

October 12, 2007

EN 43359, EN 43439, EN 43542

Mr. Jack D. Fuller  
Facility Manager, M/C A20  
Global Nuclear Fuel - Americas, LLC  
P.O. Box 780  
Wilmington, NC 28402

SUBJECT: INSPECTION REPORT NO. 70-1113/2007-203 AND NOTICE OF VIOLATIONS

Dear Mr. Fuller:

The U.S. Nuclear Regulatory Commission (NRC) conducted a routine announced nuclear criticality safety (NCS) inspection of your facility in Wilmington, North Carolina, from September 10-14, 2007. The purpose of the inspection was to determine whether operations involving special nuclear material were conducted safely and in accordance with regulatory requirements. Inspection observations and findings were discussed with members of your staff and management throughout the inspection. An exit meeting was conducted at the conclusion of the inspection on September 14, 2007 and a telephonic re-exit meeting was held on September 24, 2007.

The inspection, which is described in the enclosure, focused on NCS analysis, risk-significant NCS controls, items relied on for safety, and principal management measures for ensuring that NCS controls are capable, available, and reliable. The inspection consisted of NCS analytical basis review, selective examinations of relevant procedures and records, examinations of NCS-related equipment, interviews with plant personnel, and facility walkdowns to observe in-plant conditions and activities related to NCS assumptions and controls. Throughout this inspection, observations were discussed with your managers and staff.

Based on the results of this inspection, the NRC has determined that two Severity Level IV violations of NRC requirements occurred. The violations were evaluated in accordance with the NRC Enforcement Policy included on the NRC's web site at [www.nrc.gov](http://www.nrc.gov); select What We Do, Enforcement, then Enforcement Policy. The violations are being cited in the enclosed Notice of Violations (Notice), and the circumstances surrounding it are described in detail in the subject inspection report. The violations are being cited in the Notice because they were identified as the result of events or NRC inspection. The first violation being cited as a Severity Level IV violation is the failure to verify the composition or periodically verify the integrity of polyvinylchloride pipe in the gadolinia slugger press. The second violation being cited as a Severity Level IV violation is the failure to ensure that criticality controls in the new revision of the ISA were current and properly documented.

You are required to respond to this letter and should follow the instructions specified in the enclosed Notice when preparing your response. The NRC will use your response, in part, to determine whether further enforcement action is necessary to ensure compliance with regulatory requirements.

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

Sincerely,

**/RA/**

Deborah A. Jackson, Chief  
Technical Support Branch  
Division of Fuel Cycle Safety  
and Safeguards, NMSS

Docket No.: 70-1113

Enclosures: 1. Notice of Violations  
2. Inspection Report No. 70-1113/2007-203

Attachment: Supplementary Information

cc: w/enclosures: Scott Murray  
Global Nuclear Fuels - Americas, LLC

cc: w/o enclosures: Beverly O. Hall  
North Carolina Department of Environmental  
Health and Natural Resources

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## NOTICE OF VIOLATIONS

Global Nuclear Fuel - Americas, LLC  
Wilmington, North Carolina

Docket No. 70-1113  
License No. SNM-1097

During an NRC inspection from September 10 - 14, 2007, violations of NRC requirements were identified. In accordance with the NRC Enforcement Policy, the violations are listed below:

Safety Condition No. 1 of License No. SNM-1097 requires that material be used in accordance with the statements, representations, and conditions in the license application dated June 5, and December 7, 1999, and supplements thereto.

1. License section 6.2.5.5 requires, in part, that for fixed neutron absorbers used as part of a geometry control, (1) the composition of the absorber are measured and documented prior to first use, and (2) periodic verification of the integrity of the neutron absorber system subsequent to installation is performed on a scheduled basis approved by the criticality safety function.

Contrary to the above, on and before May 11, 2007, removable polyvinylchloride piping was used in the gadolinia slugger press as part of a geometry control and was not treated as a fixed neutron absorber. Specifically, the composition of the polyvinylchloride was not verified prior to first use and periodic integrity verification of the polyvinylchloride piping was not performed on a scheduled basis subsequent to installation.

This is a Severity Level IV Violation (Supplement VI).

2. Section 4.1 of the license application states, in part, that the GNF is committed to establish and maintain the controls identified in the integrated safety analysis (ISA) and to provide an appropriate level of assurance to ensure their reliability. The ISA will be maintained current through the configuration management program process.

Section 4.10 of the license application states, in part, that the ISA is maintained current through a configuration management program that ensures that: (1) facility changes receive adequate integrated safety review, and (2) changes are adequately documented.

Contrary to the above, on and before August 1, 2007, the licensee failed to ensure that criticality controls in the new revision of the ISA were current and properly documented. Specifically, the licensee identified 14 examples of criticality controls that were not described as items relied on for safety in the new ISA revision but were required to be in place according to criticality analysis. The licensee could not demonstrate that the configuration management program would maintain the reliability and availability of the omitted controls as required by 10 CFR 70.61(e) and 10 CFR 70.62(a)(3).

This is a Severity Level IV Violation (Supplement VI).

**Enclosure 1**

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

If you contest this enforcement action, you should also provide a copy of your response to the Director, Office of Enforcement, U.S. Nuclear Regulatory Commission, Washington, D.C. 20555-0001.

Because your response will be made available electronically for public inspection in the NRC Public Document Room, or from the NRC's document system (ADAMS), accessible from the NRC web site at <http://www.nrc.gov/reading-rm/adams.html>, to the extent possible, it should not include any personal privacy, proprietary, or safeguards information so that it can be made available to the public without redaction. If personal privacy or proprietary information is necessary to provide an acceptable response, then please provide a bracketed copy of your response that identifies the information that should be protected and a redacted copy of your response that deletes such information. If you request withholding of such material, you must specifically identify the portions of your response that you seek to have withheld, and provide in detail the bases for your claim of withholding (e.g., explain why the disclosure of information will create an unwarranted invasion of personal privacy or provide the information required by 10 CFR 2.790(b) to support a request for withholding confidential commercial or financial information). If safeguards information is necessary to provide an acceptable response, please provide the level of protection described in 10 CFR 73.21.

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

**Dated this 12 th day of October 2007**

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

Docket No.: 70-1113

License No.: SNM-1097

Report No.: 70-1113/2007-203

Licensee: Global Nuclear Fuel - Americas, LLC

Location: Wilmington, North Carolina

Inspection Dates: September 10-14, 2007

Inspector: Dennis Morey, Senior Criticality Safety Inspector, Headquarters

Approved: Deborah A. Jackson, Chief  
Technical Support Branch  
Division of Fuel Cycle Safety  
and Safeguards, NMSS

**Enclosure 2**

**Global Nuclear Fuel - Americas, LLC Fuel Fabrication Facility  
NRC Inspection Report 70-1113/2007-203**

**EXECUTIVE SUMMARY**

**Introduction**

Staff of the U.S. Nuclear Regulatory Commission (NRC) performed a routine and announced nuclear criticality safety (NCS) inspection at Global Nuclear Fuel - Americas (GNF), LLC, fuel fabrication facility in Wilmington, North Carolina, from September 10-14, 2007. The inspection included an on-site review of the licensee NCS program, NCS analyses, NCS-related audits and investigations, and plant operations. The inspection focused on risk-significant fissile material processing activities including the dry conversion process (DCP), dry scrap recovery, gadolinium scrap recovery, and pellet pressing operations.

**Results**

- A severity level IV violation was identified for the failure to implement license requirements for fixed neutron absorbers.
- A severity level IV violation was identified for the failure to ensure that criticality controls in the new revision of the integrated safety analysis (ISA) were current and properly documented.
- A Non-Cited Violation was identified related to a nonbounding NCS calculation.
- No safety concerns were identified during review of NCS audits.
- No safety concerns were identified during walkdowns of plant operations.

## REPORT DETAILS

### 1.0 Plant Status

Global Nuclear Fuels - America, LLC manufactures uranium dioxide (UO<sub>2</sub>) powder, pellets, and light water reactor fuel bundles at its Wilmington, NC facility. During the inspection, the facility was converting uranium hexafluoride (UF<sub>6</sub>) to UO<sub>2</sub> with a DCP and performing normal powder, UO<sub>2</sub> and gadolinia pellet and fuel fabrication operations. Waste operations consisted primarily of packaging and storage of dry waste and processing of wet sanitary waste.

### 2.0 Nuclear Criticality Safety Program [88015, 88016]

#### a. Inspection Scope

The inspector reviewed 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 inspector accompanied NCS and other technical staff on walkdowns of NCS controls in selected plant areas. The inspector reviewed selected aspects of the following documents:

- CSA 1020.00, "Rotary Press Unit Analysis," Revision 3, dated February 21, 2007
- CSA 1050.30, "Automated Bundle Assembly Machine Unit Analysis," Revision 3, dated May 7, 2007
- CSA 1320.07, "Moderation Restricted Area," Revision 7, dated July 23, 2007
- CSA 1720.02, "Gad Rotary Slugger," Revision 0, dated November 13, 1998
- CSA 1720.02, "Gad Slugger Lower Section," Revision 1, dated June 4, 2007
- CSA1922.00, "FMO [fuel manufacturing operation] Radwaste Filtration and Disposal," Revision 1, dated April 27, 2007
- Interaction Analysis, "Grind Rod-Load," Revision 12, dated May 31, 2007
- Parameter Analysis, "Safe Mass Limits for Uranium Systems," Revision 0 dated June 1, 2007

#### b. Observations and Findings

The inspector determined that analyses were performed by qualified NCS engineers and that independent reviews were completed for the evaluations by other qualified NCS engineers. With the exception of the violations noted in the remainder of this inspection report, the inspector determined that subcriticality of analyzed systems and operations was assured through appropriate limits on controlled parameters, and that double contingency was assured for each credible accident sequence leading to inadvertent criticality. With the exception of the violations noted, the inspector determined that appropriate NCS controls were identified in NCS analyses and that the controls assured the safety of the operations.

The inspector reviewed preliminary calculations for placement of detectors in a proposed new licensee criticality warning system (CWS). The licensee had previously calculated

CWS detector placement using point depletion methodology and a 10 mrad detection threshold. The licensee now plans to use monte carlo n-particle calculations and a 100 mrad detection threshold for detector placement. The inspector observed that the licensee source was modeled surrounded by 1-inch of steel to simulate incidental shielding so that process equipment does not have to be modeled. The inspector also noted that maximum detection range under these criteria appears to be about 300 feet which required the analyst to use variance reduction. The highest secondary to primary gamma ratio noted was 1.25 which the inspector felt was reasonable. The inspector noted that significantly higher secondary to primary gamma ratios would indicate that the estimated gamma flux might be too sensitive to incidental shielding thus reducing confidence in the 1-inch steel model. No safety issues were identified regarding the licensee CWS detector placement scoping calculations.

### **Gadolinia Slugger Press**

The inspector reviewed NCS analysis related to the gadolinia slugger press (CSA 1720.02, "Gad Rotary Slugger," Revision 0, dated November 13, 1998). The licensee NCS analysis had considered an upset condition of the lower body of the slugger press becoming filled with  $UO_2$  and oil. The licensee filled the lower slugger press body with polyvinylchloride (PVC) pipe as a geometry control. This geometry control is discussed below in Section 4.b which reviews a reported loss of geometry control event in the slugger press. The inspector noted that, subsequent to the loss of geometry control event, the licensee revised the slugger press analysis to more accurately reflect the actual control configuration. In the original NCS analysis, the licensee inserted about 8,500 inches of PVC pipe when only about 4,500 inches of pipe could actually be placed into the press body. The pipe was in the form of a mixture with  $UO_2$  and isostearic acid which the inspector observed would fix the system reactivity at a subcritical value. This upset condition was used to establish the subcriticality of the system with a calculated effective neutron multiplication factor of approximately 0.92.

License section 6.3.2.1 requires, in part, that credible process upsets include anticipated off-normal or credible accident conditions and must be demonstrated to be critically safe in all cases. Contrary to the above, on and before June 4, 2007, NCS analysis, CSA 1720.02, Revision 0, did not demonstrate for the credible accident condition of uranium accumulation in the lower housing, that the gadolinium slugger press was critically safe in all cases. Specifically, the analytical model of the gadolinium slugger press placed PVC piping, a neutron absorber, where it could not actually fit in the equipment such that anticipated off-normal or credible accident conditions were not bounded. The inspector determined that the previous NCS analysis (CSA 1720.02 Revision 0) had not demonstrated that the gadolinium slugger press was critically safe in the case of uranium and oil accumulation in the lower slugger press body because the analytical model used more PVC piping than could reasonably be fitted into the subject equipment.

This non-repetitive, licensee identified and corrected violation is being treated as a Non-Cited Violation consistent with Section VI.A.8 of the NRC Enforcement Policy. The failure to demonstrate that the gadolinium slugger press was critically safe in all cases is **Non-Cited Violation (NCV) 70-1113/2007-203-01**.

c. Conclusions

A Non-Cited Violation was identified related to a nonbounding NCS calculation.

**3.0 Nuclear Criticality Safety Inspections, Audits, and Investigations [88015]**

a. Inspection Scope

The inspector reviewed licensee internal audit procedures, records of previously completed audits of fissile material operations, and records of NCS infractions. The inspector observed a licensee audit team conduct an audit in the DCP homogenization lines and blend/press/granulate lines. The inspector reviewed selected aspects of the following document:

- Nuclear Safety Instruction E-2.0, "Internal Nuclear Safety Audits," Revision 41, dated March 27, 2007

b. Observations and Findings

The inspector found that NCS audits were conducted according to procedural requirements. The inspector noted that NCS audits were focused on determining that plant operational requirements conform to those listed in the applicable NCS specification documents. During the audit of the DCP homogenization lines and blend/press/granulate lines, the inspector observed that the licensee's NCS auditor carried a copy of the applicable NCS requirements, examined NCS postings, labels, and other controls and identified appropriate NCS-related deficiencies.

c. Conclusions

No safety concerns were identified during review of NCS audits.

**4.0 Nuclear Critically Safety Event Review and Follow-up [88015]**

a. Inspection Scope

The inspector reviewed three recent NCS-related events that the licensee had reported to NRC. The inspector reviewed licensee investigation reports, interviewed NCS engineers and operators, and performed walkdowns of selected work areas.

b. Observations and Findings

The inspector observed that the selected licensee reportable events were investigated in accordance with written procedures and that appropriate corrective actions were assigned and tracked.

### **Gad Slugger Press PVC Pipes**

The licensee uses a rotary press called a slugger press as a precompaction step in gadolinia powder processing. The slugger press recirculates lubricating oil in the large lower section of the press body where uranium could potentially accumulate. The licensee had filled the lower section of the slugger press with PVC pipe sections as a geometry control. During maintenance, an engineer observed that the PVC pipe sections were not correctly installed. The licensee reported a loss of geometry control in event notice (EN) 43359 involving a gadolinia slugger press. The licensee has since reinstalled the piping as required by the NCS control and has completely revised the related NCS analysis. This event is closed.

The inspector noted that the chlorine in the PVC piping that the licensee was using for geometry control was necessary to meet the license-required subcritical limit and was, therefore, a fixed neutron absorber. The inspector noted that license Section 6.2.5.5 requires, in part, that for fixed neutron absorbers used as part of a geometry control; (1) composition of the absorber is measured and documented prior to first use, and (2) periodic verification of the integrity of the neutron absorber system subsequent to installation is performed on a scheduled basis approved by the criticality safety function. The inspector determined that licensee actions in response to the event had included verification of the composition and integrity of the PVC pipe. Licensee staff stated that, since they considered the PVC pipes to be primarily a geometry control, they had not proceduralized the composition or periodic integrity verifications. The failure to verify the composition or periodically verify the integrity of PVC pipe in the gadolinia slugger press is **Violation VIO 70-1113/2007-203-02**.

### **Die Lubricant Substituted for Pore Former**

Following the discovery of a quality control upset, the licensee reported a failed NCS item relied on for safety (IROFS) in EN 43439. After observing poor pellet pressing performance, the licensee determined that excess carbon was present in the powder and concluded that an operator had substituted die lubricant for pore former during an operation to put additives into UO<sub>2</sub> powder. The licensee had identified the two most likely possibilities for entering the incorrect additive and completed corrective actions to clarify procedural requirements for additive operations. Other corrective actions, such as modifying the additive station, were being considered by the licensee. The inspector noted that the carbon content of the two additives was different but that no criticality safety limit was exceeded during the event. The inspector noted that the established NCS limit of nine liters of moisture equivalent in the powder blender was substantially higher than could be reached by a single additive substitution. This event is closed.

### **DSR Container Transfer Station not in ISA**

In EN 43542, the licensee reported that the dry scrap recovery transfer station was not identified in the ISA and required IROFS had not been declared. The discovery of the missing dry scrap recovery transfer station ISA documentation resulted from investigation of EN 43439 (incorrect additive) discussed above. Subsequent to discovery of the missing

documentation, the licensee reviewed their ISA and identified 8 more processes not identified in the ISA and 12 more required IROFS that had not been declared. Licensee staff indicated that previous ISA methodology had resulted in the identification of many upset conditions as initiating events. Based on this, many controls that were actually being relied on to meet the performance requirements were not declared as IROFS. The licensee believes that the misunderstanding regarding methodology has been corrected and that required IROFS have been declared. The inspector reviewed about 25% of the ISA hazard review documentation and did not identify any additional examples. The inspector determined that the licensee corrective actions for the ISA documentation issue did not effectively address the root cause of the problem to provide assurance that the problem would not recur.

Section 4.10 of the license application states, in part, that the ISA is maintained current through a configuration management program that ensures that: (1) facility changes receive adequate integrated safety review, and (2) changes are adequately documented. Contrary to the above, the licensee failed to ensure that criticality controls in the new revision of the ISA were current and properly documented. Specifically, the licensee identified 14 examples of criticality controls that were not described as IROFS in the new ISA revision but were required to be in place according to criticality analysis. Omitting these IROFS from the ISA reduces assurance that the controls would have been properly considered when a configuration change was proposed or that proper management measures would have been implemented to ensure their reliability such as surveillance, scheduled maintenance, and IROFS failure tracking. The failure to ensure that criticality controls in the new revision of the ISA were current and properly documented is **VIO 70-1113/2007203-03**.

c. Conclusions

A severity level IV violation was identified for the failure to implement license requirements for fixed neutron absorbers.

A severity level IV violation was identified for the failure to ensure that criticality controls in the new revision of the ISA were current and properly documented.

**5.0 Plant Operations [88015]**

a. Inspection Scope

The inspector performed plant walkdowns to review activities in progress and to determine whether risk-significant fissile material operations were being conducted safely and in accordance with regulatory requirements. The inspector interviewed operators, NCS engineers, and process engineers both before and during walkdowns.

b. Observations and Findings

The inspector performed walkdowns of the DCP, dry scrap recovery, gadolinium scrap recovery, and pellet pressing operations. The inspector did not identify any safety concerns during facility walkdowns.

c. Conclusions

No safety concerns were identified during walkdowns of plant operations.

**6.0 Exit Meeting**

The inspector communicated observations and findings to licensee management and staff throughout the week of the inspection and presented the final results to licensee management during an exit meeting held on September 14, 2007 and a telephonic re-exit meeting on September 24, 2007. The licensee management acknowledged the results of the inspection and understood the findings presented.

## SUPPLEMENTARY INFORMATION

### 1.0 Items Opened, Closed, and Discussed

#### Items Opened

NCV 70-1113/2007-203-01	Failure to demonstrate that the gadolinium slugger press was critically safe in all cases.
VIO 70-1113/2007-203-02	Failure to verify the composition or periodically verify the integrity of PVC pipe in the gadolinia slugger press.
VIO 70-1113/2007-203-03	Failure to ensure that criticality controls in the new revision of the ISA were current and properly documented.

#### Items Closed

NCV 70-1113/2007-203-01	Failure to demonstrate that the gadolinium slugger press was critically safe in all cases.
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#### Items Discussed

None.

### 2.0 Event Reports Reviewed

EN 43359	Closed	Loss of geometry control in the gadolinia slugger press.
EN 43439	Closed	Failed IROFS in powder blending.
EN 43542	Closed	Dry scrap recovery transfer station not identified in the ISA and required IROFS not declared.

### 3.0 Inspection Procedures Used

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

**Attachment**

#### 4.0 Key Points of Contact

##### Global Nuclear Fuel

A. Allen	Material Control and Accountability
Q. Ao	Principal Criticality Safety Engineer
C. Bough	Logistics
*J. DeGolyer	Criticality Safety Engineer
G. Dickman	Dry Conversion
*M. Dodds	Senior Criticality Safety Engineer
G. Gardner	Fuel Support
M. Grimstead	Team Leader
B. Haughton	Mechanical Leader
A. Hilton	Engineer, Dry Conversion
*H. Knight	Manager, Fuels EHS
*T. Leister	Manager, Manufacturing
G. Luft	Program Manager, Projects
A. Mabry	Radiation Safety Program Manager
K. Maloy	Radiological Safety Engineer
R. Martin	Manager Material control and Accountability
P. Mathur	Environmental Engineer EHS
K. McGowan	Engineer Dry Conversion
*C. Moneta	Manager, EHS
*S. Murray	Manager, Licensing
P. Ollis	Licensing Engineer
L. Paulson	Manager, Nuclear Safety
*T. Priest	Manager Shop Operations
L. Quintana	EHS Licensing
C. Roche	Radiation Safety Engineer
*J. Rohner	Criticality Safety Engineer
E. Saito	GNEP Environmental Project Manager
C. Savage	Engineer, Dry Conversion
S. Suek	Manager, Shop Operations
D. Wilson	Licensing
*J. Zino	Program Manager, Criticality Safety

##### NRC

D. Morey      Senior Criticality Safety Inspector

All attended the exit meeting on September 14, 2007 with the exception of C. Moneta

\*Attended the telephonic re-exit meeting on September 24, 2007.

## 5.0 List of Acronyms and Abbreviations

ADAMS	Agency-wide Documents Access and Management System
CSA	criticality safety analysis
CFR	code of federal regulations
CWS	criticality warning system
DCP	dry conversion process
EN	event notice
FMO	fuel manufacturing operation
GNF	Global Nuclear Fuels - America (licensee)
IP	inspection procedure
IROFS	item relied on for safety
ISA	integrated safety analysis
NCS	nuclear criticality safety
NCV	non-cited violation
NMSS	Office of Nuclear Material Safety and Safeguards
PVC	polyvinylchloride
UF <sub>6</sub>	uranium hexafluoride
UO <sub>2</sub>	uranium dioxide
VIO	violation