

DOCKET NUMBER: 70-7001

LICENSE NUMBER: GDP-1

CERTIFICATE HOLDER: United States Enrichment Corporation
Paducah Gaseous Diffusion Plant
Paducah, Kentucky

SUBJECT: REVISION TO TECHNICAL SAFETY REQUIREMENTS TO
REVISE NORMETEX PUMP URANIUM HEXAFLUORIDE
RELEASE DETECTION SYSTEM CONTROLS CONDITIONS,
ACTIONS, COMPLETION TIMES, AND SURVEILLANCE
REQUIREMENTS (TAC NO. L32477)

1.0 PROPOSED CHANGES

By letter dated November 4, 2008, United States Enrichment Corporation (USEC or certificate holder) submitted an amendment request to the Certificate of Compliance for the Paducah Gaseous Diffusion Plant (PGDP) to revise Technical Safety Requirements (TSRs) Section 2.3.4.3, "Uranium Hexafluoride (UF₆) Release Detection System – Normetex Pump," by extending the allowable completion time for restoring operability of the automatic Normetex pump UF₆ release detection and isolation system located in building C-310 product and building C-315 tails withdrawal facilities. In its request, USEC proposed that conditions and actions associated with the Normetex pump automatic trip and isolation circuitry be combined with those of the release detection system, and the allowed completion times for restoring operability be increased from one hour to 14 days for the automatic trip and isolation function, and from 72 hours to 14 days for the detection system. During the time that the automatic detection, trip, and isolation functions are not operable, certificate holder would initiate administrative actions within one hour, establish a continuous UF₆ "smoke watch" to detect UF₆ release, and ensure that the Area Control Room (ACR) is manned and ready to respond to an announcement of UF₆ release.

2.0 REGULATORY REQUIREMENTS

Title 10 of the *Code of the Federal Regulations* (10 CFR), Section 76.87, "Technical Safety Requirements," states that TSRs be established by considering the results of the safety analyses reports submitted pursuant to 10 CFR 76.35, "Contents of Application." These TSRs must include: (1) Safety Limits; (2) Limiting Control Settings; (3) Limiting Conditions for Operation; (4) Design Features; (5) Surveillance Requirements; and (6) Administrative Controls.

The regulation in 10 CFR 76.68, "Plant Changes," Paragraph (d) requires that USEC apply for amendment of the certificate to cover proposed new or modified activities not described in the safety analysis report. The USEC submittal must comply with the requirements contained in 10 CFR 76.45, "Application for Amendment of Certificate." 10 CFR 76.45 requires that amendments contain sufficient information for the U.S. Nuclear Regulatory Commission (NRC) to make findings of compliance or acceptability for the proposed activities in the same manner as was required for the original certificate.

3.0 DISCUSSION

3.1 Background

In its certificate amendment request (CAR) dated November 4, 2008, USEC stated that the CAR to modify TSRs Section 2.3.4.3 is needed because the existing maximum allowable time to complete all necessary actions to restore operability of the automatic leak detection and trip/isolation system associated with the Normetex pump in the event it becomes inoperable does not provide sufficient time to diagnose and repair the system, when required, before the existing completion time is exceeded. Further, the required actions in the event that the maximum allowable completion time is exceeded would unnecessarily place the facility in a recycle mode of operation, which poses challenges for the operators because they may be required to divert materials or mix assays to prevent exceeding approved assay limits at the top of the cascade.

Specifically, USEC proposed the following changes to its TSRs:

- Eliminate the separate conditions, actions, and completion times associated with the Normetex pump automatic trip and/or isolation circuitry, and combine them with the actions, conditions, and completion times for restoring operability of the detection heads.
- Add a requirement to verify within one hour that the ACR emergency stop button is considered operable and additionally within one hour, implement a “smoke watch” for the area affected by the inoperable detection and/or trip and isolation system.
- Add a requirement to ensure that the ACR is continually manned.
- Increase the allowable completion time to restore operability for the leak detection, and trip/isolation logic system.
- Provide an additional (new) required surveillance to functionally test the ACR emergency stop button on an annual basis and verify that the Normetex pump trips and the pump discharge valve closes in response to the activation of the emergency stop button.

In addition, USEC proposed to revise Section 3.15 of the PGDP Safety Analysis Report (SAR) to describe the safety function of the use of the smoke watch and ACR emergency stop button as an alternate means of shutting down and isolating the Normetex pumps, and to indicate that the ACR emergency stop button and associated circuitry is upgraded to a “Q” safety system. Section 4.3 of the SAR will be revised to indicate that there are both automatic and manual means for mitigating the consequences of a potential release. USEC also requested that the requirements in TSRs, Section 1.6.2.2, “Limiting Conditions for Operation, Subsection (d), regarding the reliance on the provisions of an action statement when changing operational modes would not apply. This change to TSRs Section 1.6.2.2(d) is needed because the use of the ACR emergency stop button to trip and isolate the Normetex pumps to terminate the leak would result in a operating mode change from “withdrawal” to “standby.”

3.2 Evaluation

The staff reviewed the proposed changes and assessed the effectiveness of the two control methods – automatic and smoke watch – contained in TSRs Section 2.3.4.3.

The C-310 product and C-315 tails withdrawal facilities each contain three Normetex pumps. Under anticipated abnormal operating conditions, the process gas leak detection system and associated trip and isolation logic system of the Normetex pump is designed to sense a leak and either cause an alarm to occur in the ACR, if only a single detector senses a possible leak; or an automatic initiation of a Normetex pump trip and cell isolation to terminate the leak, if more than one adjacent detector senses a possible leak.

In PGDP SAR Section 3.15.4.8.4, Normetex pump UF₆ release detection system is credited for controlling postulated releases before they can exceed off-site evaluation exposure guidelines, such that the potential releases are limited to those with offsite dose consequences less than the occupational dose limits of 10 milligrams (mg) per week for adults associated with soluble uranium intake by an individual, as required by 10 CFR Part 20, "Standards for Protection Against Radiation," Subpart C, "Occupational Dose Limits."

The accident analysis contained in SAR Section 4.3.2.2.17 notes that if the maximum credible release rate of 4.83 pounds (lbs) per second (sec) (i.e., 1.61 lbs/sec from each pump for a combined total of 4.83 lbs/sec for all three pumps) occurs during the withdrawal mode and if this maximum credible release were to be terminated within 373 seconds, the off-site dose limits would not be exceeded. The analysis further demonstrates that, if the release rate were less than this maximum credible rate, the leak could continue much longer before its eventual required termination, without exceeding the offsite dose limits.

As discussed in PGDP SAR Section 3.15.4.8.1, the safety function of the Normetex Pump UF₆ Release Detection System is to detect a UF₆ release from the UF₆ primary system, automatically trip the compression source, and isolate the pump from sources of UF₆ that are above atmospheric pressure. As stated in its April 1, 2009 response to the staff's request for additional information (RAI), USEC stated that while the PGDP SAR does not specifically discuss the minimum detectable concentration or the maximum required response time for the automatic detection system, other sections of the SAR describe the use of the same type of detectors in other safety applications.

PGDP SAR Section 3.3.5.9.5.1 discusses that a release of a 2.14 lb, perfectly-mixed cloud of UF₆ gas would develop a concentration of approximately 200 mg per cubic meter (mg/m³) in a typical cell housing, with its internal volume calculated to be approximately 116,000 cubic feet (ft³). Assuming a release that is perfectly mixed within the cell housing, a release of 2.14 lbs of UF₆ would activate all detectors within the cell housing within 30 seconds. Because a single release of 2.14 lbs is much smaller than a continual 373-second leak occurring at the rate of 4.83 lbs/sec, the automatic detection system provides significant margin to the offsite dose limit. In its RAI response dated April 1, 2009, USEC stated that a UF₆ release assumed by the accident analysis will be detected by these detectors within seconds. Therefore, although not identified specifically in the SAR, the staff concludes that there is reasonable assurance that the time needed to detect a release and complete its safety function by the Normetex pump UF₆ Release Detection System will be within 373 seconds as bounded by the accident analysis.

The staff noted that the proposed maximum allowable completion time for restoring operability to the release detection and trip/isolation circuitry was being significantly increased. Because the alternative protective action proposed by USEC involve the implementation of an administrative control via the use of a smoke watch in place of the automatic engineered control during this extended period, the staff evaluated the relative effectiveness of the use of the

smoke watch in lieu of the automatic detection system to ensure that it would continue to provide adequate margin as analyzed in the PGDP SAR.

In its April 1, 2009 response to the staff's RAI, USEC stated that the effectiveness of the manual system (i.e., smoke watch) is determined by its ability to accomplish the same safety function that the automatic system is required to perform. The proposed Basis Statement to TSRs Section 2.3.4.2 would be revised to include: "[I]n the event that one or more detector heads and/or manual trip/isolation circuitry is inoperable, a smoke watch can be utilized for pumps in Mode 2. In the event of a UF₆ release, the smoke watch would detect the release and notify the ACR to utilize the emergency stop button to trip and isolate the pump." USEC stated that the minimum detectable concentration of a UF₆ release by human or manual means is not specified in the SAR. However, it noted that Section 3.1 of the SAR states that, "[I]f UF₆ were released at room temperature, only the gas and solid phases of the UF₆ would be involved, producing a cloud of dense smoke in the area. The smoke is composed of UF₆, HF [hydrogen fluoride], and UO₂F₂ [uranyl fluoride] produced from the reaction of UF₆ and moisture in the air. The reaction products of 1 mg of UF₆ in moist air produce a visible white cloud." The Emergency Response Planning Guidelines¹ (ERPGs) for 2008 indicates that the lowest planning level, ERPG-1², for HF is 2 parts per million (ppm). The American Industrial Hygiene Association has stated that the human sensible odor threshold range for HF to be 0.04 - 0.13 ppm. Thus, very small releases are easily detectable by either human sight or odor detection (i.e., 1 mg visually or 0.04 - 0.13 ppm). Furthermore, USEC stated that, based on its operational experience, in the event that a UF₆ release occurs while the Normetex pump is inoperable, within the order of seconds, the smoke watch reports the leak and the location to the ACR operator so that immediate actions to terminate the release are initiated. Therefore, the UF₆ leak would be isolated well within the maximum required time frame of 373 seconds.

The staff also reviewed the proposed TSR changes regarding the use of a posted smoke watch for a period extending to the 14-day maximum allowable completion time to restore operability of the automatic detection and trip/isolation system. In particular, the staff evaluated the extended use of a smoke watch, from a human factors perspective, and assessed whether it would pose additional risk to the health and safety of the plant workers, to workers on site, or to members of the public at the site boundary. In its response to the staff's RAI dated April 1, 2009, the certificate holder stated that it considered human factors for personnel performing duties as a smoke watch. Specifically, it stated that the PGDP control room establishes communications with personnel serving on smoke watches via hand-held radio, and that a phone in the area could also be used by the smoke watch to report to the control room. In particular, PGDP shift first-line managers ensure through their radio communications equipment that the smoke watch personnel are attentive, responsive, and capable of performing their intended functions. USEC further stated that the smoke watch personnel are frequently rotated during their watch period to minimize fatigue. Additional management measures in place include formal periodic training on how to detect and report any releases discovered via

¹ ERPGs were developed for emergency planning and are intended as health based guideline concentrations for single exposures to chemicals. These guidelines (i.e., the ERPG Documents and ERPG values) are intended for use as planning tools for assessing the adequacy of accident prevention and emergency response plans, including transportation emergency planning and for developing community emergency response plans. The emphasis is on ERPGs as planning values.

² ERPG-1 is defined as the maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to one hour without experiencing other than mild, transient adverse health effects or without perceiving a clearly defined objectionable odor.

the PGDP's "See and Flee" procedure. In addition, USEC stated that the operations personnel selected to perform smoke watches are familiar with their assigned areas of the facility.

USEC indicated that given the relatively short distance from the Normetex pump area where the smoke watches are posted to the ACR, in the event of a failed radio communication, personnel performing smoke watch activities could easily walk to the control room and report a UF₆ leak and subsequently isolate the leak well within the time frame of 373 seconds. The staff noted that the use of smoke watches at the PGDP has already been a common practice used for this application. The proposed revisions to the TSRs on the extended posting period of smoke watch are consistent with approved facility practices in other PGDP facility applications, and do not introduce a new type of accident scenario that needs to be evaluated.

4.0 FINDINGS

The staff has reviewed the proposed revisions to TSRs Section 2.3.4.3 and determined that the criteria contained in 10 CFR 76.68 and 10 CFR 76.87 have been met. On the basis of its review, the staff concludes that the proposed revisions to TSRs Section 2.3.4.3 will not result in a significant increase in the probability of occurrence or consequences of previously evaluated accidents. In addition, the staff finds that there is reasonable assurance that the proposed revisions will not have a significant impact on public health and safety, security, or the protection of the environment, and therefore, are acceptable.

The approval of this amendment request will be documented in the Certificate of Compliance Gaseous Diffusion Plant (GDP)-1 by the addition of a reference to the November 4, 2008 letter from USEC describing the revisions of TSRs.

5.0 ENVIRONMENTAL REVIEW

Issuance of the requested amendment to Certificate of Compliance GDP-1 is subject to the categorical exclusion provided in 10 CFR 51.22 (c)(19) and will not have a significant impact on the human environment. Therefore, in accordance with 10 CFR 51.22 (b), neither an environmental assessment nor an environmental impact statement is required for the proposed CAR.

6.0 CONCLUSION

Based on its review and evaluation of the information provided by USEC in its CAR dated November 4, 2008, as supplemented by letter dated April 1, 2009, the staff finds that the proposed revisions to TSRs Section 2.3.4.3, "UF₆ Release Detection System – Normetex Pump" including the additional upgrades to the ACR emergency stop pushbutton and the additional new surveillance requirements, would continue to provide adequate protection of public health, safety, safeguards, security, and the protection of the environment. Therefore, the staff concludes that the proposed changes are acceptable and consistent with the requirements of 10 CFR 76.68 and 10 CFR 76.87.

PRINCIPAL CONTRIBUTOR

David L. Rahn, P.E.