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June 11, 1997

GDP 97-2008

United States Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, DC 20555-0001

Portsmouth Gaseous Diffusion Plant (PORTS) - Docket No. 70-7002 - Event Report 97-03 Revision 1

Pursuant to Safety Analysis Report (SAR), Section 6.9, Table 6.9-1, J(2), Enclosure 1 provides Event Report 97-03, Revision 1, for an event involving a high condensate level shutoff actuation at the Portsmouth Gaseous Diffusion Plant. The revised event report is being submitted regarding the root cause and corrective actions for this event. Changes from the previous revision are marked with a vertical line. Enclosure 2 is a list of commitments made in the report.

Should you require additional information regarding this event, please contact Scott Scholl at (614) 897-2373.

Sincerely,

Dale Allen

Dale Allen
General Manager
Portsmouth Gaseous Diffusion Plant

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Enclosure

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Description of Event

On April 3, 1997, at 1750 hours, Autoclave (AC) #2 in the X-342 was in Mode II heating a 48 inch Uranium Hexafluoride (UF_6) cylinder when the audible alarm for steam shutdown was received. Operators located at the AC #2 control panel observed that both the "A" and "B" condensate level probe lights were on, indicating the high condensate level shutoff (HCLS) safety system had actuated. Steam supply block valve FV-1613 was verified to be in the closed position, stopping steam flow to the autoclave as designed. This actuation occurred approximately one hour and twenty five minutes into the heating cycle. A HCLS actuation is reportable in accordance with the Safety Analysis Report (SAR) Table 6.9-1, J (2).

Prior to the initiation of this heating cycle, AC #2 had been shutdown as a result of an HCLS actuation that occurred on March 25, 1997. The direct cause of this previous HCLS actuation was determined to be a low pressure condition in the roll motor buffer air pressure system. At the time of the April 3, 1997, HCLS actuation, operators noted that the buffer air light was on before and after the actuation occurred. This indicated that buffer air pressure was adequate and was not the cause of this event.

The condensate level shutoff system is provided to prevent over-pressurization or a nuclear criticality in an autoclave following a postulated UF_6 release. Excess water is undesirable in the event of a UF_6 release from the cylinder that could cause either high Hydrogen Fluoride pressure as the result of the reaction between UF_6 and water or the excessive moderation of an unsafe mass of uranium thereby causing a criticality within the autoclave. The system function is to detect either a drain line plug or restriction and to shutoff the steam flow to the autoclave.

Cause of Event

The direct cause of the HCLS actuation was a failed steam trap which prevented condensate from draining from the autoclave. Condensate subsequently accumulated in the drain line causing the condensate level probes to actuate. The failed steam trap was an Armstrong Steam Trap Model No. 814T, inverted bucket type trap.

Following the HCLS actuation the condensate drain was inspected and no debris or restrictions were found.

Maintenance disassembled the steam trap for inspection and found the steam trap bucket had fallen off its hook. The bucket hook attaches to a lever assembly that opens and closes the steam

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trap discharge valve. The mechanical steam trap operates on the difference in density between steam and water. Steam entering the inverted and submerged bucket causes the bucket to float, which removes the weight off of the lever assembly and closes the discharge valve. Condensate entering the steam trap changes the bucket to a weight, which pulls the lever assembly down and opens the discharge valve. The lever assembly and the bucket are the only two moving parts in the steam trap.

Engineering personnel familiar with the autoclave operating history indicated that a similar steam trap failure was experienced by AC #2 on September 9, 1996. At that time AC #2 was being returned to service following maintenance on the steam trap. The autoclave had been operating for approximately 15 minutes when an HCLS actuation occurred. The cause of the actuation was determined to be incorrect steam trap assembly that resulted in the bucket not being connected to the lever assembly.

As a result of the September 9, 1996, incident, additional post maintenance testing to verify proper steam trap operation was implemented. This testing required operating an empty autoclave for approximately 30 minutes to ensure the steam trap cycles properly to expel condensate. This testing was performed successfully on the AC #2 steam trap just prior to the April 3, 1997, HCLS actuation. Since the autoclave operated for approximately one hour and twenty-five minutes before the actuation occurred, it is believed that the steam trap was initially functioning correctly.

Several potential root causes for the steam trap failure were reviewed. An engineering analysis to determine the steam trap failure mechanism included evaluation of the steam trap assembly methods, post maintenance testing and steam trap design. A summary of the results of the evaluation is presented below.

Steam trap assembly is performed as skill of the craft without requiring a procedure or checklist. The maintenance work package for steam trap inspection and the vendor information that is included in the package lack detail regarding assembly. Although an experienced mechanic assembled the steam trap in the presence of his front line manager, the lack of guidance regarding trap assembly could have contributed to assembly errors. It is not known for certain if an assembly error occurred. However, the autoclave had been heating for approximately 85 minutes prior to the HCLS actuation, which would indicate that the trap was initially working correctly.

The post maintenance testing (PMT) required after steam trap maintenance is a functional test of the autoclave condensate system. The autoclave is closed and locked and the steam is turned on.

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The PMT requires Operations personnel to ensure the trap operates properly. Often a trap can be heard to cycle open and close. If the trap cannot be heard, a sufficient length of time in operation without activating the level probes is sufficient to ensure proper operation. This was the case with this trap. A weakness with the current PMT was that it did not require verification that the condensate line temperature control valve (TCV) was closed. The TCV allows condensate to bypass the trap until the condensate reaches approximately 200°F. Unless the TCV is verified to be closed prior to performing the test, there is no assurance that the trap has been functioning properly.

Bench testing of the failed steam trap components showed no discrepancies in a comparison between a new trap and the failed trap. Also no significant defects or wear on the hanger mechanism were noted that could explain why it disengaged during operation. The distributor for the Armstrong steam trap was contacted and no failure mechanisms were identified consistent with autoclave operating conditions.

Attempts to reproduce the steam trap failure mode were also performed. With the trap assembled correctly, the trap was agitated, tipped upside-down and shaken around vigorously in an attempt to purposely dislodge the bucket from the hanger. The bucket did not dislodge from the lever assembly during this activity. The assembled trap was allowed to strike the concrete floor several times, to simulate what might happen if the trap were dropped during installation. Again, the bucket would not come off the lever assembly. The trap was then assembled incorrectly with the bucket installed backwards on the lever assembly. When the testing was performed again, the bucket did dislodge from the lever assembly. While this experiment with the bucket installed incorrectly does prove that the bucket can become dislodged from the lever assembly under rough handling conditions, it does not conclusively prove this was the cause for this event.

Although the exact root cause was not determined, corrective actions to address the potential root causes of this event were developed. The actions include development of a trap assembly procedure or work instructions and improvement to the post maintenance testing practices and replacement of the trap.

Following replacement of the steam trap on April 10, 1997, AC #2 was returned to service. The autoclave has operated successfully without experiencing additional condensate level problems.

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Corrective Actions

1. The steam trap on AC #2 in X-342 was replaced with a new trap on April 10, 1997.

2. On June 10, 1997, PMT for autoclave steam traps was modified requiring verification of TCV closure and a longer run time.

3. By August 8, 1997, Engineering will develop and provide work instructions for proper steam trap assembly to Work Control for inclusion in Maintenance Work Packages.

Extent of Exposure of Individuals to Radiation or Radioactive Materials

There were no exposures of individuals to radiation or radioactive materials from this incident.

Lessons Learned

Although the cause of the event is not known, improved PMT methods and installation instructions for steam trap maintenance will provide greater assurance that a defective steam trap is not placed into service.

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List of Commitments

1. By August 8, 1997, Engineering will develop and provide work instructions for proper steam trap assembly to Work Control for inclusion in Maintenance Work Packages.