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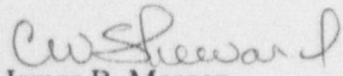
United States Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, DC 20555-001

Portsmouth Gaseous Diffusion Plant (PORTS)
Docket No. 70-7002
Event Report 97-20, Revision 1

Pursuant to the Safety Analysis Report (SAR), Section 6.9, Table 6.9-1, J (2), Enclosure 1 provides Event Report 97-20, Revision 1, for an occurrence involving the actuation of the autoclave shell high pressure containment shutdown safety system in the X-343 Building at the Portsmouth Gaseous Diffusion Plant. The revised event report includes the root cause and corrective actions. Changes from the previous report are marked with a vertical line in the right margin.

Should you require additional information regarding this event, please contact Scott Scholl at (740)897-2373.

Sincerely,

for 
James B. Morgan
Acting General Manager
Portsmouth Gaseous Diffusion Plant

Enclosures: As Stated

cc:
NRC Region III Office
NRC Resident Inspector - PORTS

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Description of Event

On October 18, 1997, at 1645 hours, X-343 autoclave #4 was in Mode IV, feeding a Uranium Hexafluoride (UF_6) cylinder to the enrichment cascade, when an audible and visual alarm for steam shutdown was received. Operators responding to the alarm found that the autoclave shell high pressure containment shutdown safety system (ASHPCS) had actuated. The internal autoclave pressure observed by the operators was 22.3 psia. TSR 2.1.3.5 lists the limiting control setting (LCS) for ASHPCS as 15 psig, though it has been conservatively set at 8.0 psig (22.45 psia), which is the same set point as the autoclave shell high steam pressure shutdown safety system (ASHSPS).

The operators followed the alarm response procedures and determined that the ASHPCS alarmed when channel "A" of the two-channel pressure sensing instrumentation actuated. The autoclave operators and the X-343 First Line Manager obtained autoclave condensate samples and verified that no UF_6 release had occurred. The autoclave alarms were reset after verifying that all containment valves had actuated as required. The autoclave was then opened and inspected. No abnormal conditions were identified.

After determining that the safety systems had functioned as designed and that there were no abnormal conditions, operators closed the autoclave, restarted the steam and the cylinder feed cycle was continued. Autoclave operation continued without further incident until the following shift. A decision was made by the Plant Shift Superintendent (PSS) on the following shift to shut the autoclave down at 2319 hours. The PSS determined that the root cause of the ASHPCS safety system actuation had not been determined before the autoclave had been restarted and that it would be more conservative to shut down the autoclave until the cause of the actuations had been determined and corrected.

The cylinder was moved to a different autoclave and the remainder of the UF_6 was fed to the cascade. There was no release of hazardous material or radiological exposures associated with this event. The actuation of the ASHPCS safety system is reportable in accordance with the Safety Analysis Report (SAR), Section 6.9, Table 6.9-1, J(2).

The ASHPCS is provided to shut off the steam supply and place the autoclave in containment in the event of a UF_6 release inside the autoclave. During a large release, a massive amount of hydrogen fluoride (HF) gas would be rapidly produced by the reaction of UF_6 with water. The HF gas would increase the pressure in the autoclave and upon the autoclave internal pressure reaching the ASHPCS setpoint, a redundant pressure sensor would trigger containment shutdown.

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Safety systems in addition to the ASHPCS which prevent the cylinder high temperature safety limit from being reached include the autoclave shell high steam pressure shutdown and the UF₆ cylinder high temperature autoclave steam shutoff.

Cause of Event

The direct cause of the ASHPCS actuation on autoclave # 4 was a higher than normal steam pressure inside the autoclave shell. The cylinder had been heating for about three hours and the feed valve had been open for about an hour. The UF₆ was being fed to the cascade at a high flow rate. High steam feed pressurized the autoclave to the ASHPCS setpoint and actuated the safety system. The safety system operated as designed and shutdown the autoclave steam supply block valve.

Following the initial written event report, Engineering conducted extensive testing on the autoclave steam supply and pressure regulation systems and utilities. No equipment failures, calibration problems or utilities transients which would have led to a high pressure alarm were found.

The root cause of the system high pressure alarm was failure to anticipate unusual system interactions due to the thermodynamic conditions which occurred while operations was feeding the cylinder at the maximum obtainable UF₆ flow rate. It is suspected that UF₆ in the cylinder was progressing through a rapid phase change from liquid to gas when the safety system actuation occurred. Rapid vaporization required significant amounts of energy which reduced the cylinder temperature to less than 200 F, which caused the steam regulator to switch to high steam loading pressure of 6 psig (20.45 psia). It appears the combination of rapid steam condensation and an extended period of high steam flow caused the autoclave pressure to overshoot the set point. Although the steam regulator is designed to self-regulate, the time lag between the increasing steam pressure and the self-regulating mechanism was long enough to allow the steam pressure to increase to 22.3 psia when it activated the ASHPCS safety system.

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Corrective Actions

1. On October 27, 1997, an administrative control was implemented to prevent challenges to autoclave safety systems by limiting autoclave cylinder feed rates during the initial feeding process to allow cylinder temperatures to stabilize prior to increasing to maximum feed rates.
2. On January 9, 1998, procedure XP4-TE-FD2701, "X-343 and X-342 Autoclave Operation," was revised to limit autoclave cylinder feed rates during the initial feeding process, superceding the administrative control.

Extent of Exposure of Individuals to Radiation or Radioactive Materials

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

Lessons Learned

The PORTS Quality Assurance Plan requires that conditions adverse to quality be identified and corrected as soon as practical. In the case of safety system actuations, the cause of the condition is determined and corrective actions are taken to preclude recurrence. Based on the facts that this was an isolated occurrence, the safety system operated properly, the pressure setpoint was actuated solely by steam pressure (no UF_6 release involved), and the fact that the autoclave contained a hot liquid cylinder, the on-duty PSS felt it was safer to continue feeding the cylinder to remove the liquid UF_6 from the autoclave prior to taking the autoclave out of service for troubleshooting.

Although no recurrence of the event actually occurred, the possibility existed that a second steam pressure isolation might have occurred had the conditions causing the original isolation been duplicated. When the next shift assumed the watch they made the decision that the more conservative course of action would be to stop feeding and take the autoclave out of service for testing.

The lesson learned from this event is that autoclave operations should not continue following safety system actuations until the cause of the actuations has been determined and corrected.