



May 12, 2011  
GDP 11-0013

Ms. Tilda Liu  
Sr. Project Manager  
Advanced Fuel Cycle, Enrichment, and Uranium Conversion Branch  
Special Projects and Technical Support Directorate  
Division of Fuel Cycle Safety and Safeguards  
Office of Nuclear Material Safety and Safeguards  
Attention: Document Control Desk  
U.S. Nuclear Regulatory Commission  
Washington, D.C. 20555-0001

**Paducah Gaseous Diffusion Plant (PGDP)  
Docket No. 70-7001, Certificate No. GDP-1  
Response to NRC's Request for Additional Information Dated May 6, 2011 Related to Amendment  
Request Regarding the Use of C-745-X for Storage of Process Equipment Containing Potentially  
Fissile Material at Paducah Gaseous Diffusion Plant (TAC L32769)**

Dear Ms. Liu:

This letter provides the United States Enrichment Corporation's (USEC's) responses to the request for additional information (RAI) identified by the NRC staff in letter from Ms. Tilda Liu (NRC) to Mr. Steven A. Toelle (USEC) dated May 6, 2011. The identified RAI supports the NRC staff's technical review of USEC's Certificate Amendment Request (CAR), letter number GDP 11-0001 dated February 14, 2011, regarding use of C-745-X as a storage area for process equipment containing potentially fissile material. Supplemental information previously requested by the NRC to support the technical review of this CAR was forwarded by letter number GDP 11-0005 dated April 04, 2011. Enclosure 1 of this letter identifies the specific additional information requested by the NRC staff in the letter dated May 6, 2011, and includes USEC's response to each request.

Should you have any questions related to this submittal, please contact me at (301) 564-3250. There are no new commitments contained in this submittal.

Sincerely,

Steven A. Toelle  
Director, Regulatory Affairs

NMSSDI

- References:
1. Letter number GDP-11-0001 from Mr. Steven A. Toelle (USEC, Director, Regulatory Affairs) to Ms. Catherin Haney (NRC, Director, Office of Nuclear Material Safety and Safeguards), Certificate Amendment Request (CAR) - Revise Technical Safety Requirements (TSR) 2.6.4.1, Safety Analysis Report (SAR) 4.2, and SAR 4.3.2.6 to Allow Use of C-745-X for Storage of Process Equipment Containing Potentially Fissile Material, April 14, 2011.
  2. Electronic mail from Mr. Kevin Mattern (NRC) to Mr. Steven A. Toelle (USEC, Director, Regulatory Affairs), Subject: USEC PGDP Certificate Amendment Request (CAR) dated February 14, 2001, Sent: March 23, 2011.
  3. Letter number GDP 11-0005 from Mr. Steven A. Toelle (USEC, Director, Regulatory Affairs) to Ms Catherine Haney (NRC, Director, Office of Nuclear Material Safety and Safeguards), Supplemental Information Required for a Detailed Technical Review Regarding USEC Certificate Amendment Request (CAR) to Allow Use of C-745-X for Storage of Process Equipment Containing Potentially Fissile Material, April 4, 2011.
  4. Letter from Ms. Tilda Y. Liu (NRC) to Mr. Steven A. Toelle (USEC, Director, Regulatory Affairs), Request for Additional Information Related to Amendment Request Regarding the Use of C-745-X for Storage Of Process Equipment Containing Potentially Fissile Material, Paducah Gaseous Diffusion Plant (TAC NO. L32769), May 6, 2011.
  5. Letter number GDP 98-0215 from Mr. Steven A. Toelle (USEC, Nuclear Regulatory Assurance and Policy Manager) to Dr. Carl J. Paperiello (NRC, Director, Office of Nuclear Material Safety and Safeguards), Certificate Amendment Request - Criticality Accident Alarm System Audibility Upgrades - Compliance Issues 46 and 50, November 5, 1998.
  6. Letter from Dr. Carl J. Paperiello (NRC, Director, Office of Nuclear Material Safety and Safeguards) to Mr. James H. Miller (USEC, Vice President, Production), Paducah Certificate Amendment Request: Criticality Alarm System Audibility Upgrades Compliance Issues 46 and 50 (TAC NO. L32103), January 7, 1999.
- Enclosures:
1. Response to NRC's Request for Additional Information Dated May 6, 2011, Related to Amendment Request Regarding the Use of C-745-X for Storage Of Process Equipment Containing Potentially Fissile Material at the Paducah Gaseous Diffusion Plant

cc: J. Calle, NRC Region II Office  
K. Mattern, NRC -HQ  
M. Miller, NRC Senior Resident Inspector - PGDP  
R. Prince - NRC Region II Inspector

**Enclosure 1**  
**GDP 11-0013**

**Response to NRC's Request For Additional Information Dated May 6, 2011 Related to  
Amendment Request Regarding the Use of C-745-X for Storage Of Process Equipment Containing  
Potentially Fissile Material at the Paducah Gaseous Diffusion Plant**

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**RAI 1**

*The supplemental responses dated April 4, 2011, only referred to outdoor storage of Uncomplicated Handling (UH) components. There is no mention of a control preventing outdoor storage of Planned Expeditious Handling (PEH) components. What ensures that only UH components will be stored outside? The information is needed because the criticality evaluation only considers intrusion of rain or snow into UH components. Assurance of subcriticality under normal and credible abnormal conditions requires that either the analysis adequately covers outdoor storage of PEH components, or PEH components be banned in the Safety Analysis Report or Technical Safety Requirements from being stored outdoors.*

*Title 10 of the Code of Federal Regulations (10 CFR) 76.85 states that the Corporation must "perform an analysis of potential accidents and consequences," and that they must provide "assurance that plant operation will be conducted in a manner to prevent or mitigate the consequences from a reasonable spectrum of postulated accidents which include internal and external events and natural phenomena in order to ensure adequate protection of the public health and safety." This information is necessary to ensure that there is adequate protection of public health and safety from the consequences of criticality accidents.*

**USEC's Response**

In an electronic mail from Mr. Kevin Mattern (NRC) to Steven A. Toelle (USEC) dated March 23, 2011, NRC requested that USEC provide "A description of the process equipment and characteristics (physical and chemical form, mass, enrichment, moderation, and geometry) of fissile material to be stored on the C-745-X pad." USEC letter GDP 11-0005 dated April 4, 2011, provided the supplemental information requested by NRC staff. In the April 4, 2011, response, USEC stated that any uncomplicated handling (UH) equipment item could be stored outdoors from an NCS perspective, subject to NCSE 120 and NCSA GEN-010 controls. The RAI above asks what ensures only UH components will be stored outside.

Items that are not UH by geometry and contain greater than the safe mass as defined by the UH/PEH curve in TSR 2.5, Appendix B, are considered PEH. The hazards and handling requirements for PEH equipment did not change from prior approvals with NCSE 120. PEH handling is a single contingent activity that is controlled by TSR 2.5. PEH equipment decontamination is required (as previously approved) within strict time limits according to TSR 2.5.4.4, PEH DECONTAMINATION TIME LIMITS, and NCSE 120 Control 5.3.2.10. TSR LCO 2.5.4.4 states, "Applicable equipment categorized and removed as PEH shall be decontaminated to a safe mass or below within 72 hours from the start of equipment removal or 24 hours from the start of decontamination, whichever is sooner." NCSE 120 Control 5.3.2.9 requires that USEC arrange for removal, transportation, and processing/decontamination prior to breaching the process boundary for PEH equipment removal activities. Due to the strict time

limits required by TSR 2.5.4.4 and NCSE 120, PEH equipment would not be stored outside in the C-745-X storage yard.

It should be noted that outdoor transportation of PEH equipment may be necessary in order to support the deposit remediation efforts. Transportation of PEH equipment is performed according to TSR 2.5.4.6, PEH EQUIPMENT TRANSPORTATION OUTSIDE OF CAAS COVERAGE, and NCSE 120 Control 5.3.3.2. Rigorous controls are implemented for handling PEH equipment to minimize the potential for exposing PEH deposits to a moderation source.

PEH equipment openings are controlled explicitly by TSR 2.5.4.3, PEH EQUIPMENT OPENINGS, and by NCSE 120 Control 5.3.2.9. TSR LCO 2.5.4.3 states, "PEH equipment openings shall be covered with fireproof covers and gasket seals." Additionally, SR 2.5.4.3-1 requires daily inspections of PEH equipment to verify openings are covered or closed when not being decontaminated, visually inspected, remediated, or reinstalled. TSR 2.5.4.3 actions require that PEH equipment openings be constantly attended when system covers are removed for equipment decontamination, remediation, visual inspection, or reinstallation. If a condition develops that could result in moderating material entering the equipment, the TSR actions require that the covers be reinstalled.

There is no specific NCS or TSR control that prohibits outdoor storage of PEH equipment; however, the NCS controls and associated TSRs ensure expeditious deposit remediation and rigorous control of moderation until the equipment is reduced below the UH mass limit. The controls in place for PEH equipment handling are adequate, and it is not necessary to specifically prohibit PEH equipment from being stored outdoors.

## **RAI 2**

*The only scenario considered specifically for outdoor storage of UH components is 4.5.20 in Nuclear Criticality Safety Evaluation 120. That relies only on a single administrative control and the natural and credible course of events. The certificate holder is requested to address the following: (1) failure of operators to cover openings with waterproof covers, when unattended or in inclement weather; (2) improper classification of removed process equipment as UH; (3) improper movement of PEH onto the C-745-X storage pad; and (4) [since covers do not have to be fireproof] failure due to a fire on the C-745-X storage pad. Reasonable assurance of safety with outdoor storage of UH components necessitates that failure mechanisms associated with the administrative controls be considered.*

*10 CFR 76.85 states that the Corporation must "perform an analysis of potential accidents and consequences," and that they must provide "assurance that plant operation will be conducted in a manner to prevent or mitigate the consequences from a reasonable spectrum of postulated accidents which include internal and external events and natural phenomena in order to ensure adequate protection of the public health and safety." This information is necessary to ensure that there is adequate protection of public health and safety from the consequences of criticality accidents.*

## USEC's Response

UH equipment stored outdoors is a subset of the other scenarios related to UH equipment. NCSE 120 provides analyses of a wide range of upsets that conservatively address all scenarios related to any UH equipment whether it is stored indoors or outdoors. Those analyses include upsets related to categorization (e.g. errors in mass or enrichment determination), interaction, and spills in general.

NRC specifically requested the following points to be addressed in this response:

- (1) *failure of operators to cover openings with waterproof covers, when unattended or in inclement weather.*

If the operator fails to cover the openings, the item would remain subcritical as it collects moderator from rain or snow since no degree of moderation could ever cause a criticality in the UH item. The basis for that statement is the collective analyses of the general UH hazards addressed in Section 4.5 of NCSE 120. The failure to cover multiple UH items in the storage yard would be necessary in order for a criticality to be possible. The items would have to collect and spill their contents into the same localized area, and the spill would have to collect into an unsafe geometry. If the item is UH by geometry, it might contain more than a UH mass if the narrow geometry were plugged over a long length. However, the potential for inadvertent collection and spills from long items with narrow openings is considered a very low probability event that requires multiple openings to be uncovered (e.g. both ends of a long pipe), or collection and a subsequent unmitigated spill during handling. Even then, the spilled material would spread out on the ground or concrete below the item and would have a very low probability of collecting in an unsafe geometry.

- (2) *improper classification of removed process equipment as UH*

As noted above, UH equipment stored outdoors is a subset of the other scenarios related to UH equipment. The primary risk of improper UH classification involves errors in the mass determination or associated enrichment determination since the UH limit is a mass limit for a particular enrichment. Hazards related to the determination are explicitly analyzed in:

- Section 4.5.1.1 What if actual mass in an item to be removed from installation is greater than the mass reported by inspection results?
- Section 4.5.1.2 What if actual mass in a previously removed UH item is greater than the NDA mass?
- Section 4.5.2.1 What if actual enrichment is higher than expected in an item moderated by wet air in-leakage?
- Section 4.5.2.2 What if actual enrichment is higher than expected in an item moderated by liquid moderation?
- Section 4.5.3 What if the wrong piece of equipment is inspected or removed from the cascade?

*(3) improper movement of PEH onto the C-745-X storage pad*

As discussed in the response to RAI-1, PEH handling is strictly controlled as a single contingent operation in accordance with long established TSRs and NCS controls that were not changed or in any way degraded by the USEC GDP 11-0001 submittal dated February 14, 2011. As the response to RAI-1 explained, PEH equipment openings are controlled explicitly by TSR 2.5.4.3, PEH EQUIPMENT OPENINGS, and by NCSE 120 Control 5.3.2.9. PEH equipment decontamination is also required (as previously approved) within strict time limits according to TSR 2.5.4.4, PEH DECONTAMINATION TIME LIMITS, and NCSE 120 Control 5.3.2.10. Interaction control for PEH equipment is also provided in TSR 2.5.4.5, PEH SPACING REQUIREMENTS (NCSE 120 Control 5.3.2.10). Transportation of PEH items is addressed and controlled per TSR 2.5.4.6, PEH EQUIPMENT TRANSPORTATION OUTSIDE CAAS COVERAGE (NCSE 120 Control 5.3.3.2). The NCS controls and associated TSRs do not prohibit transportation or handling of PEH items outdoors; however, the controls ensure that PEH items are expeditiously remediated to below the UH mass limit and covered when unattended or when attended and moderator intrusion is possible (from any source, including rain or snow).

*(4) [since covers do not have to be fireproof] failure due to a fire on the C-745-X storage pad.*

The potential for a fire on the C-745-X storage pad is a very low probability event, but is assumed possible. The most significant impact of fire on equipment removal for NCS is the potential for fire to cause the introduction of moderator due to emergency response or sprinkler activation. However, in the case of UH equipment, it is assumed that moderator is present at any time as part of the NCS normal case from emergency response sources, rain, or snow. If a fire occurs in an outdoor storage area, then it is assumed the covers would be jeopardized and the items could have water introduced. Each UH item exposed to water intrusion would remain subcritical regardless of the degree of water intrusion that occurs. It is also noted that UH items stored in any area, including outdoor areas, are subject to spacing controls of NCSE 120 Control 5.3.2.6 (which requires minimum 2-foot edge-to-edge spacing between UH items in storage). Any fire capable of damaging process equipment would be self-identifying in an open outdoor storage area so that emergency response detection and mitigation would be timely and effective. Therefore, no common-mode failure mechanism is identified from this event that would cause both collection of fissile solution in UH items and consolidation of the material from multiple items.

### **RAI 3**

*What provisions will there be for initially and periodically verifying correct installation, and continued effectiveness, of waterproof covers on UH equipment? Because these covers are the only control preventing criticality, reasonable assurance of safety necessitates that sufficient measures be established to ensure they will perform their safety function when needed.*

*10 CFR 76.85 states that the Corporation must “perform an analysis of potential accidents and consequences,” and that they must provide “assurance that plant operation will be conducted in a manner to prevent or mitigate the consequences from a reasonable spectrum of postulated accidents which include internal and external events and natural phenomena in order to ensure adequate protection of the public health and safety.” This information is necessary to ensure that there is adequate protection of public health and safety from the consequences of criticality accidents.*

### **USEC’s Response**

NCSE 120 and NCSA GEN-010 require installation of waterproof covers capable of preventing liquid moderator intrusion in openings in UH equipment that is stored outdoors. The basis statement for the control clarifies that cover installation must be “secured such that they will remain in place during heavy weather.” Common practice for equipment stored in the C-745-X will involve the use of covers for non-NCS program requirements. Some of those covers will serve a dual-purpose for NCS and non-NCS program requirements. For instance, in many cases security and contamination control practices will result in steel or metal covers welded or clamped in place over equipment openings. Those metal covers would conservatively meet the NCS requirement because a metal cover would be waterproof and robustly installed. When those metal covers are not required, the NCS control can be met by covering openings with waterproof covers secured such that they will remain in place during heavy weather. There is no periodic inspection required for the covers.

It should be noted that the waterproof covers are not the only NCS control related to outdoor equipment storage. The primary controls are those related to making the UH equipment determination. As discussed in the response to RAI-2, moderation is not controlled for equipment classified as UH. The waterproof covers do not provide the basis for sub-criticality of any one item or even an array of items stored in the outdoor equipment storage area. Degradation of a cover, or improper installation of any single cover cannot credibly result in a criticality in a UH item. In order for a criticality to be possible from this chain of events, covers would have to be degraded in multiple items in one local area of the storage yard. The items would have to collect and spill their contents into that same localized area and the spill would have to collect into an unsafe geometry. Covers are installed according to procedure before they are left unattended in storage; therefore, improper installation of the cover on any single opening is unlikely. It would require multiple independent and concurrent process upsets for the covers on multiple items to be absent or significantly degraded in an outdoor equipment storage area, so that double contingency is inherently satisfied for this scenario.

#### **RAI 4**

*The C-746Q Critically Accident Alarm System (CAAS) Audibility Building Checklist indicates that the CASS sufficiently exceeds the background noise level at 500 hertz, for each survey location. However, in several cases, the broadband level is stated as not being acceptable, or not applicable. The listening check was also reported as not applicable for each survey location. There are also no units listed in the table [staff assumes these are in decibel (dB)]. Explain the table and how it demonstrates acceptable CAAS audibility on the C-745-X pad. ANS-8.3-1997, Section 4.3.6, specifies that horns should be at least 10 dB above background in order to ensure they will be adequate to initiate personnel evacuation.*

*10 CFR 76.85 states that the Corporation must “perform an analysis of potential accidents and consequences,” and that they must provide “assurance that plant operation will be conducted in a manner to prevent or mitigate the consequences from a reasonable spectrum of postulated accidents which include internal and external events and natural phenomena in order to ensure adequate protection of the public health and safety.” This information is necessary to ensure that there is adequate protection of public health and safety from the consequences of criticality accidents.*

#### **USEC’s Response**

The conditions used to demonstrate CAAS audibility at PGDP were established in USEC letter GDP 98-0215 dated November 5, 1998 and approved by the NRC letter, Paducah Certificate Amendment Request: Criticality Alarm System Audibility Upgrades Compliance Issues 46 and 50, dated January 7, 1999 (TAC NO. L32103). These references establish that CAAS audibility at PGDP is demonstrated when any one of the following three conditions is met:

- Condition 1: the broadband CAAS alarm signal is ensured to be at least 10 decibels (dB) above the minimum background noise. If this condition is not met, then condition 2 is evaluated.
- Condition 2: the one-third (1/3) octave 500 hertz (Hz) is at least 13 dB above the maximum expected 1/3 octave 500 Hz effective masked threshold. If this condition is not met, then condition 3 is evaluated.
- Condition 3: a minimum of ten (10) people, representing a cross section of the plant population’s age and hearing capability, are exposed to the CAAS alarm signal to ensure each of the test subjects can hear the alarm signal. This test is repeated five (5) times and the results are deemed satisfactory if each of the subjects hear the signal each time they are exposed.

USEC letter GDP 11-0005 dated April 4, 2011, identified that engineering notice EN-C-822-10-229 provides the results of criticality accident alarm horn sound level testing that confirms the horn volume in the 12-rad evacuation zone associated with the C-745-X area proposed for storage of equipment containing potentially fissile material is sufficient to meet audibility requirements of TSR 2.6.4.1b. The CAAS horn audibility measurements identified in this engineering notice (EN) are reported in decibels (dB). The audibility data reported in this EN identified the broadband CAAS signal (that is, the horn volume) in the C-745-X did not meet CAAS audibility condition 1 by exceeding the broadband background sound level by at least 10 dB. Engineering judgment indicated this was due to high background broadband sound levels and distances from the CAAS horns to the survey locations. Based

on this initial test data, engineering judgment also indicated that CAAS audibility could not be established for the remaining survey locations using CAAS audibility condition 1. Therefore, test personnel marked the remaining broadband sound survey locations as not applicable, "N/A", and proceeded to evaluate the C-745-X CAAS audibility using condition 2. The sound data in the EN documents that all survey locations for C-745-X met CAAS audibility condition 2 by having a CAAS horn sound volume at the one-third (1/3) octave 500 hertz (Hz) that is at least 13 dB above the maximum expected 1/3 octave Hz effective masked threshold. This test data demonstrated that the horn volume in C-745-X met the CAAS audibility requirements of TSR 2.6.4.1b. The 10-person listening checks were marked as "N/A" in the EN because testing data for CAAS audibility condition 3 were not needed to demonstrate CAAS audibility for the affected area.