



March 28, 2008
GDP 08-1005

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-07-09

Pursuant to 10 CFR 76.120 (d)(2), enclosed is the final event report involving the failure of the C-333 Unit 6 Cell 7 Process Gas Leak Detector (PGLD) discovered during routine testing November 20, 2007. The Nuclear Regulatory Commission (NRC) was verbally notified on November 21, 2007 at 1642 CST. NRC assigned No. 43801 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
General Manager
Paducah Gaseous Diffusion Plant

SRP:MLB:mjw

Enclosure: As Stated

cc: NRC Region II
NRC Resident Inspector – PGDP

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File: 08-890-007

EVENT REPORT
ER-07-09

A. Description of Event

At 2028 CST on November 20, 2007, the Plant Shift Superintendent (PSS) was notified that the C-333 Unit 6 Cell 7 Process Gas Leak Detector (PGLD) system failed to function during the twice per 12-hour shift test firing required by TSR SR 2.4.4.1-1. This PGLD system covers C-333 Unit 6 Cell 7 and Sections 3 and 4 of the cell bypass piping. At the time of this failure, Unit 6 Cell 7 and some areas of Sections 3 and 4 of the cell bypass were operating above atmospheric pressure (TSR mode 2). TSR 2.4.4.1 requires that at least the minimum number of detector heads in the cell and in each defined section of the cell bypass to be operable in TSR mode 2. With the Unit 6 Cell 7 PGLD system failure, none of the required cell heads and only 2 of the required 3 heads in Section 3 and Section 4 of the cell bypass were functional. After being notified, PSS declared the PGLD system inoperable, and a continuous smoke watch was put in place in the affected areas as required by the LCO actions of TSRs 2.4.4.1.B.1 and 2.4.4.1.C.1.

The system had functioned as designed in response to test firing approximately six hours earlier at 1430 hours on November 20, 2007.

Even though failures that occur during testing are not normally required to be reported, the failure may have occurred prior to the 2028 CST test. The event was therefore conservatively reported in accordance with 10 CFR 76.120(c)(2)(i).

At 1642 CST on November 21, 2007, PSS notified the Nuclear Regulatory Commission (NRC) and NRC No. 43801 was assigned to the notification.

Background:

Following the PGLD system failure on November 20, 2007, troubleshooting revealed that the system would not test fire even though the "ready" and "manual" lights were illuminated. These symptoms suggest that the Test Fire Voltage, which is developed in the Control Circuit Module, was not present. Suspecting a bad Control Circuit Module, it was then replaced; however, the system again would not test fire. The original Control Circuit Module was reinstalled, and troubleshooting efforts were redirected to the 200-volt DC detector head power supply. Voltage checks on this power supply confirmed adequate output DC voltage from the PGLD signal conditioner, but found no DC voltage on the panel terminal strip which connects the control panel on the ground floor to the cell floor PGLD heads. The wire that connects the PGLD signal conditioner to the panel terminal strip is approximately four feet long. After checking both ends of this wire for tightness, the signal conditioner end was lifted from its terminal, checked for continuity, and re-landed with no noted problems. However, when power supply voltages were rechecked, the 200-volt DC power signal was now present at both ends of the wire. The

PGLD system was tested successfully and, believing that the cause of the original failure to test fire had been corrected by re-landing the signal conditioner connection, PSS declared the PGLD system operable at 0232 on November 21, 2007.

Later that day, Engineering personnel reviewed the troubleshooting efforts described above and determined that while the symptoms described above could be the result of a bad connection at the signal conditioner terminal, the act of reconnecting this terminal could have applied a force to the circuit card in the signal conditioner producing the same symptoms. To eliminate this possibility, the system was declared inoperable and a smoke watch put in place in accordance with the TSR LCO.

As the first step in the troubleshooting process, the system was test fired. The test fire was successful. Engineering and Instrument Maintenance personnel performed checks of the test circuit and the power supply voltages. No problems were noted. All physical connections in the signal conditioner power supply area were subjected to visual inspection and ohmmeter checks with nothing abnormal noted. A decision was made to replace the Control Circuit Module; replace the Power Supply Module; fully remove, inspect, and reseal all cards in the signal conditioner rack; and fully check every screw terminal on the back of the signal conditioner rack. Every card was removed and each card edge connector and its associated solder joints were visually inspected. All screw terminals on the back of the signal conditioner were checked for tightness. No problems were noted. The Control Circuit Module and Power Supply Module were replaced and firmly seated in their connections. The PGLD system was tested and operated as designed.

As a precautionary measure, the system was maintained inoperable while the heads were test fired once an hour from 1500 on November 21, 2007 until 0800 on November 22, 2007. During this time, the system operated as designed with no problems noted. The system was declared operable and returned to normal service at 0900 on November 22, 2007.

On January 13, 2008, while preparing to submit the written report for Notification 43801, the C-333 Unit 6 Cell 7 PGLD system again failed to test fire during routine testing. Actions were taken to reduce the operating pressure in the affected area, and the PGLD system was declared inoperable. Given the similarities to the November 20, 2007 event, this test failure was reported to NRC in accordance with 10 CFR 76.120(c)(2)(i). NRC notification No. 43903 was assigned. As was the case on November 20, 2007, initial troubleshooting indicated that the 200-volt DC signal was interrupted between the output of the signal conductor and the panel terminal strip. Being unable to identify the failure mechanism, a preliminary report for Notification 43801 was submitted to NRC on January 18, 2008 to allow additional time to conduct additional analysis of the two subject events.

Subsequent to the January 13, 2008 event mentioned above, a more detailed review of the pressures in C-333 Unit 6 Cell 7, Section 3 in the cell by-pass area was performed. In accordance with Engineering Notice EN-C-821-05-090, Rev. 3, it was determined that Section 3 of the cell by-pass was actually not operating above atmosphere and thus, the PGLD system was not required to be operable at the time of the failure. Since the failure only affected detectors in an area operating in a non-TSR mode, the PGLD system is not required to be operable and reporting under 10 CFR 76.120(c)(2) is not required. On January 18, 2008, the notification (NRC No. 43903) was retracted. However, an extensive investigation to determine the failure mode was conducted.

B. Description of Equipment Failure

The original failure reported to the NRC on November 21, 2007 was attributed to a loose wire/terminal connection in the single wire circuit from the PGLD signal condition unit to the buffer panel terminal strip. The loose screw termination/connection was thought to be causing an intermittent loss of the 200-volt DC power to the C-333 Unit 6 Cell 7 PGLD system. The loose connection was corrected on November 20, 2007 during the troubleshooting/repair activity which checked and tightened all screw connections at the power supply/signal conditioner. The system was successfully tested and returned to service on November 22, 2007 and no problems were reported until the testing failure on January 13, 2008. Between the November 22, 2007 initial event and the January 13, 2008 event the subject PGLD system was successfully tested over 200 times.

Following the January 13, 2008 test failure, all wire terminations were again checked for tightness with no loose connections noted. Additionally, the single wire and terminals were replaced and subjected to destructive examination in the plant's laboratory. The inspection revealed that many of the individual wire strands were broken at the point where they entered the wire terminal. Based on the visible oxidation on the wire ends, some wire strands appeared to have been broken for some period of time but some of the strand breaks appeared to be recent. This failure was not apparent until destructive testing in the laboratory. It is Engineering's judgment that this degraded wire condition caused the testing failure on January 13, 2008 and may have contributed to the November failure. After the single wire was replaced, the system has been tested twice per shift with no indications of a problem.

C. Exact Location of the Event

C-333 Unit 6 Cell 7.

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

There was no radioactive material released or involved in this event.

E. Causes of the Event

1. Direct Cause of the Event

The event occurred when the PGLD system failed to respond as expected to scheduled routine twice per shift testing.

2. Root Cause (s) of the Event

The initial test failure was caused by an intermittent loss of electrical continuity due to a degraded wire connection. Subsequent laboratory testing also indicated the wire which carries power from the PGLD power supply to the detector head terminal block became degraded over time such that power was intermittently interrupted. In this case, the system failed two tests almost 60 days apart with no problems between failures. As stated above, the system passed over 200 tests between failures.

3. Contributing Cause of the Event

None identified.

F. Corrective Actions Taken

Instrument Maintenance personnel repaired the system by replacing the degraded wire and connection for the 200-volt DC supply to the smoke detector heads. The system was tested and performed as required.

Engineering and Maintenance personnel performed extensive investigation into all connections associated with the signal conditioner rack including circuit card edge connections and all terminal strip connections with no connection problems identified.

Following the maintenance activities the system was tested and returned to service.

G. Corrective Actions Planned

No further corrective actions are planned.

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 release or involved in this event.

J. Lessons Learned

None.

LIST OF COMMITMENTS
EVENT REPORT-07-09

There are no commitments contained in this event report.