

August 1, 2007

Mr. Russell B. Starkey, Jr.  
Vice President - Operations  
United States Enrichment Corporation  
Two Democracy Center  
6903 Rockledge Drive  
Bethesda, MD 20817

SUBJECT: INSPECTION REPORT NO. 70-7001/2007-203

Dear Mr. Starkey:

The U.S. Nuclear Regulatory Commission (NRC) conducted a routine, scheduled, and announced criticality safety inspection July 16-20, 2007, at the Paducah Gaseous Diffusion facility in Paducah, Kentucky. The purpose of the inspection was to determine whether activities authorized by your certificate involving special nuclear material were conducted safely and in accordance with regulatory requirements. Throughout the inspection, observations were discussed with your staff. An exit meeting was held on July 20, 2007, during which inspection observations and findings were discussed with your management and staff.

The inspection, which is described in the enclosure, focused on: (1) the most hazardous activities and plant conditions; (2) the most important controls relied on for safety and their analytical basis; and (3) the principal management measures for ensuring controls are capable, available, and reliable to perform their functions relied on for safety. The inspection consisted of analytical basis review, selective review of related procedures and records, examinations of relevant nuclear criticality safety (NCS)-related equipment, interviews with NCS engineers and plant personnel, and facility walkdowns to observe plant conditions and activities related to safety basis assumptions and related NCS controls.

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

R. B. Starkey, Jr.

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If you have any questions concerning this report, please contact Thomas Marenchin, of my staff, at (301) 492-3209.

Sincerely,

**/RA/**

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

Docket No.: 70-7001

Enclosure: Inspection Report No. 70-7001/2007-203

cc: S. Penrod, Paducah General Manager  
V. Shanks, Paducah Regulatory Affairs Manager  
W. Jordan, Portsmouth General Manager  
S. A. Toelle, Director, Nuclear Regulatory Affairs, USEC  
R. M. DeVault, Regulatory Oversight Manager, DOE  
G. A. Bazzell, Paducah Facility Representative, DOE  
Janice H. Jasper, State Liaison Officer

R. B. Starkey, Jr.

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

Docket No.: 70-7001

Certificate No.: GDP-01

Report No.: 70-7001/2007-203

Certificatee: United States Enrichment Corporation

Location: Paducah, Kentucky

Inspection Dates: July 16-20, 2007

Inspectors: Thomas Marenchin, Criticality Safety Inspector

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

**Enclosure**

**United States Enrichment Corporation  
Paducah Gaseous Diffusion Plant**

**NRC Inspection Report 70-7001/2007-203**

**EXECUTIVE SUMMARY**

**Introduction**

Staff of the U. S. Nuclear Regulatory Commission (NRC) performed a routine, scheduled, and announced criticality safety inspection of the Paducah Gaseous Diffusion Plant in Paducah, Kentucky, from July 16-20, 2007. The inspection included an on-site review of certificatee programs dealing with plant operations, the nuclear criticality safety (NCS) program, audits and inspections, and NCS-related corrective actions. The inspection focused on risk-significant fissile material processing activities including those in Buildings C-310, C-331, C-333, C-335, C-337, C-360, C-400, C-409, C-720, C-746-Q1, and C-754.

**Results**

- No safety concerns were noted regarding the NCS program.
- No safety concerns were noted regarding certificatee NCS walkthroughs, assessments, and surveillance.
- No safety concerns were identified regarding the certificatee internal event reporting, investigation, and correction actions.
- No safety concerns were identified during walkdowns of the facility and operations.
- No safety concerns were noted regarding certificatee NCS evaluations.
- No concerns were identified regarding certificatee criticality accident alarm system (CAAS) coverage of fissile material operations.

## REPORT DETAILS

### 1.0 Summary of Plant Status

U.S. Enrichment Corporation enriches uranium for domestic and international customers at the Paducah Gaseous Diffusion Plant. In conjunction with routine enrichment activities, the certificatee performs laboratory operations, cleaning and decontamination services, and maintenance and support activities. During the inspection, the certificatee was performing routine enrichment and support operations.

### 2.0 Nuclear Criticality Safety Program (88015)

#### a. Inspection Scope

The inspector reviewed the certificatee NCS program. The inspector evaluated the adequacy of the program to assure the safety of fissile material operations. The inspector interviewed certificatee managers, NCS engineers, system engineers, and facility operators during document review and facility walkdowns. The inspector reviewed NCS administrative procedures and selected NCS controls to determine whether the procedures adequately implemented the NCS program described in the certificate. The inspector reviewed selected aspects of the following documents:

- NCSE [Nuclear Criticality Safety Evaluation] -032, "Product and Side Withdrawal in the C-310 Building," Revision 6, dated October 7, 2005
- NCSE-032, "Product and Side Withdrawal in the C-310 Building," Revision 7, dated June 14, 2007
- NCSE-080, "Operation of the C310 70-ft and 200-ft Exhaust Stacks," Revision 3, dated June 29, 2007
- DIVS [Design Installation and Verification Specification]-Z66150-J066, "Redistribute Water Sensing Cables in Scale Pits, C-310," Revision 0, dated October 13, 2006
- SE-Z66150-439, "Redistribute Sensing Cable for Scale Pit Water Detection Systems, C-310," Revision 0, dated October 13, 2006
- PMR [Preventive Maintenance Request] 105424, "Semi-annual Functional Test of the Scale Pit Water Detection System," Revision 0, dated October 20, 2006
- Crew Briefing File Number 07-31-832-005, "Failure to Report Loss of Double Contingency NOV 2006-203-02," dated March 27, 2007
- CP2-EG-NS6048, "Software Configuration Control Program for Nuclear Criticality Safety Code Systems," Revision 1, dated November 11, 1999
- CP4-CO-AR8310, "Alarm Response for C-310," Revision 16, dated March 27, 2007
- CP4-CO-CN6048, "Scale/Elevator Pit Periodic Tests," Revision 5, dated October 26, 2006
- CP4-EG-NS1101, "Nuclear Criticality Safety Evaluations and Approvals," Revision 10, dated February 1, 2007
- CP4-EG-NS1104, "Nuclear Criticality Safety Engineer Response to Emergency, Off-Normal, and Process Upset Conditions," Revision 2, dated June 13, 2007

- CP4-EG-NS1107, "Nuclear Criticality Safety Oversight Program," Revision 3, dated June 22, 2006

b. Observations and Findings

The inspector observed that the certificatee had an NCS program which was independent from production and was implemented through written procedures. The inspector determined that the licensee NCS program was conducted in accordance with written administrative procedures that reflected the program described in the certificate.

c. Conclusions

The NCS program as observed was adequate for maintaining acceptable levels of safety.

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

a. Inspection Scope

The inspector reviewed records of previously-completed certificatee internal NCS walkthroughs of fissile operations in Buildings C-333, C-335, C-360, and C-400. The inspector observed a surveillance of the Building C-360 criticality accident alarm system (CAAS). The inspector reviewed selected aspects of the following documents:

- 07-WS-001, "NCS Walk-Through for C-333A/C-337A Buildings," dated March 23, 2007
- 07-WS-003, "NCS Walk-Through for C-400," dated June 15, 2007
- 07-WS-004, "NCS Walk-Through for C-700 Maintenance and Receiving Areas and C-720-C," dated June 28, 2007
- C31-NCS-SA-07-01, "NCS Group Self-Assessment," dated March 27, 2007
- CP2-EG-NS1031, "Nuclear Criticality Safety," Revision 9, dated March 27, 2007
- ATRC-07-0757, "Negative Observations During CAAS Self Assessment," dated March 27, 2007
- ATRC-07-0758, "Recommendations During CAAS Self Assessment," dated March 27, 2007

b. Observations and Findings

The inspector determined that certificatee NCS engineers observed plant operations to determine adequacy of implementation of NCS requirements and ensured that implementation weaknesses were identified and entered into the corrective action system. The inspector observed that the certificatee NCS walkthroughs and assessments were conducted within the required time limit and were performed in accordance with written procedures. The inspector noted that the walkthroughs and assessments were performed by NCS engineers who: (1) reviewed NCS issues from previous audits; (2) reviewed the adequacy of control implementation; (3) reviewed plant operations for compliance with certificatee requirements, procedures, and postings; and (4) examined equipment and operations to determine that past evaluations remained

adequate. During the surveillance testing of the building C-720 CAAS, the inspector observed that the certificatee personnel conducted the surveillance and work in accordance with written procedures.

c. Conclusions

Certificatee NCS walkthroughs, assessments, and surveillance were adequate for maintaining acceptable levels of safety.

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

a. Inspection Scope

The inspector reviewed recent internally- and externally-reported NCS-related events. The inspector reviewed selected aspects of the following documents:

- NCS-INC-04-012, "C-335 Waste Drums," Revision 20, dated March 22, 2007
- NCS-INC-04-012, "C-335 Waste Drums," Revision 21, dated April 21, 2007
- NCS-INC-06-010, "C-310 Scale Pit," Revision 2, dated September 22, 2006
- NCS-INC-07-001, "C-331 Unit 1 Tc Traps," Revision 1, dated June 1, 2007
- NCS-INC-07-002, "C-710 Waste Drum," Revision 0, dated June 11, 2007
- NCS-INC-07-003, "C-709 Unlabeled PF [Potentially Fissile] Samples," Revision 0, dated June 19, 2007

b. Observations and Findings

The inspector determined that events were investigated in accordance with written procedures and appropriate corrective actions were assigned.

c. Conclusions

No safety concerns were identified regarding the certificatee internal event reporting, investigation, and correction actions.

**5.0 Plant Activities (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 verified the adequacy of management measures for assuring the continued availability, reliability, and capability of safety-significant controls relied upon by the certificatee for controlling criticality risks to acceptable levels. The inspector performed walkdowns of Buildings , C-310, C-333, C-335, C-360, and C-400. The inspector reviewed selected aspects of the following documents prior to performing the walkdowns:



- NCSA GEN-015, "The On-Site Generation, Handling, and Storage of Fissile/Potentially Fissile Material," Revision 3, dated August 29, 2005
- NCSE-038, "Nuclear Criticality Safety Evaluation of the Liquid UF<sub>6</sub> [Uranium Hexafluoride] Sampling and Refeed Operations in the C-360 Toll, Transfer, and Sampling Facility at the Paducah Gaseous Diffusion Plant," Revision 3, dated April 20, 2007
- NCSE-080, "Operation of the C310 70-ft and 200-ft Exhaust Stacks," Revision 3, dated June 29, 2007
- CP2-CO-CA2030, "Operation of the Criticality Accident Alarm System (CAAS)," Revision 17, dated January 10, 2007
- CP4-GP-IM6525, "C-360/C-360A CASS Maintenance and Testing," Revision 12, dated November 1, 2006

b. Observations and Findings

The inspector verified that controls identified in the NCS analyses reviewed were adequate to assure safety. The cognizant NCS engineers were knowledgeable and able to explain the basis for changes in operations and controls.

c. Conclusions

No safety concerns were identified during walkdowns of the facility and operations.

## 6.0 Nuclear Criticality Safety Evaluations and Analyses (88016)

a. Inspection Scope

The inspector reviewed NCS analyses to determine that criticality safety of risk-significant operations was ensured through engineered and administrative controls with adequate safety margin including 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:

- KY/G-748, "Validation of MCNP-5 Nuclear Criticality Safety Code System Using the ENDF/B-V Cross-Section Library at the Paducah Gaseous Diffusion Plant," Revision 3, dated July 17, 2007
- KY/G-797, "Validation of the SCALE 4.4 Nuclear Criticality Safety Code System and the 27 GROUPNDF4 and 238 GROUPNDF5 Cross-Section Libraries at the Paducah Gaseous Diffusion Plant," Revision 1, dated May 22, 2007
- KY/S-251, "Guidelines for Nuclear Criticality Safety Evaluations at the Paducah Gaseous Diffusion Plant," Revision 5, dated January 2007
- NCSA GEN-015, "The On-Site Generation, Handling, and Storage of Fissile/Potentially Fissile Material," Revision 3, dated August 29, 2005
- NCSE-038, "Nuclear Criticality Safety Evaluation of the Liquid UF<sub>6</sub> Sampling and Refeed Operations in the C-360 Toll, Transfer, and Sampling Facility at the Paducah Gaseous Diffusion Plant," Revision 3, dated April 20, 2007

- NCSE-040, "Auxiliary Seal Exhaust/Wet Air Stations," Revision 0, dated July 27, 2006
- NCSE-103, "C-400 and C-409 Floor Drains and Containment Pans," Revision 0, dated December 1, 2005

b. Observations and Findings

The inspector reviewed NCS Approvals, NCS Evaluations, and supporting calculations for new, changed, and other selected operations. Within the selected aspects reviewed, the inspector determined that the analyses were performed by qualified NCS engineers, that independent reviews of the evaluations were completed by qualified NCS engineers, that subcriticality of the 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. The inspector determined that NCS controls for equipment and processes assured the safety of the operations. Nuclear criticality safety analyses and supporting calculations demonstrated adequate identification and control of NCS hazards to assure operations within subcritical limits.

c. Conclusions

No safety concerns were noted regarding certificatee NCS evaluations.

**7.0 Criticality Alarm System (88017)**

a. Inspection Scope

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

- CP2-CO-CA2030, "Operation of the Criticality Accident Alarm System (CAAS)," Revision 17, dated January 10, 2007
- CP4-GP-IM6525, "C-360/C-360A CASS Maintenance and Testing," Revision 12, dated November 1, 2006
- EN-C-832-01-004, "Transmit CAAS Detection Coverage Drawings for Building C-360," Revision 0, dated May 24, 2001

b. Observations and Findings

The inspector determined that the certificatee had installed and maintained a system of criticality detectors that were capable of monitoring fissile material operations at the facility and reliably detecting the minimum accident of concern.

c. Conclusions

No concerns were identified regarding certificatee CAAS coverage of fissile material operations.

**8.0 Open Item Followup**

**IFI 70-7001/2006-201-01**

This item tracks: (1) the certificatee's justification for inclusion of Mixed-Oxide (MOX)-driven benchmarks in the validation reports and establishment of criteria for demonstration of Area of Applicability (AOA) compliance in facility calculations, as well as (2) the certificatee's development of guidelines which will ensure a consistent minimum level of documentation for verifying the compliance of future facility calculations with the validated AOA. During a previous inspection, the inspectors had determined that the certificatee had updated two procedures, CP4-EG-NS1101 and KY/S-251, to include detailed guidance on what to include in NCSEs to ensure adequate documentation of compliance with the AOA. During this inspection, the inspector determined that the certificatee had revised their validation reports, KY/G-748 and KY/G-797, to address the justification for the inclusion of MOX benchmarks in the validation reports. This item is closed.

**VIO 70-7001/2006-203-01**

This item concerned the certificatee's failure to maintain the safe geometry limit in the C-310 scale pit of 3.68 inches. During a previous inspection, the inspectors observed that 4.375 inches of water had accumulated in the C-310 scale pit area which was greater than the 3.68 inches of water limit. The inspector determined that the certificatee adequately completed the necessary corrective action to both address the violation and prevent the reoccurrence. This item is closed.

**VIO 70-7001/2006-203-02**

This item concerned the certificatee's failure to report a loss of double contingency to the NRC within 24 hours. The inspector determined that the certificatee adequately completed the necessary corrective action to both address the violation and prevent the reoccurrence. This item is closed.

**9.0 Exit Meeting**

The inspector communicated the inspection scope and results to members of Paducah Gaseous Diffusion Plant management and staff throughout the inspection and during an exit meeting on July 20, 2007. Paducah Gaseous Diffusion Plant management and staff acknowledged and understood the findings as presented.

## SUPPLEMENTARY INFORMATION

### 1.0 Items Opened, Closed, and Discussed

#### Items Opened

None

#### Items Closed

**IFI 70-7001/2006-201-01** Tracks: (1) the certificatee's justification for inclusion of Mixed-Oxide (MOX)-driven benchmarks in the validation reports and establishment of criteria for demonstration of Area of Applicability (AOA) compliance in facility calculations, as well as (2) the certificatee's development of guidelines which will ensure a consistent minimum level of documentation for verifying the compliance of future facility calculations with the validated AOA.

**VIO 70-7001/2006-203-01** Failure to maintain the safe geometry limit in the C-310 scale pit of 3.68 inches.

**VIO 70-7001/2006-203-02** Failure to report a loss of double contingency to the NRC within 24 hours.

### 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 Partial List of Persons Contacted

#### **USEC**

M. Boren	Nuclear Regulatory Affairs
R. Helme	Manager, Engineering
T. Henson	Manager, Nuclear Criticality Safety
L. Jackson	Manager, Operations
M. Keef	Plant Manager
J. Lewis	Manager, Maintenance
S. Penrod	General Manager
D. Quigley	Scheduling WWM
V. Shanks	Manager, Nuclear Regulatory Affairs
D. Snow	Manager, H&S
D. Stadler	Senior Engineer, Nuclear Regulatory Affairs
M. Wilson	Engineer, NCS

**Attachment**

**NRC**

T. Marenchin                      Criticality Safety Inspector, Headquarters  
M. Thomas                         Sr. Resident Inspector, RII

All attended the exit meeting on July 20, 2007.

**4.0 List of Acronyms and Abbreviations**

ADAMS	Agency-Wide Document Access and Management System
AOA	area of applicability
CAAS	criticality accident alarm system
CFR	Code of Federal Regulation
DIVS	Design Installation and Verification Specification
DOE	U.S. Department of Energy
IFI	inspector follow-up item
IP	inspection procedure
MOX	mixed oxide
NCS	nuclear criticality safety
NCSA	nuclear criticality safety approval
NCSE	nuclear criticality safety evaluation
PF	potentially fissile
PMR	Preventive Maintenance Request
UF <sub>6</sub>	uranium hexafluoride
USEC	U. S. Enrichment Corporation (certificatee)
VIO	violation