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GDP 06-1045

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-06-05

Pursuant to 10 CFR 76.120 (d)(2)(i), enclosed is the final written event report pertaining to the failure of a C-333, Unit 6, Cell 3, Process Gas Leak Detector (PGLD) system on November 7, 2006. The Nuclear Regulatory Commission (NRC) was verbally notified on November 8, 2006, at 0956 hours. NRC assigned notification number 42973 to the event.

Any questions regarding this event report should be directed to Steve Cowne at (270) 441-6796.

Sincerely,

Mark Kuhlbar

Steven R. Penrod
General Manager
Paducah Gaseous Diffusion Plant

SRP:MLB:mjw

Enclosure: As Stated

cc: NRC Region II Office
NRC Resident Inspector, PGDP

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EVENT REPORT
ER-06-05

A. Description of Event

At 1607 on November 7, 2006, the C-333, Unit 6, Cell 3, Process Gas Leak Detection (PGLD) system failed. The C-333 operators were alerted to the Unit 6, Cell 3, PGLD failure by the receipt of an Area Control Room (ACR) alarm. The operators responded to the Unit 6, Cell 3, cell panel and discovered the Ready and Manual lights were extinguished indicating a loss of the 200-volt DC supply voltage to the PGLD detector heads. C-333, Unit 6, Cell 3, and associated piping were operating above atmospheric pressure (Cascade Mode 2) at the time of the PGLD failure. The Plant Shift Superintendent (PSS) was notified of the failure and declared the system inoperable. Facility operators initiated a continuous smoke watch of the affected area until the associated cascade equipment and piping pressure was reduced below atmospheric pressure in accordance with Technical Safety Requirement (TSR) LCO 2.4.4.1. The PGLD system is required per TSR 2.4.4.1 to be operable when a cascade cell and associated piping is above atmospheric pressure (Cascade Mode 2).

On November 8, 2006, at 0956 CST, the Nuclear Regulatory Commission (NRC) Headquarters Operations Office was notified of the event in accordance with 10 CFR 76.120(c)(2) (NRC No. 42973).

B. Description of Equipment Failure

The C-333, Unit 6, Cell 3, PGLD system consists of a signal conditioner rack in a ground floor cell panel which houses a 200-volt DC power supply/signal conditioner module, 1 control logic module circuit card and 5 detector head signal channel cards. Each detector head signal channel card can monitor up to 5 heads which provides up to 25 detector head points per signal conditioner rack. The C-333, Unit 6, Cell 3, PGLD system has 16 active detector head channels. A loss of power relay monitors the 200-volt DC and provides alarm indication in the ACR upon a loss of power. The signal conditioner rack is connected to the individual smoke detectors on the cell floor via wires in conduit and hard-wired detector head bases. The PGLD heads plug into the bases.

At 1607 on November 7, 2006, the C-333, Unit 6, Cell 3, PGLD system failed causing the Ready and Manual lights to extinguish. Prior to this failure, facility operators had occasionally noticed the local PGLD lights flickering intermittently after the test fire button was released following a satisfactory system test. During troubleshooting, as a part of the event investigation, an intermittent short to ground in the system was observed. When this short to ground occurs, the load on 200-volt DC supply causes the Ready and Manual lights on the signal conditioner to extinguish and the loss of power relay to activate the Unit 6, Cell 3, PGLD alarm in the ACR.

Troubleshooting continued on Unit 6, Cell 3, from November 7, 2006 through November 11, 2006. During the troubleshooting evolution, the intermittent nature of the problem was observed. A distinct repeatable oscilloscope trace was identified which showed an increased current load occurring in turn causing the system voltage to drop out. The wiring was tested with a 1,000-volt megger test and found to be acceptable. All bases and heads were replaced. The system performed as required after this work and testing with the oscilloscope verified that the previously identified oscilloscope trace was gone. The removed bases and their components (capacitor and diode) were checked and were found to be acceptable. Since the wiring was disconnected and reconnected during the wire testing and all bases and heads were replaced, the conclusion is either there was a physical short in a wire connection that was corrected as a result of removing, testing, and reconnecting wiring, or one of the removed heads was experiencing an intermittent failure causing the short.

C. Exact Location of Event

C-333, Unit 6, Cell 3, Cell Panel PGLD System.

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

None.

E. Causes of the Event

1. Direct Cause of the Event

   The direct cause of this event was the loss of the 200-volt DC voltage to the smoke detector heads due to a short circuit to ground of a detector base/wiring or head. In this condition, the power supply is not able to maintain the 200-volt DC required to fire the heads.

2. Root Cause of the Event

   The root cause for this event was insufficient troubleshooting techniques to identify the true cause of the intermittent condition observed by Operators. Prior to the failure of the system, C-333, Unit 6, Cell 3 had been subjected to repeated troubleshooting activities and work packages without fixing the intermittent ground.

F. Corrective Actions Taken

1. On November 9, 2006 through 11, 2006, extensive troubleshooting/repair activities were conducted involving Instrument Maintenance, Electrical Maintenance, and Engineering. This work resulted in some improved troubleshooting approaches such as use of a storage oscilloscope to capture transient conditions, lengthened test firing periods during troubleshooting, and use of a 1,000-volt megger test for wiring. These approaches, although not necessary in every troubleshooting scenario, offer additional tools for better assessment and troubleshooting for the more difficult intermittent problems.

3. On November 28, 2006, a database of past PGLD work orders was developed to aid in tracking/review for possible intermittent problems.

4. On December 15, 2006, load testing of all power supplies in plant stores was completed as an improvement beyond their current Safety System Inspection Plan requirements. Engineering Specification Data Sheet ESDS DS-CIE-16289-483 now includes the load test requirement for acceptance.

5. On November 11, 2006 through December 14, 2006, other cells in C-333 (Unit 5, Cell 1; Unit 3, Cell 1; and Unit 2, Cell 8) were pro-actively made inoperable and turned over for maintenance troubleshooting based on any appearance of possible intermittent issues. Using the improved troubleshooting techniques, similar issues were identified in these cells and corrected.

G. Corrective Actions Planned

1. By January 19, 2007, Engineering will develop guidance for Operations to better assess possible PGLD issues based on cell panel light indications ("flickering" lights).

2. By February 19, 2007, Engineering will provide to Maintenance guidance on improved troubleshooting techniques and improved Hold for Evaluation process.

3. By March 15, 2007, Operations will be briefed on the need to provide detail in work requests and communicate the guidance for "flickering" lights.

4. By March 15, 2007, Maintenance will revise appropriate Generic Work Packages to implement the improved troubleshooting techniques and improved Hold for Evaluation process.

5. By March 15, 2007, Maintenance will communicate lessons learned on troubleshooting techniques and need for detail in maintenance work package task history.

6. By March 15, 2007, Operations will revise appropriate procedures to flowdown "flickering" lights information as provided by Engineering.

H. Results of Any Evaluations or Assessments

None.

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

None.

J. Lessons Learned

1. This work resulted in some improved troubleshooting approaches such as use of a storage oscilloscope to capture transient conditions, lengthened test firing periods during troubleshooting, and use of a 1,000-volt megger test for wiring. These approaches, although not necessary in every troubleshooting scenario, offer additional tools for better assessment and troubleshooting for the more difficult intermittent problems.

2. Operator input regarding "flickering" lights revealed an opportunity for improved guidance for Operations to better assess possible PGLD issues based on cell panel light indications ("flickering" lights).

3. Detailed task history on work packages is always important; however, of particular importance when troubleshooting these difficult intermittent problems. Work package history was identified as needing improvement on several work packages.

List of Commitments

1. By February 19, 2007, Engineering will provide to Maintenance guidance on improved troubleshooting techniques and improved Hold for Evaluation process.

2. By March 15, 2007, Maintenance will revise appropriate General Work Packages to implement the improved troubleshooting techniques and improved Hold for Evaluation process.

3. By March 15, 2007, Maintenance will communicate lessons learned on troubleshooting techniques and need for detail in maintenance work package task history.