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GDP 07-1021

United States 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
Event Report ER-07-02

Pursuant to 10 CFR 76.120 (d)(2), enclosed is the final written event report pertaining to the rupture of the C-337 High Pressure Fire Water system C-12 on April 16, 2007. The Nuclear Regulatory Commission was verbally notified on April 16, 2007 at 1036 hours.

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

Sincerely,

Steven R. Penrod
General Manager
Paducah Gaseous Diffusion Plant

SRP:MLB:mjw

Enclosure: As Stated

cc: NRC Region II Office
NRC Resident Inspector-PGDP

United States Enrichment Corporation
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EVENT REPORT
ER-07-02

A. Description of Event

On April 16, 2007, at 1915 hours, a large water leak occurred on the High Pressure Fire Water (HPFW) System. An alarm was received indicating a drop in the level of the HPFW elevated tank. Building personnel were contacted to investigate, and the leak was quickly located inside the C-337 process building. The exact system that was leaking was not apparent as the leak was under the building concrete floor. To ensure isolation of the leak, the HPFW sectional valves outside the C-337 building were closed. Two of the plant's HPFW pumps automatically started, as designed, in response to the drop in system pressure caused by the leak. The other two pumps were disabled prior to automatic start. These actions resulted in the HPFW system for all process buildings being declared inoperable. Applicable Technical Safety Requirement (TSR) Limiting Conditions for Operation (LCO) actions were entered.

During the HPFW isolation process at C-337, the leak was determined to be on C-337 system C-12. This system and the two adjacent systems (C-10 and C-11) were isolated and the previously closed sectional valves were reopened. The HPFW pumps were returned to service, and the elevated tank was refilled to the TSR required level. These actions restored HPFW operability to the other areas in the plant (except C-10, C-11, and C-12) at 2101 hours. The Plant Shift Superintendent (PSS) notified the Nuclear Regulatory Commission (NRC) Headquarters Operations Office as required by 10 CFR 76.120(c)(2) at 1036 hours CDT on April 16, 2007. NRC notification number 43305 was assigned.

B. Description of Equipment Failure

The C-12 system is one of 66 wet pipe sprinkler systems in the C-337 process building. All process building sprinkler systems were installed in 1958, several years after construction of the buildings in the early 1950s. The 8-inch cast iron pipe supplying water to system C-12 failed due to a crack that initiated at the mechanical joint flange just below the concrete floor. As the crack propagated, a section of the pipe wall blew out, causing the release of approximately 600,000 gallons of water. The hydraulic pressure from this water raised the concrete floor in the vicinity of the C-12 piping approximately 8 inches. Adjacent systems C-10 and C-11 penetrate the same concrete slab and while the slab deformation near this piping was significantly less than 8 inches, their integrity was also suspect. Therefore, the concrete around all 3 piping systems was removed to allow excavation, inspection, and repair as necessary.

Plant engineers and the plant metallurgist were present in the field for the key stages of excavation and removal. The affected sections of pipe were removed and delivered to the plant's laboratory for metallurgical analysis.

C. Exact Location of Event

C-337 system C-12 at column B-35 just under the ground floor.

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

There was no radioactive material involved in this event. However due to possible spread of low-level contamination from water leakage onto potentially contaminated materials, cleanup activities were immediately begun. The wastewater was verified to be non-contaminated prior to release in accordance with plant procedures.

E. Causes of the Event

1. Direct Cause of the Event

   Rupture of the HPFW system supply line rendered the C-337 C-12 system incapable of performing its intended safety function.

2. Root Cause of the Event

   The root cause was determined to be improper installation (during original HPFW construction in 1958) of the C-12 cast iron piping. The gland sealed mechanical joint just below the concrete floor was misaligned beyond the maximum allowed by design, preventing adequate crush to the gasket, and allowing slow HPFW (approximately 130 psig system) leakage past the rubber seal. This eventually compromised the integrity of the joint and both carbon steel restraining rods holding the joint together (one shown in Figure 1 on page 4). The restraining rods failed and a crack, initiated at the joint, propagated into the 8-inch pipe that ruptured.

   Further excavation revealed that misalignment of the failed mechanical joint was itself caused by misalignment of the next upstream mechanical joint, a 90 degree elbow fixed in a concrete thrust block. When the concrete thrust block was poured during initial installation, the 90 degree elbow was slightly tipped. This caused the pipe between the elbow and the failed mechanical joint to be approximately 7 degrees off vertical.

   Figure 2 demonstrates the severe bend that must have existed at the failed joint before the rupture. This picture was taken after reassembly of the system with the elbow still tipped and before repairing the elbow. After this picture was taken, the elbow and riser section was replaced. Figure 3 shows the recast elbow and repaired joint.

3. Contributing Causes of the Event

   None.

F. Corrective Actions Taken

1. By May 2, 2007, all other HPFW systems were inspected for hanger integrity, standing water (and source), and pipe restraint rod condition. Corrective actions were completed where needed.

2. By May 4, 2007, the four systems that were discovered with restraint rods severed were repaired. All four systems were declared inoperable until repairs to the restraint rods were made.

3. On May 11, 2007, the C-10, C-11, and C-12 systems were returned to service. The systems were repaired and tested prior to operability.

G. Corrective Actions Planned

None.

H. Results of Any Evaluations or Assessments

None.

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

There was no radioactive material released and no exposures to individuals.

J. Lessons Learned

None.

Figure 1

Figure 1 – Restraint rod failure and degradation of the piping at the joint caused by leaking joint.

Figure 2

Figure 2 – C-12 - Original elbow in place and piping reconstructed, showing misalignment.

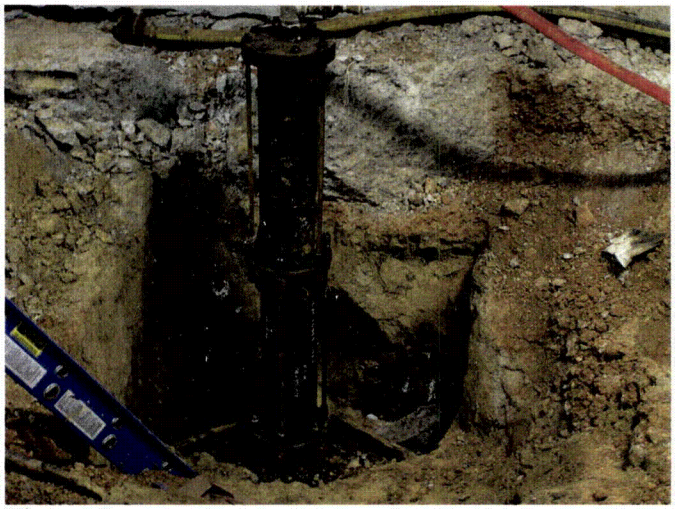

Figure 3.

Figure 3 – C-12 – Following elbow replacement and total reconstruction (final repair). The restraint rods are the threaded rods between the mechanical joint flanges.

List of Commitments
ER-07-02

No commitments have been made in this report.