USEC
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July 5, 2007
GDP 07-0026

Mr. Michael F. Weber
Director, 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
Certificate Amendment Request – Technical Safety Requirement (TSR) Change to Add UF_6 Release Detection Controls for Interbuilding Tie-Lines at the Paducah Gaseous Diffusion Plant (PGDP)

Dear Mr. Weber:

In accordance with 10 CFR 76.45, the United States Enrichment Corporation (USEC) hereby submits a request for amendment to the Certificate of Compliance for PGDP. This Certificate Amendment Request (CAR) proposes to revise TSR Section 2.4.4.1 to establish UF_6 release detection controls for the cascade interbuilding tie-lines. The current Safety Analysis Report (SAR) requires TSR controls for UF_6 release detection for areas of the cascade that are operated above atmospheric pressure. Currently the interbuilding tie-lines are not permitted to be operated above atmospheric pressure because the necessary TSR controls for UF_6 release detection are not established. This proposed change will establish the necessary TSR controls to allow the tie-lines to be operated above atmospheric pressure at PGDP.

Enclosure 1 contains the Oath and Affirmation. Enclosure 2 to this letter provides a detailed description and justification of the proposed change. Enclosure 3 is a copy of the revised TSR page associated with this request for Nuclear Regulatory Commission (NRC) approval. Enclosure 3 also contains associated changes to the Safety Analysis Report (SAR) that have been evaluated under 10 CFR 76.68, and determined not to require NRC review and approval. These SAR pages are provided for information and to facilitate the NRC's review. Enclosure 4 contains the basis for USEC's determination that the proposed changes associated with the CAR are not significant.

The proposed TSR change is needed to improve PGDP cascade operating efficiency at higher power levels by allowing tie-line internal UF_6 pressure to go above atmospheric pressure. This proposed change will provide PGDP the same capability to operate interbuilding tie-lines above atmosphere that currently exists at PORTS. USEC requests NRC approval of this CAR by August 28, 2007 to support USEC's plans to increase cascade power levels. The amendment should become effective 30 days after issuance.

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NMSS01

Any questions related to this submittal should be directed to Mark Smith at (301) 564-3244. There are no new commitments contained in this submittal.

Sincerely,

S. A. Toelle

Steven A. Toelle
Director, Regulatory Affairs

Enclosures:
1. Oath and Affirmation
2. United States Enrichment Corporation (USEC), Certificate Amendment Request, Technical Safety Requirement (TSR) Change to Add UF_6 Release Detection Controls for Interbuilding Tie-Lines at PGDP, Detailed Description and Justification of the Changes
3. Certificate Amendment Request, Paducah Gaseous Diffusion Plant, Letter GDP 07-0026, Removal/Insertion Instructions
4. United States Enrichment Corporation (USEC), Certificate Amendment Request, Technical Safety Requirement (TSR) Change to Add UF_6 Release Detection Controls for Interbuilding Tie-Lines at PGDP, Significance Determination

cc: J. Henson, NRC Region II Office
M. Raddatz, NRC Project Manager, PGDP
M. Thomas, NRC Sr. Resident Inspector, PGDP

Enclosure 1
GDP 07-0026

Oath and Affirmation

OATH AND AFFIRMATION

I, Steven A. Toelle, swear and affirm that I am the Director, Regulatory Affairs of the United States Enrichment Corporation (USEC), that I am authorized by USEC to sign and file with the Nuclear Regulatory Commission this Certificate Amendment Request for the Paducah Gaseous Diffusion Plant addressing revisions to the Technical Safety Requirements described in USEC letter GDP 07-0026, that I am familiar with the contents thereof, and that the statements made and matters set forth therein are true and correct to the best of my knowledge, information, and belief.

S. A. Toelle

Steven A. Toelle

On this 5th day of July, 2007, the individual signing above personally appeared before me, is known by me to be the person whose name is subscribed to within the instrument, and acknowledged that he executed the same for the purposes therein contained.

In witness hereof I hereunto set my hand and official seal.

Rita Peak

Rita Peak, Notary Public
State of Maryland, Montgomery County
My commission expires December 1, 2009

Enclosure 2
GDP 07-0026

USEC-01
Certificate Amendment Request
Technical Safety Requirement (TSR) Change to Add UF_6
Release Detection Controls for Interbuilding Tie-Lines at PGDP

United States Enrichment Corporation (USEC)
Certificate Amendment Request
Technical Safety Requirement (TSR) Change to Add UF_6 Release Detection Controls for Interbuilding Tie-Lines at PGDP
Detailed Description and Justification of the Changes

Description of Change

This proposed change will add a new action to TSR 2.4.4.1, UF_6 Release Detection System, to define UF_6 release detection head operability requirements when the interbuilding tie-lines are operated above atmospheric pressure. The new action is shown below.

ACTIONS:

Condition	Action	Completion Time
F. Fewer than the minimum of 1 of the UF_6 release detection heads in each end of the interbuilding tie-line housing are operable.	F.1 Perform a continuous UF_6 smoke watch on the interbuilding tie-line housing end(s) affected by the PGLD inoperability. TSR 1.6.2.2(d) is not applicable.	1 hour

The new action is similar to existing TSR 2.4.4.1 actions for other areas of the cascade that are operated above atmosphere. The complete revised TSR page is shown in Enclosure 3, page 2.4-14. The change is noted with a revision bar in the right hand margin.

Reason for the Change

USEC's operational plans call for increasing cascade power to levels that require tie-line operation above atmospheric pressure to achieve maximum efficient use of electrical power. The tie-lines are currently operated below atmospheric pressure because UF_6 release detectors are not installed in the tie-line housings and the necessary TSR controls for above atmospheric operation are not established. USEC has initiated a project to install UF_6 release detectors in tie-lines where above atmospheric pressure operation is desired. This proposed change will establish the necessary TSR controls for UF_6 release detection and will permit tie-line operation above atmospheric pressure for tie-lines where smoke detectors have been installed.

Justification of the Changes

The function of the interbuilding tie-lines is to transport UF_6 process gas between cascade buildings. The interbuilding tie-lines are located above ground and are contained in thermally insulated housings provided with steam heat to prevent freeze-out of the process gas. Since the Safety Analysis Report (SAR) currently indicates that UF_6 pressures in the tie-lines can go above atmospheric pressure as the power level increases, operating the tie-lines above atmospheric pressure does not represent a new or unanalyzed operation. The SAR requires UF_6 release detection in areas of the cascade that are operated above atmospheric pressure and requires TSR controls for these UF_6 release detection systems. As noted earlier, the tie-lines do not have UF_6 release detectors installed to perform this function and TSR controls for the tie-line UF_6 release detection system have not been established. This proposed change will establish the necessary TSR controls so that the tie-lines can be operated above atmospheric pressure when the tie-line UF_6 release detection is installed. Tie-lines without UF_6 release detection will continue to be operated below atmospheric pressure.

Initially USEC plans to install UF_6 release detectors in the C-331/C-333 tie-line because this will result in the greatest increase in electrical power utilization efficiency. The new installation will be consistent with existing Process Gas Leak Detection (PGLD) installations that are already established as an effective means of monitoring cascade process piping operated above atmospheric pressure. Multiple detectors will be installed in the tie-line housing to enhance reliability. For the C-331/C-333 tie-line, USEC plans to install four UF_6 release detectors at each end of the tie-line housing. Two separate signal conditioners, each powered from a separate lighting panel will be employed in the design. Each of the signal conditioners will power two detectors at each end of the housing. The effect of this design is that a simultaneous failure of one individual detector and one signal conditioner will still leave one detector at each end of the tie-line housing operable. The activation of a detector will cause an alarm in the Area Control Room (ACR).

The proposed TSR change will require each end of the tie-line housing to have at least one UF_6 release detector operable. The proposed action statement will require that a smoke watch be established if one or both end(s) have less than one detector operable. A smoke watch will only be required for a tie-line end that does not have at least one UF_6 release detector operable.

An engineering evaluation determined that a release of less than one pound of UF_6 evenly distributed throughout the free volume of the C-331/C-333 tie-line housing would result in a concentration of UF_6 reaction products of at least 200 mg/m^3. The SAR currently indicates that this concentration is sufficient to activate all of the detectors in a cell housing within 30 seconds. Since the low humidity environment of a cell housing is a reasonable approximation of the typical environment expected in the tie-lines, the 200 mg/m^3 concentration is also a reasonable assumption for activation tie-line UF_6 release detectors. The evaluation concluded that during a release the heat generated by the UF_6 and water reaction plus any pressure differential between the buildings would cause the released UF_6 to funnel to one or both ends of the tie-line housing where the new detectors will be installed. The physical location of UF_6 detectors in the cross-section or length of the tie-line housing is not critical due to the small amount of UF_6 needed to activate the detector heads.

Changes to the SAR that are associated with this proposed change are provided in Enclosure 3. These changes include revisions to SAR Sections 3.3 and 4.3 to indicate that tie-lines are included in those areas that can operate above atmosphere. These changes have been evaluated under 10 CFR 76.68, and determined not to require NRC review and approval. The changes are noted with a revision bar in the right hand margin.

Although not associated with this proposed change, USEC has identified structural deficiencies in the interbuilding tie-line support structures that have resulted in additional restrictions placed on tie-line operation. These restrictions require the tie-lines to be operated below atmospheric pressure until the affected support structure is repaired. Affected tie-lines will continue to be operated below atmospheric pressure until these repairs are complete.

Certificate Amendment Request Paducah Gaseous Diffusion Plant Letter GDP 07-0026 Removal/Insertion Instructions	
Remove Pages	**Insert Pages**
APPLICATION FOR UNITED STATES NUCLEAR REGULATORY COMMISSION CERTIFICATION VOLUME 1	
SAR Section 3.3 Page 3.3-53, 3.3-54, 3.3-82	**SAR Section 3.3** Page 3.3-53, 3.3-54, 3.3-82
SAR Section 3.15 Page 3.15-58, 3.15-59, 3.15-64, 3.15-93, 3.15-117	**SAR Section 3.15** Page 3.15-58, 3.15-59, 3.15-64, 3.15-93, 3.15-117
APPLICATION FOR UNITED STATES NUCLEAR REGULATORY COMMISSION CERTIFICATION VOLUME 2	
SAR Section 4.3 Page 4.3-47, 4.3-49, 4.3-63, 4.3-64	**SAR Section 4.3** Page 4.3-47, 4.3-49, 4.3-63, 4.3-64
APPLICATION FOR UNITED STATES NUCLEAR REGULATORY COMMISSION CERTIFICATION VOLUME 4	
TSR Section 2.4 Page 2.4-14	**TSR Section 2.4** Page 2.4-14

3.3.5.9.2 Stage Instrumentation

The purpose of stage instrumentation is to control the flow of process gas between stages. Gas flow is maintained by holding a constant pressure on the barrier. Stages have similar instruments which function alike. The process gas is controlled at each stage by a stage control valve whose position is indicated and set by a stage controller. The controller can be operated on automatic or manual control. A typical stage pressure control is shown in Figure 3.3-19.

3.3.5.9.3 Temperature Instrumentation

Cell temperatures are regulated by controlling the coolant pressure in the coolant systems. This is based on the principle that fluids such as the coolant have specific vapor pressures associated with temperature. Therefore, a coolant pressure can be specified that will yield the desired UF_6 temperature.

Coolant pressures are monitored and controlled at the local cell panel. Alarms are actuated on the local cell panel, the ACR and from the ADP system in the ACR ("000" and "00" only) when the coolant temperature exceeds the set limits.

The temperatures of individual stages are monitored by thermocouples installed in the gas lines and indicated at the local cell panel.

3.3.5.9.4 Analytical Equipment

The process gas stream is monitored as necessary to maintain the proper assay of material and to determine the concentration of gases such as nitrogen, coolant, fluorine, and ClF_3. Several types of analyzers are used which include mass spectrometers (refer to Section 3.3.3.2 for a description) for assay measurement (referred to as assay machines) and miscellaneous gas concentration detection equipment (referred to as line recorders); infrared and ultraviolet analyzers for fixed and portable measurement of F_2, ClF_3, UF_6, coolant, and other gases; and space recorders for measurement of UF_6 at low concentrations. Connections are provided at each cell to accommodate portable analytical instrument usage whereas most fixed application instruments can be aligned to various locations via manifolds to assist in activities such as inleakage location.

3.3.5.9.5 UF_6 Release Detection System

The Cascade UF_6 Release Detection Systems have detection and alarm functions only. They are available to monitor cascade equipment that is operated above atmospheric pressure. The UF_6 Release Detection Systems are important to safety as described in Section 3.15. Figure 3.3-20 provides a simplified block diagram of a typical cascade UF_6 Release Detection System.

The operation of the systems are described in the following paragraphs.

Multiple detectors are installed in cell housings, bypass housings, and above the "B" seals on the axial flow compressors. The detectors are typically mounted inside, near the top of the housings. The housing of interbuilding tie-lines that operate at pressures exceeding atmospheric are also equipped with release detectors. The detectors are connected to signal conditioners that monitor detector status, provide a means to test the detectors, and process output signals from the detectors to produce the appropriate alarm indications.

3.3.5.9.5.1 Detectors

The UF_6 detectors in the cascade operate by means of a cold cathode tube and dual ionization chambers—one chamber to detect UF_6 release reaction products in the air, and one that serves as a reference to help stabilize the detector's sensitivity for changes in ambient temperature, humidity, and pressure. In the detection chamber, ambient air in the gap between two charged electrodes is ionized by an alpha-emitting source. As the concentration of particles in the air increases to a characteristic point, the cathode tube produces an output signal. Detector sensitivity is maintained by twice each shift applying a bias voltage to the detectors, which increases the voltage at the cathode starter electrode and produces an electrical simulation of the presence of UF_6 reaction products. Records from the many tests conducted on detector sensitivity, operating at elevated temperatures, indicate that a firing of detector heads on an eight-hour interval is sufficient to maintain a sensitivity that will detect UF_6 leaks.

The UF_6 release quantity that would actuate the detectors is established as follows. On the basis of the drawing of a typical cell housing ("000"), it was calculated that the volume internal to the cell housing was approximately 116,000 ft^3 (after subtracting the volume of the cell equipment itself). Assuming a release that is perfectly mixed within the cell housing, a release of 2.14 lb of UF_6 would provide a concentration of 200 mg/m^3 which would activate all of the detectors in the cell housing within 30 seconds. It should be noted that a release in cell housings with smaller volumes than the "000" equipment housings ("00" or withdrawal area housings) would actuate all the leak detectors at smaller release quantities. Actually, the release would initially have two components: the reaction products of UF_6 and H_2O, and unreacted UF_6. The reaction of UF_6 with moisture in the cell housing air would contribute approximately 124 BTU/lb UF_6 reacted. At 50% relative humidity, there would be enough moisture in the cell housing air to react with about 1500 lb UF_6 and would generate about 200,000 BTU. The reaction would be primarily adiabatic due to the rapid reaction rate and the poor heat transfer mechanisms from the gas phase to the cell housing and cell equipment. Assuming adiabatic reaction, the temperature of the gases in the cell housing would increase initially by about 120 °F from a normal operating temperature of about 200 °F. If there were only 10% relative humidity, the initial temperature increase would be about 25 °F. It should be noted that the reaction products would be considerably hotter initially because complete mixing would not occur instantaneously.

The heat of reaction would cause the reaction products to rise to the top of the cell housing and spread out along the top. Since the UF_6 leak detectors are within about 3 feet from the top of the cell housing which is approximately 19 ft in height, it would only take a fraction of the amount discussed earlier to cause the detectors to actuate. This is consistent with plant experience with the ability of the UF_6 detectors to detect very small leaks that required considerable searching and leak testing to discover. This indicates that, for the postulated accidents described in Section 4.3.2, that one operational detector in the cell housing would be more than adequate to detect the release. It also points out that a release of the magnitude described in the Section 4.3.2 would actuate every operational detector in the cell housing and probably within adjacent bypass and cell housings as the release spread through the bypass housings. The time to reach the concentration required would be within seconds of the postulated releases.

The number of detectors required to be operational to detect the releases postulated should be one per cell housing. The housing of interbuilding tie-lines that operate at pressures exceeding atmospheric should have one operational detector at each end of the tie line. However, due to the extreme non-specificity and sensitivity of the detectors and their desired operational capability of detecting very small releases, it is desirable to have more than one detector operational per cell housing since actuation of one detector is not necessarily an indication of a

stage motors. A second control switch (permissive) allows closure of the motor circuit breakers and starting of the other four stage motors. The primary control switch can be used to stop all eight stage motors. An ACR control switch is also available to open the ACB to trip the stage motors.

In the C-331, Process Building and the C-335, Process Building ("00" buildings), the switchyard ACB typically remains closed, and stage motors are started by closing the motor breakers using control switches at the local cell panel. A primary control switch starts five stage motors by closing the motor circuit breaker "A". Closure of a second control switch (permissive) allows starting of the other five stage motors. The primary control switch can be used to stop all ten stage motors. An ACR motor stop button is also available to open the motor breakers and trip the stage motors.

In C-310, closure of a primary control switch starts six stage motors by closing the motor circuit breaker. Closure of a second control switch (permissive) allows starting of the other six stage motors. The primary control switch can be used to stop all 12 stage motors. The primary control switch forms part of the boundary of the important to safety Cell Remote Manual Shutdown System as described in Sections 3.3.4 and 3.15.

Cells are always started at the local panel, but can be shut down from the local panel, ACR (except C-310), emergency shutdown switches on the cell floor, or CCF.

3.3.7.1.12 Instrument Cubicle Low Temperature Alarm

Instrument lines containing gas from various positions in the cascade cell go from the cell floor to the local cell panel on the operating floor. The instrument cubicle is heated to prevent UF_6 freeze-out in these instrument lines. Since instrument line freeze-out could cause inaccurate cell status indications, there is a low temperature alarm installed to alert operating personnel of a low instrument cubicle temperature condition.

3.3.7.1.13 UF_6 Release Detection Alarm System

A UF_6 Release Detection System (or process gas leak detection-PGLD) is used to detect a UF_6 release in areas with equipment that operates above atmospheric pressure. Detectors are installed inside cell housings, cell bypass housings, unit bypass housings, interbuilding tie-line housings, and in interbuilding booster stations.

The system annunciates alarms at the unit/cell level in the ACR and at the individual detector head level at the local cell panel ("000" and "00" buildings only) upon detection of UF_6 outleakage. Further description is given in Section 3.3.5.

3.3.7.2 Area Control Room

Each process building (C-310, C-315, C-331, C-333, C-335, and C-337) has an ACR located on the ground floor. The purpose of each ACR is to permit operators to monitor process equipment, make changes in operation, and take corrective action to mitigate abnormal operating conditions. All operating cells except C-310 cells can be shut down and isolated from the building's ACR. The C-310 cells must be shut down at the local panels.

3.15.7.3 UF6 Release Detection System

3.15.7.3.1 Safety Function

The UF_6 release detection system shall detect and annunciate in the ACR, UF_6 releases in enrichment cascade operating equipment that is operated above atmospheric pressure. The UF_6 release detection system for the feed, withdrawal, and toll transfer and sampling facilities shall detect UF_6 releases and provide an alarm to alert personnel to take appropriate action (i.e., investigate to verify a release occurred and, if necessary, evacuate the area affected by the release). Other systems that perform alarm and mitigation functions are discussed in other sections (see Sections 3.15.4.1, 3.15.4.8, and 3.15.5.2).

3.15.7.3.2 Functional Requirements

Each of the UF_6 detection systems in the areas of the enrichment cascade that are intended to be operated above atmospheric pressure, and in the withdrawal, feed, and toll transfer and sampling (zones 2, 3, and 5-8) facilities shall be designed in accordance with the following functional requirements to ensure the capability to accomplish the required safety function:

- The system shall monitor the designated areas of the facility for UF6 releases outside of the UF6 primary system.
- The system shall provide, in the ACR, an alarm indication of a UF6 release from the UF6 primary system.

3.15.7.3.3 System Evaluation

Enrichment cascade. The safety function of the system is to detect a UF_6 release from the UF_6 primary system and provide an alarm to alert on-site personnel in the ACR. This facilitates early detection by the operators allowing them to initiate required actions to minimize the release. The system is designed to detect releases in those areas that have the potential for a large UF_6 release and provide an alarm in the ACR.

The detector heads are located in "000" or "00" areas that are intended to be operated above atmospheric pressure. Detectors are installed inside cell housings, cell bypass housings, unit bypass housings, interbuilding tie-line housings, and in interbuilding booster stations. Operation of these detector heads is required during a UF_6 release. The detectors heads would be subjected to an environment associated with the release of UF_6 and its reaction products. However, the response time is relatively quick once the smoke is detected based on operational history. Once a detection signal is generated, the alarm circuit will be sealed in and operator action will be required to clear the alarm. Therefore, the environmental conditions during an event should not cause failure of the detection system. Additionally, there are multiple detector heads in each area to provide detection capability. Normal operation environments can also cause some spurious operations due to various causes and result in detector failures. These are typically detected during the testing process and the detector head will not reset. However, these are typically limited to one detector at a time. With multiple detectors located in each area, additional protection is provided to ensure system operability. Based on these requirements and evaluation, the system can accomplish the required safety function and meet its functional requirements.

Feed, toll transfer (zones 2, 3, and 5-8), and withdrawal facilities. The safety functions of the withdrawal, feed, and toll transfer and sampling facility UF_6 release detection systems are to detect a UF_6 release from the UF_6 primary system and provide an alarm to alert on-site personnel to take appropriate action (i.e., investigate to verify a release occurred and, if necessary, evacuate the area affected by the release). The systems are designed to detect releases in those areas that have the potential for a UF_6 release and provide an alarm inside the facility ACR. Operating history has shown the system to be capable of detecting releases and providing an alarm. Based on these requirements and operating history, the safety function of the system can be accomplished. Credit is also taken for these systems for nuclear criticality safety. See Section 3.15.10.2.7.

The withdrawal facilities are equipped with several systems that can detect and annunciate an alarm in the ACR upon a UF_6 release. These systems include: (1) the UF_6 release detection system - low voltage system at the UF_6 withdrawal room ceiling, (2) the UF_6 release detection system - high voltage ("old") system for UF_6 condensers, accumulator, and piping heated housings, and (3) UF_6 release detection system - high speed centrifugal pumps (C-315 only). A high-voltage (200 VDC) or low-voltage (24 VDC) UF_6 release detection system can be used to monitor the C-315 high speed centrifugal pumps. These systems are classified as alarm-only building UF_6 detection systems for operations performed within the withdrawal facilities. The low voltage UF_6 release detection systems is also credited for nuclear criticality safety by limiting the release of fissile material.

3.15.7.3.4 System Classification

The UF_6 release detection system that is located in any "000" or "00" areas that are intended to be operated above atmospheric pressure (including inside the cell housings, cell bypass housings, unit bypass housings, interbuilding tie-line housings and other piping and equipment housings) and in interbuilding booster stations are required to:

- Detect UF6 releases and annunciate in the ACR; and
- Be used, in conjunction with the compressor motor manual trip system, to reduce the UF_6 primary system pressure and minimize any UF_6 releases.

Use of this system in this manner will minimize exposure of on-site personnel to UF_6 and ensure the off-site EGs are not exceeded. Credit is taken for this system to prevent exceeding the off-site EBE EGs in the large UF_6 release to atmosphere (Section 4.3.2.1.7) EBE. Therefore, this system meets the criteria for classification as a Q system.

The UF_6 detection systems in the feed, toll transfer and sampling (zones 2, 3, and 5-8), and withdrawal facilities are required to:

- Aid in the detection of UF6 releases for several events, and
- Minimize the exposure to on-site personnel.

However, these systems are not essential for the protection of the off-site public since for any significant release of UF_6 material that could threaten off-site EBE EGs, other methods of indicating that

3.15.8.1.4 System Classification

The non-radiological chemical systems are required to:

- Provide primary system integrity during normal operation for the toxic gas distribution process to minimize the consequences to on-site personnel from releases of toxic gases from the process (e.g., distribution system breaches).
- Minimize the potential for failure of the primary system integrity and provide protection for on-site personnel during pressure increase events;
- Detect a toxic gas release and provide alarm for personnel in the immediate vicinity of the release.

The non-radiological chemical systems are classified as AQ systems.

3.15.8.1.5 Boundary

The AQ boundaries for the non-radiological chemical systems are defined in Table 3.15-2.

3.15.9 Building Structures and Confinement

3.15.9.1 Process Buildings

The process buildings house the UF_6 primary systems including the feed facilities, enrichment and purge cascades, withdrawal facilities, and the toll transfer and sampling facility. These buildings include the enrichment process buildings (C-310, C-310-A, C-315, C-331, C-333, C-335, and C-337), the feed buildings (C-333-A, and C-337-A), and the toll transfer and sampling facility (C-360). This section includes the tie-line structures connecting the main cascade process buildings.

3.15.9.1.1 Safety Function

The process buildings provide a significant role in minimizing both the on-site and off-site releases of UF_6 and ensure that the following safety functions are accomplished:

- Provide limited holdup of UF6 releases to allow deposition of uranium and slower release rates to atmosphere (cascade facilities and withdrawal facilities only), and;
- Maintain structural integrity during evaluation basis natural phenomena events (i.e., earthquakes, high winds, and flooding) to the degree needed to prevent failure of the UF6 primary system.

3.15.9.1.2 Functional Requirements

The functional requirements are no different than the safety function.

3.15.9.1.3 System Evaluation

Process buildings C-310, C-310-A, C-315, C-331, C-333, C-335, and C-337 are the structural facilities housing the operations associated with the enrichment and purge cascade facilities and the

Table 3.15-1. Boundary Definition for Q Structures, Systems, and Components (continued).

System	Facility	Boundary Definition	Support Systems
Liquid UF_6 Cylinder Handling Equipment (Section 3.15.6.3 and 3.15.10.2.9)	C-310 C-315 C-360	1. Scale carts ; 2. C-360 levelator which includes: a. Hydraulic lift, b. The hydraulics, c. Rail stop, d. Interlock switch (prevents cart motion when levelator is not in position). 3. C-360 Elevator which includes: a. Hydraulic lift, b. Hydraulics, c. Elevator key lock, the interlock on the elevator door to prevent opening when the elevator floor is not level with the floor, and d. Deadman switch. 4. Rail stops located at the head of the C-310 and C-315 cylinder fill/weigh stations.	No support systems are required.
Cylinder Scale Cart Movement Prevention System (Sections 3.15.6.5 and 3.15.10.2.8)	C-310 C-315 C-360	1. Differential pressure sensors 2. Solenoid valves 3. Associated interlocks on the air supply to the scale cart.	The scale carts fail safe upon loss of air.
UF_6 Release Detection System (Section 3.15.7.3)	C-331 C-333 C-335 C-337	The UF_6 release detection system that is located in any "000" or "00" areas that are intended to be operated above atmospheric pressure (including inside the cell housings, cell bypass housings, unit bypass housings, and interbuilding tie-line housings) and in interbuilding booster stations, including: 1. Leak detector heads 2. Associated signal conditioners 3. Signal cable from the detector heads to the signal conditioner 4. Alarm annuciators in ACR 5. Electrical signal lines and associated alarm circuitry 6. 120 VAC power supply back to the first breaker 7. 125 VDC power supply back to the first breaker	120-VAC power - Required for the UF_6 release detection system to support 200 VDC power supply to the detectors 125 VDC power - Required to annunciate alarms in the ACR

Table 3.15-2. Boundary Definition for AQ Structures, Systems, and Components (continued).

System	Facility	Boundary Definition	Support Systems
Enrichment and Purge Cascade, interbuilding tie-line, and Product and Tails Withdrawal Facility Structures (Section 3.15.9.1)	C-310 C-310-A C-315 C-331 C-333 C-335 C-337	1. Foundations 2. Base plates 3. Building frames 4. Column anchorage 5. Load bearing walls 6. Reinforcing tees 7. Bracing 8. Seismic expansion joints (gaps between floor sections) 9. Connections 10. Supports for important to safety piping 11. Siding at the cell floor and above 12. Roof	No support systems are required.
Feed and Toll Transfer and Sampling Facility Structures (Section 3.15.9.1)	C-333-A C-337-A C-360	1. Foundations 2. Base plates 3. Building frames 4. Column anchorage 5. Load bearing walls 6. Reinforcing tees 7. Bracing 8. Supports for important to safety piping	No support systems are required.
Process Building Cranes (Section 3.15.9.2)	C-333 C-337	1. Bridge crane rails, crane structure and structural supports for the C-333 and C-337 cranes parked over unit bypass piping.	No support systems are required.
Cascade Equipment Housings (Section 3.15.9.3)	C-331 C-333 C-335 C-337	For housings over UF_6 primary system piping and equipment, defined in 3.15.3.3, intended to be operated above atmospheric pressure: 1. Steel frame surrounding UF_6 primary systems. 2. Non-metallic or sheet metal panels attached to the framing.	No support systems are required.

(i.e., reaction products of UF_6 and moisture) or (2) the odor of HF, which is a product of the reaction of UF_6 and moisture. The visual indication or the odor of HF will provide indication of (1) the occurrence of a release and (2) the need for the workers to evacuate the area of the release. All the cascade UF_6 processing equipment and major piping are enclosed in housings to maintain normal operating temperatures. The configuration of the housings required to maintain normal operating temperatures, and therefore to keep UF_6 in the gaseous state, provides an inherent barrier against UF_6 releases within the housing. Although the housings provide the local worker with additional time to detect the release and evacuate the area, the housings are not considered an essential control for this receptor rather they provide further assurance that workers will be able to evacuate the area in accordance with the plant see and flee policy. Personnel protective equipment (PPE) or other protective measures (e.g. emergency egress capability) must be available for personnel operating process building cranes.

Operational personnel in the ACR — Operational personnel who are required to take mitigative action are located in the ACR, which typically would not be impacted by the event. However, during cold weather periods, the air on the cell floor is recirculated inside the building to minimize heat loss and maintain building temperatures. This mode of operation could result in elevated concentrations of HF in the ACR area, which would result in evacuation of the ACR. An evaluation of this potential concern concluded that adequate time is available for operators to perform the required actions prior to evacuation should the need arise. However, once these essential actions have been accomplished, the essential control to protect these personnel is evacuation, if required, upon detection of the release by sight or by odor.

Workers outside the process buildings — The essential controls for protecting on-site personnel outside the process buildings are (1) detection of the release, (2) minimization of the release by tripping applicable cells, (3) temporary holdup of the release by the existing process building structure, and (4) training of on-site personnel to evacuate areas upon detection of a release by sight or by odor. The first essential control is to detect the release of UF_6. As stated previously, the motor load indicators provide an indication of a pressure increase in the affected cell. Typically, this indication will be detected, and corrective action will be taken prior to any failure in the primary system. However, should a release occur, the equipment that has the potential for causing a large release [i.e.,"000" or "00" areas that are intended to be operated above atmospheric pressure (including inside the cell housings, cell bypass housings, unit bypass housings, interbuilding and tie-line housings and in interbuilding booster stations)] are equipped with UF_6 release detection that alarms in the applicable ACR. Other portions of the cascade do not have operating pressures or inventories sufficient to result in any significant consequences outside the building, and this receptor would not be applicable (see Section 4.2.6.4). The second essential control, is for operators to trip the appropriate cell(s) to reduce the pressure and minimize the release of UF_6. Tripping the cell would quickly end the release as the compressors stop and the system pressure falls to atmospheric pressure. Pressure at an interbuilding booster compressor can be reduced, if needed, by tripping the compressor motor or by tripping adjacent enrichment cell compressor motors. Once the pressure has dropped to atmospheric pressure or below, the release of material is effectively terminated for any potential exposure outside the process building. Sufficient time is then available to perform any necessary valve evolutions to isolate the cell. The third essential control, process building holdup, is provided by the existing process building structure. The process building structure is expected to reduce the potential hazardous material concentrations to receptors outside of the building by holdup of a portion of the UF_6 released, and by causing most of the UF_6 that escapes the building to be released via the exhaust and roof vents flush with the top of the building. If workers outside of the process building have received no other instructions for action to be taken (i.e., shelter in place

- Motor load indicators in ACR—indication of pressure increase (i.e., significant increase in motor load) (EG 3 only); and
- Compressor motor manual trip in ACR—decrease pressure (EG 3 only).

Essential mitigation of any UF_6 releases associated with this event (EGs 1, 2, and 6) are summarized as follows:

- Compressor motor manual trip in ACR—minimize release for all receptors except local worker (EG s 1, 2, and 6);
- UF_6 release detection system for "000" or "00" areas that are intended to be operated above atmospheric pressure (including inside the cell housings, cell bypass housings, unit bypass housings, interbuilding tie-line housings, and in interbuilding booster stations)—all receptors except local worker (EGs 1, 2, and 6);
- Equipment housing holdup for compressors operating above atmospheric pressure—off-site public (EGs 1 and 2);
- Visual/odor detection of release, worker training, and evacuation of affected area—all on-site workers (EGs 1 and 2);
- Administrative control—personal protective equipment (PPE) or other protective measures shall be available to personnel operating process building cranes (EGs 1 and 2); and
- Process building holdup—workers outside process building and the off-site public (EGs 1 and 2).

Based on the above essential controls, the resulting important to safety SSCs and TSRs are as follows:

- The motor load indicators, UF_6 compressor motor manual trip systems, UF_6 release detection system, equipment housings, and process buildings are identified as important to safety SSCs. See Section 3.15 for details including safety classification.
- TSRs are provided for the motor load indicators; cascade cell trip function; UF_6 release detection system; and administrative requirements for procedures and training of workers for evacuation actions, and for protective equipment/measures for crane operators.

4.3.2.1.4 Limited UF_6 Release to Atmosphere (Primary System Integrity)

a. <u>Scenario Description</u>

Small passive failures in the primary system may result in limited releases of UF_6 into the process buildings. These could be caused by initiators such as failures of instrument lines, expansion joints, weld joints, etc., that could be caused by vibration, fatigue, or corrosion. These types of failures are expected frequently enough to place them in the AE category.

A limited UF_6 release event was evaluated in the PrHA, and it was determined that the consequences could include significant on-site impact in the above atmospheric pressure operating mode if no mitigation were provided.

The primary concern associated with this event is controlling the UF_6 release. The applicable EGs (see Table 4.2-2) associated with this event are all the EGs for the AE frequency range. EG 3 is not

applicable cells, (3) temporary holdup of the release by the existing process building structure, and (4) training of on-site personnel to evacuate areas upon detection of a release by sight or by odor. The first essential control is to detect the release of UF_6. Equipment that has the potential for causing a large release [i.e.,"000" or "00" areas that are intended to be operated above atmospheric pressure (including inside the cell housings, cell bypass housings, unit bypass housings, interbuilding and tie-line housings and in interbuilding booster stations)] are equipped with UF_6 release detection that alarms in the applicable ACR. Other portions of the cascade do not have operating pressures or inventories sufficient to result in any significant consequences outside the building, and this receptor would not be applicable (see Section 4.2.6.4). The second essential control, is for operators to trip the appropriate cell(s) to reduce the pressure and minimize the release of UF_6. Tripping the cell would quickly end the release as the compressors stop and the system pressure falls to atmospheric pressure. Pressure at an interbuilding booster compressor can be reduced, if needed, by tripping the compressor motor or by tripping adjacent enrichment cell compressor motors. Once the pressure has dropped to atmospheric pressure or below, the release of material is effectively terminated for any potential exposure outside the process building. Sufficient time is then available to perform any necessary valve evolutions to isolate the cell. The third essential control, process building holdup, is provided by the existing process building structure. The process building structure is expected to reduce the potential hazardous material concentrations to receptors outside of the building by holdup of a portion of the UF_6 released, and by causing most of the UF_6 that escapes the building to be released via the exhaust and roof vents flush with the top of the building. If workers outside of the process building have received no other instructions for action to be taken (i.e., shelter in place or take cover), then the essential control for these receptors is to evacuate their areas if a release is detected by sight or by odor.

Off-site public — Because this event, as described, could involve a significant UF_6 release, a scenario is presented that indicates how much material is required to be released at the assumed conservative flow rate to result in the 30 mg U exposure at the nearest site boundary. For the worst-case conditions, the results indicate that it takes about 31,200 lb (14,165 kg) of UF_6 to reach a 30 mg U exposure at the nearest site boundary. With the conservative release rate assumed, this would result in a release time of about 4 min. The large UF_6 release to atmosphere event is characterized by the B-stream block valve closure event. The large UF_6 release to atmosphere event ignores the time required to reach a 40-psia (0.27-MPa) cascade pressure, at which the primary system is assumed to fail (about 2.5 min, see Section 4.3.2.1.3). This extra time would allow the operator even more time to react to the event (i.e., about 6.5 min to trip the compressors for the worst case assumptions). There is sufficient time for operator response based on operator presence near the controls when this event is expected to occur. In addition, with any quicker response time, different wind conditions, ventilation system settings, or variations in the wake effects, the resulting consequences would be below the guidelines.

d. Comparison With Guidelines

For workers in the immediate area, specific exposures were not calculated because of variables and uncertainties associated with the calculations and because of obvious evacuation actions that would be taken by the worker. However, the controls identified (i.e., see and flee, and PPE or other protective measures for crane operators) will maintain exposures within EGs 1 and 2 to the extent practical. Actions required of operational personnel in the ACR were evaluated, and they can be accomplished to meet the requirement for EG 6. In the event that the release ultimately affects habitability of the ACR, this receptor would be able to evacuate the area before EGs 1 and 2 are exceeded. In addition, based on the

controls identified (i.e., release detection, cell trip, building holdup, and evacuation of areas upon detection of a release), EGs 1 and 2 would be met for workers outside the process building. Finally, an analysis was performed to determine the worst-case scenario at which an off-site exposure of 30 mg U would be reached. Results of this analysis indicated that the operator action could be accomplished within the time frame to meet the EGs.

e. **Summary of SSCs and TSR Controls**

Based on the results of this analysis, the essential controls for the large UF_6 release to atmosphere event are summarized as follows:

- Compressor motor manual trip in ACR—minimize release for all receptors except local worker (EGs 1, 2, and 6);
- UF_6 release detection system for "000" or "00" areas that are intended to be operated above atmospheric pressure (including inside the cell housings, cell bypass housings, unit bypass housings, interbuilding tie-line housings and in interbuilding booster stations)—all receptors except local worker (EGs 1, 2, and 6);
- Equipment housing holdup for compressors operating above atmospheric pressure—off-site public (EGs 1 and 2);
- Visual/odor detection of release, worker training, and evacuation of affected area—all on-site workers (EGs 1 and 2);
- Administrative control—personal protective equipment (PPE) or other protective measures shall be available to personnel operating process building cranes (EGs 1 and 2); and
- Process building holdup—workers outside process building and the off-site public (EGs 1 and 2).

Based on the above essential controls, the resulting important to safety SSCs and TSRs are as follows:

- The UF_6 compressor motor manual trip systems, UF_6 release detection system, equipment housings, and process buildings are identified as important to safety SSCs. See Section 3.15 for details including safety classification.
- TSRs are provided for the cascade cell trip function; UF_6 release detection system; and administrative requirements for procedures and training of workers for evacuation actions, and for protective equipment/measures for crane operators.

4.3.2.1.8 Heavy Equipment Drop (Primary System Integrity)

a. **Scenario Description**

During process building operations, the change-out of cascade equipment for maintenance requires that heavy equipment (converters, compressors, valves, etc.) occasionally be moved over operating cells by overhead building cranes and lifting fixtures. If this equipment should be dropped because of a failure of the crane or lifting rig, the primary system could be breached, and UF_6 released if the cell is operating above atmospheric pressure. The fall of a crane itself is not considered a credible release initiator. The cranes that are normally parked over cascade equipment have been shown to be seismically qualified in this position (see Section 3.15). The greatest potential for a UF_6 release would be from a drop of a converter on a B-bypass line operating at the maximum operating pressure. The heavy equipment drop

SECTION 2.4 SPECIFIC TSRS FOR ENRICHMENT CASCADE FACILITIES

2.4.4 GENERAL LIMITING CONDITIONS FOR OPERATION

2.4.4.1 UF_6 RELEASE DETECTION SYSTEM

LCO 2.4.4.1: At least the minimum number of the UF_6 release detection heads inside the areas of the cascade stated in the ACTIONS table below shall be operable prior to steady state operations above atmospheric pressure.

APPLICABILITY: Modes: Cascade Mode 2. Other cascade associated equipment, steady state operations above atmospheric pressure.

ACTIONS:

Condition	Action	Completion Time
A. Fewer than the minimum of 3 of the UF_6 release detection heads for each cell housing roof and cell exhaust duct in buildings C-331 and C-335 are operable.	A.1 Perform a continuous UF_6 smoke watch on the cell or cells affected by PGLD detection head inoperability. TSR 1.6.2.2(d) is not applicable.	1 hour
B. Fewer than the minimum of 3 of the UF_6 release detection heads for each cell housing roof and inter cell housing in buildings C-333 and C-337 are operable.	B.1 Perform a continuous UF_6 smoke watch on the cell or cells affected by PGLD detection head inoperability. TSR 1.6.2.2(d) is not applicable.	1 hour
C. Fewer than the minimum of 3 of the UF_6 release detection heads in each defined section of the cell bypass are operable.*	C.1 Perform a continuous UF_6 smoke watch on the cell bypass or bypasses affected by PGLD detection head inoperability. TSR 1.6.2.2(d) is not applicable.	1 hour
D. Fewer than the minimum of 3 of the UF_6 release detection heads in each defined section of the unit bypass are operable.*	D.1 Perform a continuous UF_6 smoke watch on the unit bypasses affected by PGLD detection head inoperability. TSR 1.6.2.2(d) is not applicable.	1 hour
E. Either of the minimum of 2 UF_6 detector heads (the detector head located in a B Booster Pump housing, or the detector head located over the pump) inoperable.	E.1 Perform a continuous UF_6 smoke watch on the B Booster Pump affected by PGLD detection head inoperability. TSR 1.6.2.2(d) is not applicable.	1 hour
F. Fewer than the minimum of 1 of the UF_6 release detection heads in each end of the interbuilding tie-line housing are operable.	F.1 Perform a continuous UF_6 smoke watch on the interbuilding tie-line housing end(s) affected by the PGLD inoperability. TSR 1.6.2.2(d) is not applicable.	1 hour

*"Defined Section" defined in Basis.

United States Enrichment Corporation (USEC)
Certificate Amendment Request
Technical Safety Requirement (TSR) Change to Add UF_6 Release Detection Controls for Interbuilding Tie-Lines at PGDP
Significance Determination

The United States Enrichment Corporation (USEC) has reviewed the proposed changes associated with this certificate amendment request and provides the following Significance Determination for consideration.

1. No Significant Change to Any Conditions to the Certificate of Compliance

   None of the Conditions to the Certificate of Compliance specifically address the subject SAR or TSR sections that are being revised. Thus, the proposed change will have no impact on any of the Conditions to the Certificate of Compliance.

2. No Significant Change to Any Condition of the Approved Compliance Plan

   All Compliance Plan Issues have been closed. As a result, the conditions specified in the compliance plan are no longer in effect. Thus, this proposed revision does not represent a significant change to any condition of the approved Compliance Plan.

3. No Significant Increase in the Probability of Occurrence or Consequences of Previously Evaluated Accidents

   The accidents of concern associated with this proposed change are the B-Stream Block Valve Closure, Limited UF_6 Release to the Atmosphere and Large UF_6 Release to the Atmosphere accidents. These accident scenarios currently address various primary system failures in cascade process piping during the above atmospheric mode of operation. The probability of a tie-line failure is the same as that assigned to these previously evaluated primary system failures. The bounding accident scenario identified for these previously evaluated accidents is a rupture along a B-line at a location where the pressures and interstage flows are the highest at a power level of 3040 MW. This scenario also bounds the effects of potential tie-line failures. For large releases these accident scenarios require that TSR controls be established for UF_6 release detection equipment. The only effect of this proposed change is to establish the TSR controls required by the accident analysis to permit operating the tie-lines above atmospheric pressure. The establishment of these new TSR controls and operating the interbuilding tie-lines above atmospheric pressure does not change the probability of occurrence or consequences of these previously evaluated accidents. Based on the above, this proposed change will not result in a significant increase in the probability of occurrence or consequences of previously evaluated accidents.

4. No New or Different Type of Accident

   As noted above, the only effect of this proposed change is to establish the TSR controls required by the accident analysis to permit operating the tie-lines above atmospheric pressure. The SAR accident analysis currently addresses various primary system failures in cascade process piping during the above atmospheric mode of operation. Since the SAR currently indicates that UF_6 pressures in the tie-lines can go above atmospheric pressure as the power level increases, operating the tie-lines above

atmospheric pressure does not represent a new or unanalyzed operation. Therefore, raising the operating pressure of interbuilding UF_6 process piping from below atmospheric pressure to above atmospheric pressure does not create a new type of accident. The interbuilding tie-line PGLD system associated with this effort is similar to other PGLD systems currently used in the enrichment cascade. This proposed change does not introduce any accident initiators or equipment failure mechanisms that are different that those previously evaluated in the SAR. Therefore, this proposed change will not create a new or different type of accident.

5. No Significant Reduction in Margins of Safety

The margins of safety associated with this proposed change are those related to cascade operating pressure. The Technical Safety Requirements (TSRs) define the mode for operating above atmospheric pressure as occurring when the stage high-side pressure is $\geq$ 14.5 psia for "000" cells and C-310 cells, and $\geq$ 13.5 psia for "00" cells. The TSRs also establish the safety limit for maximum cascade operating pressure as less than 40 psia. This value is less than 110% of the design pressure of the limiting cascade system components. The TSRs also establish a Limiting Condition for Operation (LCO) that limits cascade pressure to less than or equal to 25 psia. This proposed change does not affect these established limits. The interbuilding tie-lines will continue to be operated within these limits. Based on the above, this proposed change does not adversely affect any safety limit defined in the TSRs or supporting bases. Therefore, there is no significant reduction in margins of safety associated with the proposed change.

6. No Significant Decrease in the Effectiveness of Any Programs or Plans Contained in the Certificate Application

This proposed change will not result in a change to any of the programs or plans contained in the Certificate Application. Operations will continue to be conducted in accordance with the current programs and plans contained in the Certificate Application. Therefore, the proposed changes will not decrease the effectiveness of any programs or plans contained in the Certificate Application.

7. The Proposed Changes do not Result in Undue Risk to 1) Public Health and Safety, 2) Common Defense and Security, and 3) the Environment

Due to the fact that there is no significant increase in the probability or consequences of any accident previously analyzed and no new or different type of accident, there will be no undue risk to the public health and safety because of the proposed change. The proposed change will have no impact on plant effluents or on the programs and plans in place to implement physical security, protection of classified matter, transportation security, or special nuclear material accountability. Consequently the proposed change will not pose any undue risk to the public health and safety, common defense and security, or the environment.

8. No Change in the Types or Significant Increase in the Amounts of Any Effluents that May be Released Off-Site

The proposed change does not involve any physical change to the plant, or plant operations that could change the types or increase the amounts of any effluents that may be released off-site. Therefore, the proposed change does not change the type or significantly increase the amount of effluents that may be released off-site.

9. No Significant Increase in Individual or Cumulative Occupational Radiation Exposure

The proposed change does not increase the probability or consequences of a UF_6 release or inadvertent criticality. The proposed changes will not effect the radiological protection program description or the actions in place to minimize occupational exposures. Therefore, there is no increase in individual or cumulative occupational radiation exposure as a result of this change.

10. No Significant Construction Impact

The construction activities associated with this proposed change will be handled in accordance with existing procedures and in the same manner as existing maintenance activities which involve repair and replacement of equipment. Therefore, there are no significant construction impacts associated with this change.