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February 4, 2005
GDP 05-0004

Mr. Jack R. Strosnider
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
Response to NRC Request for Additional Information
Certificate Amendment Request: Technical Safety Requirement (TSR) Changes to the C-337-A Feed Facility Crane Design Features at the PGDP (TAC No. L52561)

Dear Mr. Strosnider:

The purpose of this letter is to provide the United States Enrichment Corporation's (USEC's) response to the NRC's December 7, 2004, request for additional information regarding the subject Certificate Amendment Request (CAR). The request for additional information (RAI) was provided to USEC in the Reference. During a January 7, 2005, phone conversation between Mr. Bob Nelson (NRC) and Mr. Mark Smith (USEC), the response date for this RAI was extended to February 4, 2005. USEC's response to the NRC's request for additional information is provided in the Enclosure.

Any questions or comments regarding this letter 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, Nuclear Regulatory Affairs

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NMSS01

Reference: NRC letter from Dan E. Martin (NRC) to Steven A. Toelle (USEC), Paducah Gaseous Diffusion Plant – Certificate Amendment Request (TAC L52561), dated December 7, 2004.

Enclosure: USEC Response to NRC Request for Additional Information Regarding the Technical Safety Requirements (TSR) Changes to the C-337-A Feed Facility Crane Design Features at the PGDP.

cc: G. Janosko, NRC-HQ
J. Henson, NRC Region II
B. Bartlett, NRC Senior Resident Inspector, PGDP
D. Martin, NRC Project Manager, PGDP

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1. The proposed basis for TSR 2.2.5.5, "C-337-A Jet Station Barrier Frame," SAR 3.15.2.9.3, "System Evaluation," and SAR 4.3.2.2.10, "Pigtail/Line Failure Outside Autoclave (Primary System Integrity)," mentioned an analysis of the frame structure that verified that the frame structure would absorb the load imposed by an impact without collapse or contact with the primary system piping.

   Please provide the assumptions used in the analysis, a brief description of the analysis method, as well as a summary of the results of the analysis for Nuclear Regulatory Commission (NRC) review. Please describe the "scenarios" analyzed and how they bound the potential types and magnitudes of impacts.

   The NRC staff must review the details of the barrier frame analysis in order for the NRC staff to determine that the barrier frame provides equivalent or better protection than the current crane travel limit switch.

   <u>USEC Response</u>

   A brief description of the jet station barrier frame analysis assumptions, analysis method, analysis results and scenarios analyzed are provided below. The complete analysis is available at the site for NRC review should additional details be required.

   <u>Analysis Assumptions</u>

   The frame was treated as an elastic spring. The spring coefficient was assumed to be linear in the elastic range for all steel components. This is consistent with steel design theory. Based on the timeframe of the installation, the steel was assumed to be ASTM A36 mild carbon steel since the original design drawings did not specify the steel type. ASTM A36 is a common structural steel used at that time. The steel was assumed to yield at 36,000 pounds per square inch.

   The frame was modeled using STAAD III structural analysis software with nodes defining the frame joints. The cylinder loading was assumed to occur directly at the nodes at the top of the frame. This presents the worst case loading on the frame, as different load locations would spread the loads to multiple joints.

   The top of the frame structure has rubber bumpers installed in case of cylinder impact. The effects of the bumpers were neglected in the analysis. This is conservative as the bumpers would absorb some amount of impact loading.

   A 48Y model 14-ton cylinder with a maximum weight of 34,000 pounds was assumed to hit the frame. This represents the worst case cylinder loading.

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The columns of the frame extend 5 feet below grade and are encased in concrete that is 16 inches in diameter. By inspection, this encasement was deemed capable of developing the full plastic moment of the column for a shock loading condition.

Analysis Method

The 34,000 pound maximum weight of a 48Y model 14-ton cylinder was applied to the frame for each scenario. This provided the spring constants and deflection data for the frame. Using the maximum deflection in the elastic range and the principles of energy and work, the maximum velocity of the cylinder was calculated. This velocity was compared to the normal operating velocities for the cranes. Any possible crane velocity above those calculated for the elastic range of the frame would have the potential to cause permanent deformation to the frame. The top crane velocity at C-337-A is 185 feet per minute (FPM) and is equivalent to the worst case high speed setting of the crane.

Analysis Results

The results showed that for the slow and medium speed settings of the crane (50 FPM and 115 FPM respectively) the frame remained in the elastic range of the structure during an impact event. At the high speed setting (185 FPM) some permanent deformation of the frame would occur. However, compared to the maximum speeds calculated for the elastic range, deflections would increase only up to 30 percent, causing movement up to 1 3/8-inch and a small permanent deformation of approximately 3/8-inch in the structure. This deformation occurs in the main support columns of the frame. The jet station piping is located well below the top of the frame where the maximum deflection occurs and approximately 6-inches away from any of these structural components. Only a major failure such as a collapse could cause damage to the piping. At the high speed setting (worst case) the frame will see a small permanent deformation, but will not collapse.

Scenarios Analyzed

The C-337-A jet station barrier frame is a steel structure approximately 17 feet long by 15 feet wide by 11 feet high. It was installed specifically for protection of jet station piping located in close proximity of the southwestern most autoclave. The northern edge of the barrier frame is approximately 5 feet from the centerline of the autoclave. Cylinders are lifted by overhead crane in and out of the autoclave near the jet station. The length of the autoclave, as well as a cylinder when positioned for installation in an autoclave, is parallel to the length of the barrier frame. The analysis

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was performed to demonstrate that the barrier frame will withstand a cylinder impact without collapsing the jet station barrier frame or contacting process piping.

Three scenarios were identified as plausible cylinder impact events. The first and most viable scenario was a cylinder coasting past the autoclave and contacting the frame with the cylinder oriented parallel with the autoclave. The second scenario was with the cylinder turned perpendicular to the autoclave and the cylinder end impacting the center of the barrier. The third scenario was similar to the second except with the end of the cylinder impacting the end of the barrier. The second and third scenarios are less likely than the first considering cylinders are normally orientated parallel to the autoclaves.

2. The proposed surveillance requirement (SR) for TSR 2.2.5.5, "C-337-A Jet Station Barrier Frame," requires, "The jet station barrier frame in C-337-A shall be inspected for structural defects."

   Please provide a description of how the barrier frame will be inspected for structural defects, including procedures to be used and what the user is directed to look for.

   Please provide a discussion of why the SR requires an inspection for structural defects. Describe how an inspection for structural defects includes verification that the frame meets its original design specification for dimensions, material condition, that it has sustained no significant structural damage, and that the inspection verifies that no field modifications have been made since the original installation. Please describe the minimum qualifications of the person performing this inspection and how they are defined and documented.

   <u>USEC Response</u>

   The barrier frame will be inspected according to the structural inspection requirements of Engineering procedure CP2-EG-EG1048. The inspection and evaluation will be performed by Engineering personnel with a civil/structural background who are specifically chosen to perform the inspection by Engineering management. The inspection will be performed on a five-year cycle in accordance with Surveillance Requirement SR 2.2.5.5-1. This inspection is required to determine if structural degradation has occurred which could potentially affect the frame's structural capacity for protecting the jet station piping.

   The inspector develops an inspection plan that includes the frame's foundation, steel members, bracing, and connections as inspection features. The procedure lists issues for the inspector to consider when performing the inspection, such as damage to the

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structural items, corrosion and whether the members are plumb. The inspection also looks for any unusual changes or modifications to the structure such as welding to the structure, items that have been added, bent or moved to a different connector point. The inspection requires a review of drawings to determine where changes may have occurred, or are proposed.

Development of the inspection plan includes the review of existing drawings, previous inspection reports, and Assessment and Tracking Reports (ATRs) for incorporation of issues needing addressed. The final plan is approved by Engineering management. The results of the inspection are documented in a report, and potential deficiencies found are reported in ATRs and evaluated by Engineering.

3. Please describe the "administrative controls" that are relied on to prevent a cylinder or other heavy load from being moved over the jet station piping. Please explain how a cylinder or other heavy load will be prevented from "drifting" over the jet station piping.

   <u>USEC Response</u>

   The administrative controls that will minimize the likelihood of a cylinder or other heavy load being moved over jet station piping are procedure controls placed on the crane movement path and crane speed. The procedure control on the crane movement path will require that crane operators ensure no cylinder or other load is intentionally moved over the jet station barrier frame. As discussed in the response to question 4 below, the currently established crane travel path ensures that cranes do not carry loads over the jet station. This established crane travel path will continue to be followed.

   The procedure controls placed on crane speed will require crane operators to use slow speeds when using the crane to move heavy loads that are in the vicinity of the jet station. Operators will be required to maintain the crane speed slow enough so that the load will not drift into the barrier frame after the crane stop signal is initiated. This administrative control relies on the skill of the operator to control crane drift by controlling crane speed. This is not a new crane operator skill as operators normally have controlled the crane to a slow speed when approaching the autoclave next to the jet station. The slow speed is an operational necessity to allow a cylinder to be placed precisely over the autoclave that is being loaded.

   As part of USEC's current plans for implementing this proposed change, the above administrative controls will be incorporated into procedures CP4-CO-CN2045a, "Operation of the C-333A and C-337A Vaporizer Facilities", and CP2-CO-CA2031,

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"Operation of Overhead Cranes". Operators will be trained on these procedure revisions prior to implementation.

The administrative controls on crane movement path and crane speed minimize the likelihood that a cylinder or other heavy load will be inadvertently moved over jet station piping. If these controls fail it is possible for a solid UF_6 cylinder to travel over or impact the jet station barrier frame. The TSR controls that will be in place to protect the jet station piping in the event the administrative controls fail are further discussed in the response to Question 5 below.

4. Please describe the horizontal distance from the jet station barrier frame from the current crane travel limit stop and the proposed crane travel limit stop location. Please describe how the crane travel limit stop is activated to prevent loads from traveling over the jet station, while allowing loads to be moved by the jet station, to the side, if not over the jet station.

<u>USEC Response</u>

There is a travel exclusion zone around the C-337-A jet station that is controlled by limit switches. There are turnstile limit switches physically located on both the crane bridge and the trolley. There are trip arms constructed of unistrut that are welded to the bridge support structure and the crane bridge at fixed locations such that when the crane/trolley traverses by it contacts the limit switch and the switch changes state. Allowable bridge/trolley movement is dependent upon the state of the combined limit switches. The system is configured such that once the exclusion zone is entered, movement in the opposite direction is allowed.

If the bridge is traveling north/south towards the jet station with the trolley located at the west end of the bridge (in line with the jet station), bridge movement is stopped when the bridge turnstile limit switch contacts the trip arm and changes state.

On the other hand, if the bridge is traveling north/south towards the jet station with the trolley located to the east end of the bridge (out of line with the jet station), bridge movement will not be stopped when it contacts the trip arm and changes state due to the state of the trolley limit switch.

If the trolley is moved from the east to the west towards the jet station with the crane stopped over the jet station, the trolley limit switch will change state when it contacts the trip arm and trolley movement will stop.

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The two bridge limit switch trip arms originally located at the north and south edges of the jet station were moved approximately 19.5 feet further north and south in 2001 when it was discovered they did not prevent carrying a load over the jet station due to the bridge brake drift. In accordance with ANSI B30.2-1990 Section 2-1.12.4.i, the maximum drift allowed is 10 percent of the crane's full rated speed. The C-337A North crane full rated speed is 185 FPM; therefore, the trip arms were moved greater than 18.5 feet to accommodate for the drift and still prevent carrying a load over the jet station. At this new location, the north trip arm position no longer allowed the crane to access the two autoclaves nearest the jet station. Pending approval of this proposed change, the north trip arm will be moved closer to the edges of the jet station to regain access to the two autoclaves. Current plans are to leave the south trip arm at its present location unless an operational need is identified that requires that it be moved closer to the jet station.

5. Current SAR Section 3.2.2 states that "Limit switches on the cranes keep cylinders from being transported over the jet stations in C-337-A." Since the TSR-required limit switch control would be replaced by the "administrative controls" to prevent loads from traveling over the jet station, please describe how an equivalent level and margin of safety will be maintained.

   <u>USEC Response</u>

   The proposed change will replace the TSR required limit switch control with two separate TSR controls to provide protection to the jet station piping. The purpose of the administrative controls is to minimize the likelihood that the TSR controls will be called upon. If an operator error or crane failure results in a heavy load being inadvertently moved over or impacting the jet station barrier frame, then a failure of the TSR controls would be required for the occurrence of a heavy load drop or impact event that could rupture the pressurized piping within the jet station.

   There are two accident scenarios of concern associated with using the cranes to move heavy loads around the process piping in the C-337-A jet station. The first scenario involves moving a heavy load over the piping and then dropping the load such that it ruptures the pressurized piping. The second scenario involves a crane horizontally moving a heavy load into the pressurized piping with sufficient force to rupture the pressurized piping.

   The first scenario requires a heavy load be hoisted high enough to clear the C-337-A jet station barrier frame combined with an operator error or crane failure that results in the heavy load being moved over the pressurized jet station piping. If this occurred, an independent failure of the TSR controlled design features of either the

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crane (TSR 2.2.5.2) or UF_6 cylinder slings and lifting fixtures (TSR 2.2.5.1) would also have to occur before a heavy load could drop onto the jet station piping. For this scenario, the TSR controlled active and passive engineered safety features of the crane and lifting fixtures provide an equivalent level and margin of safety to the active engineered safety feature of the crane travel limit switch.

The second scenario involves an operator error or crane failure that results in the crane horizontally moving a heavy load into the pressurized piping with sufficient force to rupture the piping. For this to occur, an independent failure of the TSR controlled design features of the C-337-A jet station barrier frame would also be required before a crane-carried load could rupture the pressurized jet station piping (new TSR 2.2.5.5). For this scenario, the TSR controlled passive engineered safety features of the jet station barrier frame provide an equivalent level and margin of safety to the active engineered safety feature of the crane travel limit switch.