WI-18-104-02, “Internal Nuclear Safety Audits,” Rev. 0, dated March 6, 2013.
- WI-18-104-02-F01, “Nuclear Safety Quarterly Audit Form,” Rev. 0, dated March 6, 2013.

3.4 Nuclear Critically Safety Event Review and Follow-up (IP 88015 & 88016)

- CR # 4703, dated January 18, 2013.
- CR # 5588, dated March 20, 2013.
- CR # 5651, dated March 22, 2013.
- CR # 5705, dated March 6, 2013.
- CR # 6872, dated June 12, 2013.
- WI-16-108-01, “Condition Review Process,” Rev. 0, dated May 21, 2012.

3.5 Criticality Alarm Systems (IP 88017)

- NEDC-33699P, “Analysis of Criticality Accident Alarm System Coverage in GNF-A Fuel Manufacturing Operation Facility,” Rev. 0, dated April 2012.

- DRF Section 0000-0147-4218 R1, “Dry Conversion Process and Shipping Warehouse Facility,” Rev. 1, dated September 2012.
- DRF Section 0000-0161-5561 R0, “Criticality Accident Alarm System Coverage in GNF-A Facilities: Executive Summary,” Rev. 0, dated July 2013.

3.6 Open Items

- CSA 1820.00, “GSR DM-10 Vibromill,” Rev. 3, dated October 6, 2006

3.7 Exit Meeting

Not Applicable

4.0 Inspection Procedures Used

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

5.0 Key Points of Contact

Global Nuclear Fuel

Crate, R	Program Manager, Fuels Growth Projects
Dodds, M	Sr. Criticality Safety Engineer
Dunn, E	Criticality Safety Engineer
Eghbali, D	Sr. Criticality Safety Engineer
Gual, M	Risk Assessment Engineer
Head, J	GM Regulatory Affairs
Hilton, A	FAB, Manager
Kennedy, A	ISA Program Manager
Murray, S	Manager, Licensing
Ollis, P	Licensing Engineer, Licensing
Paulson, L	GLE Manager, EHS/Nuclear Safety
Reeves, J	Manager, Integrated Safety Analysis
Rohner, J	Manager, Criticality Safety Program
Saito, E	EHS Manager
Stachowski, R	Chief Consulting Eng, Nuclear & Reactor Physics
Thomas, A	Criticality Safety Engineer (Training)
Vexler, A	FMO Facility Manager
Zino, J	Engineering
Livengood, D	Gad Area Engineer

NRC

Christopher S. Tripp,	Sr. Criticality Safety Inspector
Timothy Sippel,	Criticality Safety Inspector
Marvin Sykes,	NRC RII Branch Chief
Tom Vukovinsky,	Fuel Facility Inspector
Nicholas Peterka,	Fuel Facility Inspector
Timothy Goulding,	Fuel Facility Inspector

All attended the exit meeting on July 25, 2013.

6.0 List of Acronyms and Abbreviations

ADAMS	Agencywide Documents Access and Management System
CAAS	criticality accident alarm system
CIDAS	Criticality Incident Detection and Alarm System
CRS	condition reports
CSA	criticality safety analysis
CWS	criticality warning system
DCP	Dry Conversion Process
DSR	Dry Scrap Recycle
EN	event notice
FMO	Fuel Manufacturing Operation
GDSR	Gad Dry Scrap Recycle
GE	General Electric
GNF-A	Global Nuclear Fuels - America (licensee)
HEPA	high efficiency particulate air
HVAC	heating, ventilation, and air conditioning
IP	inspection procedure
IROFS	item relied on for safety
ISA	Integrated Safety Analysis
MRA	moderator restricted area
NCS	Nuclear Criticality Safety
NMSS	Office of Nuclear Material Safety and Safeguards
NRC	U.S. Nuclear Regulatory Commission
NSR/R	Nuclear Safety Release/Requirements
NSI	Nuclear Safety Instruction
OP	Operational Procedure
UO_2	uranium dioxide
QRA	quantitative risk assessment
TOP	Temporary Operating Procedure
WFSC	Wilmington Field Service Center