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April 3, 1997

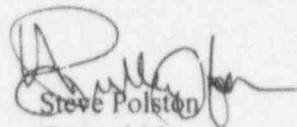
United States Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, DC 20555-001

Paducah Gaseous Diffusion Plant (PGDP) - Docket No. 70-7001 - Event Report ER-97-003

Pursuant to the PGDP Safety Analysis Report (SAR) 6.9 Table 1, J.2, Enclosure 1 is the required 30-day Event Report 97-003. This event involves the automatic actuation of the autoclave water inventory control system (WICS) at C-333-A on March 5, 1997. The Nuclear Regulatory Commission (NRC) was verbally notified of the event on March 5, 1997. Enclosure 2 is a list of commitments made in the report.

Should you require further information on this subject, please contact Bill Sykes at (502) 441-6796.

Sincerely,



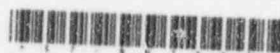
Steve Polston
General Manager
Paducah Gaseous Diffusion Plant

SP:WES:mcl

Enclosures (2)

cc: NRC Region III
NRC Senior Resident Inspector, PGDP

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United States Nuclear Regulatory Commission
Page Two
April 3, 1997

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File: 97-890-119

Docket No. 70-7001

Enclosure 2

Page 1 of 1

Event Report 97-03

The following commitments have been made in this Event Report:

- 001 By 4-18-97, an inspection of all C-333-A and C-337-A autoclave TE-523 thermocouple assemblies will be completed to determine if other deficiencies exist and repairs affected as necessary.
- 002 By 4-11-97, Maintenance will conduct crew briefings on this event with qualified IM personnel who may be subject to working in the feed facilities.
- 003 By 6-20-97, appropriate Conduct of Maintenance procedures will be revised to ensure that adequate guidance for maintaining equipment design integrity is incorporated.
- 004 By 4-30-97, Maintenance will conduct crew briefings on Configuration Management Program Requirements as described in UE2-TO-CF-1032.
- 005 By 4-15-97, Maintenance personnel will complete Conduct of Maintenance training, including training on the Stop/Think/Act/Review/ (STAR) methodology and the questioning attitude thought process.
- 006 By 7-24-97, the autoclave TE-523 temperature thermocouple protective covers will be replaced where necessary.
- 007 By 4-30-97, Operations will conduct crew briefings with available feed facilities operators on management's expectations relative to operators need to be aware of all equipment indications.

EVENT REPORT
ER-97-03

BACKGROUND

The autoclave water inventory control system (WICS) provides the means to limit the water inside an autoclave such that upon a UF₆ release from a feed cylinder, over pressurization of the autoclave or a nuclear criticality cannot occur. This is accomplished by two electrically powered sonic probes (primary condensate probes) located slightly below the autoclave in the 3-inch drain line. The probes actuate upon the presence of excessive condensate in the autoclave and send a signal through electrical interlocks to remove power from the solenoid valves which removes air from the steam isolation valve and the vent valve. These valves are air powered and fail closed upon loss of air (thus fail closed). The system function is to isolate the sources of steam and condensate upon detecting a level of water accumulating in the condensate drain line. A secondary condensate probe (which is not a part of WICS), located lower in the condensate drain line provides an alarm and opens a steam trap bypass valve before the condensate level reaches the primary probes. The WICS is designed as an "Q" safety system and required to be operable by TSR 2.2.4 when in Mode 5 (heating).

DESCRIPTION OF EVENT

On 3-5-97 at approximately 1030 hours, C-333-A feed vaporizer facility operators initiated the heating (TSR Mode 5) of a feed cylinder in the 1 North autoclave position. Approximately 10 to 15 minutes prior to placing the autoclave into Mode 5, the 1 North process temperature recorder (TR-523-1N) in the operation monitoring room (OMR) indicated an open circuit by going off scale for about 10 minutes (no visual or audible alarms are initiated from this indication); however, at the precise time the autoclave was placed into Mode 5, the T-523 temperature loop was performing correctly as indicated on TIC-523-1N. Facility operators failed to note this off scale TR-523-1N indication prior to entering Mode 5.

Approximately 45 to 50 minutes into the heat cycle, the electrical open circuit occurred again. The T-523 temperature/pressure control loop immediately responded to the perceived high autoclave temperature by closing steam control valve TCV-523-1N. The closing of TCV-523-1N steam control valve stopped the steam supply to the autoclave. At the time of the steam supply shutdown, the cylinder pressure was at its triple point (approximately 22 psia). The demand for steam at the cylinder triple point is at its highest. The autoclave pressure immediately decreased from 3.0 psig to less than 0.25 psig due to the high rate of steam

condensing in the autoclave. This sudden loss of autoclave pressure removed a necessary motive force to expel the condensate produced in the autoclave. Subsequently, water accumulated in the drain line causing a secondary condensate alarm. Before facility operators could react to these alarms, the WICS actuated as designed at 1159 hours. This automatically closed the steam inlet block valves and the vent line block valve to place the autoclave in a safe status. All systems performed their intended function as designed.

This automatic actuation of this "Q" safety system was reported to the NRC-HQ Operation Office at 1620 hours on 3-5-97 per SAR 6.9 Table 1, Criteria J.2 as a 24-hour report.

In reaction to the safety system actuation, facility operators completed the actions described in the C-333-A Alarm Response Procedure (ARP) CP4-CO-AR8333A-6 and notified the Plant Shift Superintendent (PSS) of the actuation. After successful completion of the ARP actions, the operators entered procedure CP4-CO-ON3038, "C-333-A/C-337-A Interrupted Heat Cycle," and completed required steps to place the autoclave in Mode 2 (autoclave open). Instrument Maintenance (IM) was contacted to inspect the T-523 autoclave temperature/pressure control loop instrumentation. IM found corrosion buildup on the thermocouple extension wire at the TE-523-1N head. The corroded section of wire was removed and the wire reterminated. This wire is located inside the heated housing at autoclave position 1N which is a relatively harsh environment (170° to 210° F.). The thermocouple extension wire is rated at 221°F. The wire and terminal connector meet manufacturer specifications.

The corroded extension wire is run in conduit to the thermocouple terminals. These terminals are protected from the elements by a screwed over plate. Inspection of this component revealed that the protective cover was not in place. This allowed moisture from occasional fin heater leaks to enter the thermocouple housing causing the corrosion of the extension wire.

The temperature element/thermowell (TE-523-1N/TW-523-1N) involved in this event has an internal type thermocouple and termination point. The thermowell is manufactured by Weed Instrument, Model 2D50AO-T2E25OU (15.5) A-1/2" 5260-410-1/2. Its operational function is to provide an internal autoclave temperature signal to temperature transmitter (TT-523-1N) in the T-523 temperature/pressure control loop. The transmitter (TT-523-1N) is an acromag 772-T temperature transmitter with a range of 0°-300°F. The T-523 control loop does not provide a direct safety function. TW-523-1N (thermowell) is listed as part of the autoclave containment boundary in the C-333-A Boundary Definition Manual (BDM) KY/G-567-001. The specific boundary function is the pressure retention attributes of the thermowell itself. This boundary function was not affected by the failure. Currently, only the thermowell (TW-523-1N) is considered a "Q" component. Temperature transmitter (TT-523-1N) and other components

associated with the temperature control instrumentation are designated as non-safety. Thus, calibration, maintenance or trouble shooting activities do not require approved work packages.

A similar open circuit condition related to TE-523-1N was witnessed by the responsible system engineer and IM personnel approximately 60 days prior to this event. The cause was identified as a loose termination at the thermowell screw terminals. This condition was repaired and no subsequent problem had been observed prior to the subject event.

At 1307 hours on 3-5-97, the PSS approved the resumption of normal operations and autoclave was returned to service. No similar problems have occurred.

DIRECT CAUSE

The WICS actuation was caused by an open circuit which occurred at the autoclave temperature transmitter thermocouple extension wire termination due to corrosion. This open circuit caused the temperature recorder to go off-scale indicating the maximum reading above 300°F. The T-523 temperature/pressure control loop responded to this perceived high temperature by closing steam control valve TCV-523-1N. This caused the autoclave pressure to immediately drop from 3.0 psig to less than 0.25 psig. This sudden loss of pressure removed the motive force needed to expel the condensate from the autoclave. Subsequently, this condensate accumulated in the drain line causing the secondary condensate alarm and primary WICS actuation.

CONTRIBUTING CAUSES

The failure of the C-333-A facility operators to notice the off-scale indication on the OMR autoclave temperature/pressure chart recorder prior to placing the autoclave in Mode 5 (heating) is a contributor to the actuation. Had the operators noted this abnormal indication and taken action to have it repaired, the actuation would not have occurred. This inattention to detail and conduct of operations issue will be addressed by crew briefings as directed by planned Action 007.

ROOT CAUSE

The WICS actuation occurred from a failure to maintain the design integrity of the temperature thermocouple at some point in the past. This was caused by a failure to effectively communicate management's concerns for quality workmanship. This legacy Conduct of Maintenance issue is being addressed by Training Maintenance personnel on the concepts of configuration management. Additionally, Conduct of Maintenance training is on-going which emphasizes

management's expectations relative to quality of workmanship. This root cause will be addressed completion of Planned Actions 002, 003, 004, and 005.

CORRECTIVE ACTIONS TAKEN

1. A formal inspection of all C-333-A/C-337-A autoclave thermocouple assemblies is being completed to determine if other deficiencies exist.

CORRECTIVE ACTIONS PLANNED

- 001 By 4-18-97, an inspection of all C-333-A and C-337-A autoclave TE-523 thermocouple assemblies will be completed to determine if other deficiencies exist and repairs affected as necessary.
- 002 By 4-11-97, Maintenance will conduct crew briefings on this event with qualified IM personnel who may be subject to working in the feed facilities.
- 003 By 6-20-97, appropriate Conduct of Maintenance procedures will be revised to ensure that adequate guidance for maintaining equipment design integrity is incorporated.
- 004 By 4-30-97, Maintenance will conduct crew briefings on Configuration Management Program Requirements as described in UE2-TO-CF-1032.
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Docket No. 70-7001

Enclosure 1

Page 5 of 5

EXTENT OF EXPOSURE OF INDIVIDUALS TO RADIATION OR TO RADIOACTIVE MATERIALS

No release of radioactive material occurred during this event and facility personnel were not exposed to abnormal levels of radiation.

LESSONS LEARNED FROM THE EVENT

Maintaining the design integrity of process instrumentation and equipment is critical to avoiding process upsets.

SIMILAR EVENTS

In the past, numerous WICS actuations have occurred. Corrective action has reduced this trend. There have not been any previous WICS actuations attributed to a failure of temperature control instrumentation. The WICS has always performed as designed to place the system in a safe condition.