

United States Enrichment Corporation United States Enrichment Corporation

2 Democracy Conter 6903 Rockledge Drive Bethesda, MD 20817

Tel (301) 564-3200 Fax (301) 564-3201

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United States Nuclear Regulatory Commission Attention: Document Control Desk Washington, D.C. 20555-0001 GDP 97-2029

Portsmouth Gaseous Diffusion Plant (PORTS) - Docket No. 70-7002 - Event Report 97-19

Pursuant to Safety Analysis Report (SAR), Section 6.9, Table 6.9-1, J(2), Enclosure 1 provides the required 30 day written Event Report (ER) for an event involving an autoclave high condensate level shutoff actuation at the Portsmouth Gaseous Diffusion Plant. 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,

Ngai Morgan

General Manager Portsmouth Gaseous Diffusion Plant

DIA:SScholl:mc

120001

cc: NRC Region III D. Hartland, NRC Resident Inspector, PORTS





ETA

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Description of Event

On October 9, 1997, at 0120 hours, X-343 Autoclave (AC) #4 was in Mode II, heating a 14 ton Uranium Hexafluoride (UF₆) cylinder when the audible alarm for steam shutdown was received. Operators responding to the alarm found the "A" and "B" condensate level probe lights on, indicating the high condensate level shutoff (HCLS) safety system had actuated. The autoclave local alarm panel indicated steam supply block valve FV-413 was closed, stopping steam flow to the autoclave as designed. Operations personnel noted wat the internal autoclave pressure was 14.4 psia at the time of the actuation.

A second event occurred on October 9, 1997. At 0545 hours, X-343 Autoclave (AC) #2 was also in 'Mode II, heating a 14 ton Uranium Hexafluorid ϵ (UF₆) cylinder when the audible alarm for steam shutdown was received. Operators responding to the alarm found the "A" and "B" condensate level probe lights on, indicating the high condensate level shutoff (HCLS) safety system had actuated. The autoclave local alarm panel indicated steam supply block valve FV-213 was closed, stopping steam flow to the autoclave as designed. Operations personnel noted that the internal autoclave pressure was 13.7 psiz at the time of the actuation.

In both events operators acknowledged the steam shutdown alarm, which silenced the alarm and caused the "A" and "B"condensate level probe lights to clear. If condensate had still been in contact with the probes, the lights would have remained illuminated.

Both actuations of the HCLS safety systems are reportable in accordance with the Safety Analysis Report (SAR), Table 6.9-1, J (2).

Both of the above events were associated with the heating of 14 ton cylinders in six foot diameter feed autoclaves. Discussions with Operations and Customer Order Management personnel indicated that they believe these were the first 14 ton cylinders fed to the cascade in several years. Normally 10 ton cylinders are used for feed. However, due to a drop in the number of 10 ton feed cylinders available, feeding of 14 ton cylinders was resumed to provide adequate feed to the cascade. After the second HCLS actuation, plant operators recognized that the heating of 14 ton cylinders could be a common cause for both actuations. As a result, heating of 14 ton cylinders was suspended until the cause of the actuations could be determined.

The condensate level shutoff system is provided to prevent over pressurization or a nuclear criticality in an autoclave following a postulated UF₆ release. Excess water is undesirable in case of a UE release from the cylinder that could cause either high hydrogen fluoride pressure as the result of the reaction between UF₆ 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. Docket No. 70-7002 Enclosure 1 Page 2 of 4

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Cause of Event

The direct cause for the HCLS safety system actuation on AC #4 and AC #2 was a drop in internal autoclave pressure which caused water to back up into the drain line and activate the condensate lovel the probes.

The root cause for the actuation of the HCLS safety system on AC #4 and AC #2 has been determined to be an inadequately designed condensate system on six foot autoclaves. The similarity from these HCLS actuations are that both occurred in six foot diameter autoclaves while heating 14 ton cylinders. Information obtained from operations personnel indicated that HCLS actuations have occurred in the past while heating 14 ton cylinders in six foot autoclaves. Past operating practices allowed these actuations to be considered routine and no corrective actions were taken. As a result, no controls were put in place to prevent 14 ton cylinders from being heated in six foot autoclaves.

The actuations occur because the steam supply to the six foot autoclaves is not adequate to prevent the internal autoclave pressure from going to a vacuum. After the 14 tons of solid UF₆ is heated to 147° F and 22 psia pressure, the entire mass of UF₆ begins to liquefy. This liquefaction proceeds at a rate which is comparable to the rate of energy supplied to the cylinder contents. In the case of steam supply to a six foot diameter autoclave, the energy available from the steam is not enough to both liquefy the UF₆ and maintain a positive pressure inside the autoclave. The energy demands of the UF₆ phase change to liquid absorbs enough energy from the steam to cause the internal autoclave pressure to drop below atmospheric pressure. Without this positive pressure to force the condensate end out of the autoclave, the condensate remains in the piping and is believed to actually backup in the piping activating the condensate level probes.

This phenomena has not been observed in the seven foot diameter autoclaves because the larger volume provides a greater heat reservoir for the UF_6 phase change to draw from. This reservoir is apparently large enough to allow the solid to liquid phase change to occur without a drop in pressure.

The autoclave condensate system was designed to operate at an autoclave internal pressure of approximately 2.5 psig (16.95 psia). This pressure is necessary to drive the condensate out of the autoclave, through the piping and out of the system through the steam trap. The steam trap must have at least 2 psi differential pressure to be able to move the amount of condensate produced during the UF₆ phase change. This was previously recognized as an autoclave design inadequacy and was included as a non conformance in the Plan for Achieving Compliance with NRC Regulations at the Portsmouth Gaseous Diffusion Plant (Issue 3, Item no. 7). This design deficiency will be corrected as part of the Autoclave Nuclear Safety Upgrade Project which is scheduled to be completed by February 1, 2001.

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Until the autoclaves can be upgraded, a hose is being used upstream of the steam trap to help alleviate problems with condensate flow through the trap. Unfortunately, the hose does not help remove condensate when the internal autoclave pressure is below atmosphere. With autoclave pressure below atmosphere, the entire condensate system acts as a large straw, drawing condensate back into the condensate drain line and activating the probes. The combination of liquid being retained in the piping and the continuous addition of condensate from the liquefaction of the UF₆ causes the water level to rise and activate the probes.

Following the HCLS actuations approximately two quarts of condensate was drained from the AC #4 condensate drain line and approximately one gallon of condensate was drained from the AC #2 condensate drain line. The presence of this water indicated that water had backed up in the drain.

Following the HCLS actuations the both autoclaves were inspected for obstructions which could have restricted the flow of condensate. Maintenance removed the in-line strainer screens from both autoclaves and determined that there was no accumulation of debris that could contribute to restricting condensate flow. Maintenance personnel did note that both screens were coated with a film of rust. However, the rust film is not believed to have blocked condensate flow because the condensate drain system was working properly until the autoclave internal pressure went to a vacuum. Further maintenance inspection of both condensate drains did detect one pigtail gasket and a small piece of wire in the AC #2 drain line. However, these items were not large enough to obstruct condensate flow.

Corrective Actions

- On October 9, 1997, administrative controls were put in place to prevent heating of 14 ton cylinders in six foot diameter autoclaves. These controls will remain in place until procedures can be revised.
- By January 15, 1998, autoclave operating procedures will be revised to prohibit heating of 14 ton feed cylinders in 6 foot diameter autoclaves. These controls will remain in place until modifications can be made to correct this autoclave design deficiency.

Extent of Exposure of Individuals to Radiation or Radioactive Materials

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

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Lessons Learned

The design of the six foot autoclaves does not provide for enough steam flow to maintain positive pressure during the heating of 14 ton cylinders. This design deficiency was known as a result of actuations that occurred several years ago. However, there were no controls put in place at that time to prevent heating of 14 ton cylinders in six foot diameter autoclaves.

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 By January 15, 1998, autoclave operating procedures will be revised to prohibit heating of 14 ton feed cylinders in 6 foot diameter autoclaves. These controls will remain in place until modifications can be made to correct this autoclave design deficiency.