USEC
A Global Energy Company

June 10, 2010
GDP 10-1025

U.S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, D.C. 20555-0001

Paducah Gaseous Diffusion Plant (PGDP)
Docket No. 70-7001, Certificate No. GDP-1
USEC Event Report ER 10-03

Pursuant to 10 CFR 76.120 (d)(2), enclosed is the final written event report involving the inoperability of thirty-seven cascade R-114 coolant overpressure relief devices discovered on April 30, 2010. The Nuclear Regulatory Commission (NRC) was verbally notified on May 1, 2010 at 2225 hrs. NRC assigned No. 45890 to the notification.

Any questions regarding this event report should be directed to Vernon Shanks, Regulatory Affairs Manager, at (270) 441-6039.

Sincerely,

Steven R. Penrod
Vice President, United States Enrichment Corporation
General Manager, Paducah Gaseous Diffusion Plant

SRP:MLB:mcl

Enclosure: As Stated

cc: NRC Region II
NRC Resident Inspector – PGDP

IE72
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EVENT REPORT
ER 10-03

A. Description of Event

At 1015 hrs. on April 30, 2010, the Plant Shift Superintendent (PSS) was notified that personnel performing work addressing a small coolant leak on the C-337 Unit 2 Cell 4 Odd Coolant System Rupture Disk noted that the outer (secondary) rupture disk had a significant accumulation of tar-like material, presumably due to leakage into the assembly from the facility's roof. The amount of tar in the rupture disk was such that the disk was determined to be inoperable. This event is reportable as a 24-hour event in accordance with 10CFR 76.120(c)(2)(i). Extent of condition inspections were commenced by System Engineers to identify any other locations where tar dripping from the roof might have entered rupture disk assemblies. Further locations were identified and, as each was discovered, the associated coolant system pressure relief system was declared inoperable, and the TSR LCO action (TSR 2.4.3.4, Action A.1.1, "*An operator shall continuously monitor the R-114 system pressure in order to take action to lower pressure.*") was then entered. This inspection continued over the April 30, 2010 through May 1, 2010 time frame, as there were 365 systems that required inspection. During the course of this inspection, an additional failure mode was observed in that a foreign material exclusion (FME) cap had been left installed in the outlet port of some rupture disk assemblies. Although this flexible plastic cap would not have impacted the rupture disk blowing at rated pressure, there was concern that the cap could become lodged in the rupture disk outlet diffuser nozzle. Systems with this condition were also declared inoperable and the same TSR LCO action entered as above. Once the full inspection was completed, the list of impacted operating systems totaled 37, of which 14 systems had the tar intrusion or a tar/FME cap combination and 23 had FME caps only. Since some cascade cells contain more than one system, a total of 32 cascade cells were impacted.

On May 1, 2010, at 0801 hrs., The Nuclear Regulatory Commission Headquarters Operations Office (NRC-HOO) was notified of the event in accordance with 10 CFR 76.120(c)(2) (NRC No. 45890). Two subsequent updates were made to NRC on May 1, 2010 at 2225 hrs., to report completion of the extent-of-condition inspections, and on May 2, 2010 at 0636 hrs. to report one addition location inadvertently omitted from the earlier report.

B. Description of Equipment Failure

This event involves two distinct failure modes. First, the cascade buildings make use of a "built up" roof. This consists of layers of insulation board, membrane, roofing tar and a gravel cover. It was discovered that some of this roofing tar has migrated through holes and cracks in the roof and dripped down onto the machinery below. The cascade facility cell (upper) floor is maintained at elevated temperatures and, since the zone at roof level is the hottest, the roofing tar dripped through the cracks in the roofing insulation and decking. Some of this tar has dripped down onto the coolant relief nozzles and onto the surface of the upper rupture disk. The amount of tar discovered was highly variable, from a few 1/8-inch thick traces or a few drip spots, to one that completely filled the outlet port to a depth of approximately ¾-inch. This tar impacted cells in C-333 and C-337 buildings. Neither of these facilities has had significant re-roofing work since 1982. A review of maintenance and rupture disk parts usage histories showed that there have been 13 rupture disk replacements since approximately 1998. There is no indication in the maintenance work packages for these repairs of anything abnormal found in the rupture disk area. Also, none of these 13 locations was involved in the subject event. The type of roofing tar used flows at temperatures much higher than cascade coolant component surface temperatures. Therefore, this failure is considered to be a legacy one that occurred at the time, or shortly thereafter, the roof application in the early 1980s. Occurrences of recent drips of tar onto equipment or walkways are considered rare and this problem is not an active concern.

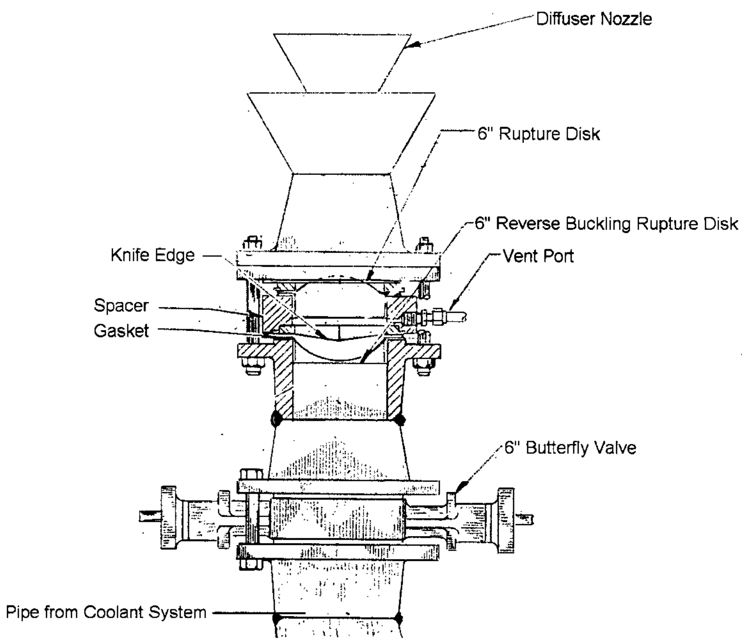
The second failure involves the presence of the thin plastic FME cover. As originally procured, the pipe elbow connecting the relief assembly to the coolant system, flanges, butterfly valve and rupture disks were all obtained as a pre-assembled unit. This unit had FME covers over the pipe inlet, the vent port (used for testing) between the two rupture disks, and the outlet of the rupture disks. The pipe inlet and vent port covers would have necessarily been removed as both of these connections were utilized during installation. However, as originally installed, nothing was connected to the rupture disk outlet, so leaving the FME cover over the disk may have been considered acceptable to prevent debris accumulation or inadvertent contact damage. This position is supported by an interview with one individual familiar with the original installation who stated that the covers on the secondary rupture disk (outlet) were not supposed to be removed so as to protect the disk. However, when the effort to install the diffuser nozzle was performed later, removal of the FME cover was not performed in a consistent manner.

PGDP does not possess the capability to functionally test either a rupture disk with adhered tar or a rupture disk/diffuser nozzle assembly with the included a FME cap. As such, a conservative decision was made that the presence of tar, even in small quantities, across the active face of the rupture disk would cause the system to be declared inoperable. It is likely that small amounts of tar on the rupture disk, which was the case for most reported cells, would not have significantly affected the disk function. Similarly for the plastic FME cap, although conservatively it is considered a nozzle plugging source, the cap would likely be blown through the nozzle in pieces, since the force of the 300 psig nominal coolant vapor is sufficient without the nozzle to damage a built up roof located above this nozzle.

Background:

Diffusion cascade stages use cooling systems to remove the heat of the uranium hexafluoride (UF_6) gas compression. These cooling systems make use of dichlorotetrafluoroethane (CFC-114 or R-114) as a coolant. Rather than a single system serving a large facility, the R-114 system is divided into many smaller systems of a convenient size, each serving a cascade cell (a group of cascade stages) or in some cases two coolant systems per cell. Each individual coolant system is provided with a pressure relief system, which consists of either a single or dual rupture disk system. A typical dual system is depicted below, and represents the style of 6-inch rupture disk assemblies impacted by tar and/or FME caps. This system is designated as important to safety (AQ) so as to limit the pressure increase in an over-heated system to prevent damaging the coolant-to-UF_6 pressure boundary, a condition that might lead to a subsequent UF_6 release to atmosphere. The coolant systems are covered under a Safety Limit (TSR SL 2.4.2.2), and Limiting Control Setting (TSR LCS 2.4.3.4) and Limiting Conditions for Operation (TSR 2.4.3.4 for the impacted systems of this event).

Each coolant pressure relief system also contains a diffuser nozzle. This nozzle was not a part of the original design installed circa 1975, but was added in 1978 to address concerns that actuation of the system would expose the facility roof over the disk outlet port (which discharges upward) to damage. The diffuser nozzle changes the coolant relief spray pattern enough to avoid such damage.



C. Exact Location of Event

Cascade coolant pressure relief systems in C-331, C-333, C-335 and C-337.

D. Description of Isotopes, Quantities, and Chemical and Physical Form of the Material Involved

There was no release of radioactive material related to this event.

E. Causes of the Event

1. Direct Cause of the Event

The direct cause of this event was the presence of foreign material in the coolant pressure relief system rupture disk discharge area so as to: 1) potentially increase the rupture disk burst pressure, and/or 2) potentially obstruct the relief path, thereby increasing the pressure experienced during a relief event.

2. Root Cause of the Event

The root cause for the roofing tar event is a lack of a control at the time of the roof application (~1982) to preclude migration of the tar into sensitive areas. This activity pre-dates present NRC required assessments to consider the impact of this type of maintenance on safety-related systems. Although this is a legacy issue, there is some concern about the length of time this condition has gone undetected. The root cause of the long term undetected discrepancy was lack of periodic inspection/surveillance or configuration controls to detect or prevent obstructions that could otherwise block the relief path external of the secondary rupture disk. System design, configuration, and normal work controls preclude entrance of foreign objects into the pressurized portion of the coolant system that could block the relief path. The formalized TSR surveillance inspection requirements include periodic checks that ensure the rupture disk isolation valves are kept open and that the cavity between the rupture disks remained vented to atmosphere. However, there was no periodic inspection or configuration controls to assure or periodically verify that the top exposed portion of the secondary disk and its relief path to atmosphere remained unobstructed. Such inspection or configuration controls are important to prevent or provide early detection of obstructions that could alter the quality of the rupture disk discharge path.

A modification is planned (planned action no. 2) to place a sacrificial cover over each diffuser nozzle to prevent foreign material entry over time. Although further migration of the existing roofing tar, given its current semi-solid state, is considered of low probability, this protection is considered prudent in light of the relative low tolerance of this system to the presence of even small amounts of this material.

The root cause of the FME cover event was lack of formal controls for inspection of the assembly at the time of installation (considered a legacy item). However, present day system operability assessments for new installation would have been sufficient in scope to have specifically checked the relief path of this TSR system, at least initially.

The presence of the FME cover is a DOE-era oversight not observable from normal access paths. However, it points to the need to evaluate safety related systems more fully to ensure that periodic tests/inspections are in place as needed to keep systems capable of performing their safety function. Although current procedures address inspection of replaced rupture disks to check for proper clarity of the relief path, relatively few assemblies are ever replaced, so some other method is needed to ensure operability on the balance of systems. This will require a system-specific review (planned action no. 1).

F. Corrective Actions Taken

Following discovery of degraded rupture disk assemblies, each was declared inoperable and the actions of TSR LCO 2.4.3.4 entered. By May 2, 2010, maintenance personnel were able to remove all FME caps, and those systems not further impacted by roofing tar were returned to operability. By May 10, 2010, all rupture disks that had been impacted by roofing tar were replaced. No attempt to repair assemblies by cleaning in place was performed.

G. Corrective Actions Planned

1. By August 27, 2010, perform a review of all nuclear safety-related systems located in process facilities for the potential to be made inoperable by dripping roofing tar (whether from new or historical roofing work).

2. By December 31, 2010, implement a plant modification to provide foreign material exclusion covers for the Coolant (R114) Overpressure Protection System to ensure that material that might impact rupture disk operability does not migrate into the outlet piping or nozzle.

H. Results of Any Evaluations or Assessments

None

I. Extent of Exposure of Individuals to Radiation or to Radiation or to Radioactive Material

None

J. Lessons Learned

None

List of Commitments
ER 10-03

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