

January 13, 2000

Mr. James N. Adkins  
Vice President Production  
United States Enrichment Corporation  
Two Democracy Center  
6903 Rockledge Drive  
Bethesda, MD 20817

SUBJECT: INSPECTION REPORT NO. 70-7002/1999-208

Dear Mr. Adkins:

This letter refers to the fire safety inspection performed by the Headquarters staff of the U.S. Nuclear Regulatory Commission (NRC) on December 13-17, 1999, at your facility in Piketon, Ohio. The purpose of the inspection was to determine whether activities authorized by your certificate were conducted safely and in accordance with the NRC requirements. At the conclusion of the inspection, the findings were discussed with those members of your staff identified in the enclosed report.

Areas examined during the inspection are identified in the report. Within these areas, the inspection consisted of facility walk-downs, selective examination of procedures and records, and examination of safety equipment, interviews with personnel, and observations. The inspection identified two unresolved items (URIs) of safety importance. You are requested to submit written evaluations along with your plans of actions developed to resolve these URIs within 30 days of the date of this letter.

In accordance with the NRC's "Rules of Practice," a copy of this letter and its enclosures will be placed in the NRC Public Document Room. If you have any questions concerning this report, you may contact me at 301-415-7156.

Sincerely,

/RA/

Philip Ting, Chief  
Operations Branch  
Division of Fuel Cycle Safety  
and Safeguards, NMSS

Docket No. 70-7002

Enclosures: Inspection Report No. 70-7002/1999-208  
cc w/enclosure: J. Brown, General Manager, Portsmouth  
P. Miner, Nuclear Regulatory Affairs Manager, Portsmouth  
D. Shisler, Manager, Nuclear Material Control and Accounting, Portsmouth  
H. Pulley, General Manager, Paducah  
L. Jackson, Regulatory Affairs Manager, Paducah  
S. Toelle, Manager, Nuclear Regulatory Assurance and Policy, USEC  
R. DeVault, Regulatory Oversight Manager, DOE

cc w/o enclosure: R. Suppes, Chief, Bureau of Radiation Protection, Ohio Dept. of Health

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U.S. NUCLEAR REGULATORY COMMISSION  
OFFICE OF NUCLEAR MATERIAL SAFETY AND SAFEGUARDS

Docket No: 70-7002  
Certificate No: GDP - 2  
Report No: 70-7002/1999-208  
Certificate Holder: United States Enrichment Corporation  
Location: Portsmouth Gaseous Diffusion Plant  
Piketon, OH 45661  
Inspection Dates: December 13-17, 1999  
Inspectors: Peter S. Lee, Fuel Cycle Operations Branch  
Albert Wong, Special Projects Branch  
Approved By: Philip Ting, Chief  
Operations Branch  
Division of Fuel Cycle Safety  
and Safeguards, NMSS

Enclosure

**United States Enrichment Corporation  
Portsmouth Gaseous Diffusion Plant  
Inspection No. 70-7002/1999-208**

**EXECUTIVE SUMMARY**

The U.S. Nuclear Regulatory Commission (NRC) performed a routine, announced fire safety inspection at the Portsmouth Gaseous Diffusion Plant (PORTS), Piketon, Ohio, on December 13-17, 1999. The inspection focused on the implementation of PORTS fire protection commitments concerning safe plant operations. Major fire safety performance reviewed included the maintenance of design bases of engineered fire protection systems, assurance of availability and reliability of fire protection systems and process equipment important to mitigation of a lube oil fire, the control of combustibles, manual fire suppression response, and sprinkler corrosion.

**Results and Conclusions**

**Engineered Fire Protection Systems**

- Plant conditions in Buildings X-326 and X-330 were adequately maintained within the original design bases of automatic sprinkler systems.
- The inspectors identified potential increased pressure demands above the original design hydraulic parameters of process building automatic sprinkler systems.

**Inspection, Testing, and Maintenance of Safety Equipment**

- Key fire protection systems and equipment were available and could be relied upon to suppress a design basis lube oil fire.
- The inspectors identified a concern regarding inadequate inspection, testing, and maintenance to ensure the availability and reliability of process equipment needed by operators to stop the fuel supply to a lube oil fire.

**Control of Combustibles**

- Combustibles were adequately controlled within Process Buildings X-326, X-330, X-343A, and X-344A to minimize potential fire severity and propagation.
- An adequate control of combustibles was provided to minimize potential fire exposure hazards to uranium hexafluoride (UF<sub>6</sub>) cylinders at staging and storage locations throughout the plant.

### Manual Fire Suppression Response

- The certificate holder has provided, through the combination of an on-site fire department and off-site fire department assistance, a reasonable assurance of an adequate emergency response for suppression of a major fire at the plant.

### Corrosion of Sprinklers

- The certificate holder has adequately determined the scope of the corrosion affecting automatic sprinkler systems at the plant. The certificate holder has preliminarily concluded that general corrosion appeared to be the root cause of the corroded sprinklers.
- The inspectors identified as a weakness the need to perform additional sampling and analysis in ongoing investigation efforts to ensure a conclusively determination of the root cause(s) for the sprinkler corrosion. Overall the certificate holder's investigation efforts appeared adequate.
- The inspectors found that the certificate holder had not evaluated the reliability of the building automatic sprinkler systems, had not determined the cumulative impact of the corroded sprinklers upon the assumptions of the safety analysis report (SAR), and had not determined the impact of the corroded sprinklers (and corrective actions) on the margin of safety established by the technical safety requirements (TSR) for the safety of operations.

### Attachments:

1. Partial Listing of Persons Contacted
2. Inspection Procedures Used
3. Items Opened, Closed, and Discussed
4. List of Acronyms and Abbreviations

## REPORT DETAILS

### **1. Engineered Fire Protection Systems**

#### **a. Scope**

The inspectors reviewed and evaluated plant conditions to ensure that they were within the design bases and/or the performance capabilities of the engineered fire protection systems. The inspector performed a walkdown inspection of the systems, conducted interviews with plant employees, and reviewed documentation and records related to the scope of this inspection.

#### **b. Observations and Findings**

The inspectors performed a walkdown inspection of Buildings X-326, X-330, and X-334A to ensure that plant conditions in these facilities were within the original design bases of the building automatic sprinkler systems. The inspectors noted that the combustible loading and storage configurations and the potential fire hazards under the sprinkler-protected areas were within design bases and would not challenge the effectiveness or the capability of the building automatic sprinkler systems.

#### Impact of Corroded Sprinklers on Performance of Automatic Sprinkler Systems

The certificate holder has identified corrosion affecting automatic wet pipe sprinkler systems in the main process buildings. To date, more than 600 corroded sprinklers have been identified. The inspectors noted that test results from the plant laboratory, the sprinkler manufacturer, and Factory Mutual Research Corporation (FMRC) have concluded that the corroded sprinklers would actuate at design temperatures. However, tests also concluded that increased pressure (i.e., above a normal pressures of 7 psi) was required for water to begin flowing from a corroded sprinkler. The cause of the increased pressures was determined to be water that had leaked from the corroded sprinklers and had dried, forming a mineral deposit that plugged the opening of the sprinkler. The certificate holder has taken corrective actions to replace a majority of the corroded sprinklers. At the time of the inspection, all automatic sprinkler systems in the process buildings were considered operable.

On the basis of the test results, the inspectors raised a concern about the potential for increased system pressure demands above those of the design hydraulic parameters of the original sprinkler systems. There was also the possibility that corroded sprinklers could challenge the capability of the plant's high-pressure fire water system (HPFWS). The certificate holder indicated that corrective actions had replaced approximately 98 percent of the corroded sprinklers, and fire pumper trucks were available to increase sprinkler system pressures. The inspectors noted that the corrective actions were reasonable in minimizing and compensating for possible negative changes to the original design hydraulic parameters and the potential challenges to the HPFWS. However, the inspectors identified as a weakness the certificate holder's lack of evaluation to determine potential negative changes to the original design hydraulic parameters and their impact on overall reliability. Section 5 of this report further discusses the corroded sprinklers.

### **c. Conclusions**

Plant conditions in Buildings X-326 and X-330 were adequately maintained plant conditions within the original design bases of automatic sprinkler systems. The inspectors identified a potential increased pressure demands above the original design hydraulic parameters of process building automatic sprinkler systems.

## **2. Inspection, Testing, and Maintenance of Safety Equipment**

### **a. Scope**

The inspectors performed walkdown inspections, conducted interviews of plant personnel, and examined licensee records and procedures for inspection, testing, and maintenance (ITM) of key fire safety systems and equipment. The appropriate ITM ensures the availability and reliability of fire safety systems and equipment in performing their intended safety functions or the success of operator actions to mitigate the consequences of a design basis lube oil fire.

### **b. Observations and Findings**

On the basis of random samples of the certificate holder's ITM records and walkdown examinations of safety equipment, the inspectors determined that the overall ITM for the following fire protection systems and equipment was adequate and performed in accordance with plant procedures:

- Automatic wet pipe sprinkler systems (Buildings X-326 and X-330)
- Automatic dry pipe sprinkler system (Building X-344A)
- Carbon dioxide fire extinguishers (Buildings X-326 and X-330)
- Plant fire pumps and tanks (Buildings X-640-1, X-640-2, and X-6644)
- Fire hydrants
- Fire hoses

The inspector noted that surveillances of the process building automatic sprinkler systems and plant HPFWS required by TSRs were met. The inspectors noted no obvious deficiencies in the material condition of selected equipment examined during walkdown inspections in Buildings X-326, X-330, and X-344A. The equipment important for firefighting (e.g., fire extinguishers, fire pumps, hydrants, and fire hoses) were adequately inspected, tested, and maintained.

#### **Water Supply for Fire Protection**

The inspectors observed that the Building X-640-1 diesel-driven fire pump was out of service for maintenance. However, the remaining five fire pumps appeared functional and were adequate to meet a demand flow rate of 16,000 gallons per minute established for a design basis lube oil fire. Over 4 million gallons of water was kept in storage tanks to meet the design basis flow rate for a period of more than 4 hours. The inspectors noted that the resident inspectors had identified a concern regarding the performance of the annual ITM related to the elevated water storage tank, which was overdue. Overall, the plant's HPFWS appeared to be adequately maintained with no major impairments.

### Process Equipment Important To Mitigating a Lube Oil Fire

SAR Section 4.1.1.3 described the following equipment and functions related to operator actions to mitigate a lube oil fire (i.e., stop the fuel supply to a fire):

<b>Equipment Description</b>	<b>Mitigating Functions To Minimize The Consequences of a Lube Oil Fire</b>
Cell lube oil trip	Automatic trip to isolate supply when oil pressure is reduced to 2 psi
Cell trip	Automatic trip by cell lube oil trip to reduce UF <sub>6</sub> pressure below atmospheric
Gravity feed tank motor-operated valves	Remotely operated from X-300, Plant Control Facility, to stop flow of oil or drain system
Lube oil quick drain valves	Drain a lube oil system within 5 minutes
Cell lube oil valves	Isolate cell oil supply from operating floor in X-330 and X-333

The inspectors noted that the SAR Section 4.6.1.10 and 6.11.4.1 and TSR (Section 3.9.1) required the development of procedures for operator actions that could mitigate the consequences of a lube oil fire. The certificate holder has developed procedures (e.g., XP4-CO-ON5975, XP4-CO-CA2632, XP4-CO-CA3946A, XP4-CO-CA3964B, XP4-CO-CA3964C, XP4-CO-CA2630, etc.) related to this subject. However, the inspectors found that the plant procedures did not adequately establish appropriate ITM to ensure availability and reliability of the equipment and functions described above.

The certificate holder acknowledged the need to establish appropriate ITM. However, the certificate holder voiced a valid concern regarding the ability to fully test equipment and functions without shutting down or damaging the process units. A plant problem report (ATR No. 99-073437) was established and entered into the plant's corrective actions tracking program to evaluate, develop, and implement appropriate ITM.

In determining the safety significance of the finding, the inspectors reviewed SAR Sections 4.6.1.3.2 and 4.6.1.10 that discussed the consequences of an unmitigated lube oil fire, the maximum potential fire loss (MPFL), and assumptions for operator actions. The inspectors noted the following:

- The SAR appeared to credit both operator actions (stop fuel to a fire) and the building automatic sprinkler system to mitigate the consequences of a lube oil fire (i.e., in the event of the failure or the inability of operators to stop fuel to a fire).
- The MPFL scenario (Section 4.6.1.3.2) inappropriately credited the building automatic sprinkler systems with controlling a fire involving the roof to prevent structural failure. The building automatic sprinkler systems were designed and installed to suppress a fire occurring below the sprinklers (i.e., on the cell floor). This information will be provided to



NRC Special Project Office that oversees the certificate for PORTS for further review and consideration.

- During unavailability of the building sprinkler systems (e.g., when they are impaired, drained for replacement of corroded sprinklers, possess a deficient water supply, are experiencing a water main break, etc.), the operators to isolate lube oil as described (or implied) in the SAR and the TSR to maintain an adequate margin of safety for continued enrichment process operations.

The inspectors determined that the ITM to ensure availability and reliability of process equipment described in Section 4.1.1.3 was necessary for the success of key operator actions that lead to an increased margin of safety and defense-in-depth fire protection. On the basis of walkdown inspections, the inspectors did not identify any concerns regarding accessibility or material conditions regarding the selected equipment examined. Therefore, the evaluation of the safety implications and the development and implementation of appropriate ITM to ensure the adequacy of equipment and functions relied on by operators (or firefighters) to stop the fuel supply to a lube oil fire will be tracked as **Unresolved Item (URI) No. 70-7002/1999-208-01**.

During an inspection follow-up discussion with the certificate holder on December 27, 1999, the certificate holder maintained that only automatic sprinkler systems were credited in the SAR accident analysis and the failure of operator actions did not affect the margin of safety (or defense-in-depth protection). The inspectors acknowledged the certificate holder's position but noted that it was because of the presence of defense-in-depth fire protection (e.g., engineered safety systems, administrative controls, and emergency response) at the plant that the inspectors' finding did not show a significant degradation of the overall margin of safety for plant operations.

### c. **Conclusions**

Key fire protection systems and equipment were available and were reliable for suppression of a design basis lube oil fire. However, the inspectors identified a concern regarding inadequate ITM to ensure availability and reliability of process equipment needed by the operators to stop fuel supply to a lube oil fire.

## 3. **Implementation of Control of Combustibles**

### a. **Scope**

The inspectors reviewed the licensee's control of combustible material, liquids, and gases to minimize the occurrence, severity, and spread of a fire in the process buildings and selected plant areas. The inspectors walked through the process and plant areas, interviewed plant employees, and reviewed documentation and records for the areas identified in the scope of the inspection.

### b. **Observations and Findings**

#### Control of Combustibles Within the Process Buildings

The inspectors examined the control of combustibles for a number of process and support buildings (i.e., Buildings X-300, X-326, X-330, X-344A, X-342A, X-640-1, X-640-2, X-6644, X-700, and X-705) and observed that they were adequately implemented. The quantity and the use of flammable liquids or gases were at a minimum. The combustible material storage areas on the operations and cell floors of Buildings X-300 and X-326 did not present a severe or increased fire hazard beyond that of the lube oil systems. The inspectors observed that control of combustibles were adequately controlled in process areas involving heating, transfer, and storage of UF<sub>6</sub> in Buildings X-344A and X-342A.

#### Control of Outside Storage To Minimize Potential Fire Exposure Hazards

The inspectors reviewed the potential for exterior fire exposures to the main process buildings. The inspectors noted that the areas surrounding the process buildings were generally kept free of combustibles that could present a fire exposure hazard. The areas adjacent to the structure support for the elevated water storage tank for the HPFWS was also kept free of combustibles.

The inspector also reviewed the control of combustibles to minimize the potential fire exposure hazards to uranium UF<sub>6</sub> cylinders that were staged or stored at various process buildings and plant areas (e.g., Buildings X-326, X-330, X-333, X-343, X-342A, X-745B, and X-745G). The inspectors found that combustibles were adequately controlled for the plant areas examined.

### **c. Conclusions**

Combustibles were adequately controlled within Process Buildings X-326, X-330, X-343A, and X-344A to minimize potential fire severity and propagation. The control of combustibles outside of process buildings and staging and storage areas for UF<sub>6</sub> cylinders were adequate to minimize potential exposure fire hazards.

## **4. Manual Fire Suppression Response**

### **a. Scope**

The inspectors reviewed the adequacy of availability and staffing of the onsite fire department to respond to the design basis lube oil fire. The inspectors also reviewed formal agreements established for offsite fire department assistance. The inspectors performed interviews with plant employees and reviewed documentation and records during the inspection.

### **b. Observations and Findings**

#### Plant Fire Department Staffing and Equipment for Response to an Onsite Fire

The inspectors reviewed plant fire department staffing and noted that the certificate holder had at least six firefighters available as required by Operating Procedure XP2-SS-FS1031. The level of staffing met the minimum required by the TSRs. The certificate holder also maintained a level of training for firefighters that was commensurate with the performance of interior structural firefighting. The inspector determined that fire department staffing and training were adequate for an initial response to a design basis lube oil fire.

### Availability and Maintenance of Key Firefighting Equipment

The inspectors performed a walkdown inspection of key firefighting equipment needed by firefighters to mitigate a design basis lube oil fire. The inspectors observed that fire pumper trucks No. 1 and No. 3 were available to support emergencies. The inspectors noted that pumper truck No. 2 was placed in reserve pending maintenance to improve fire pump performance. An appropriate supply of light-water aqueous film-forming foam (AFFF) and equipment needed for application were stored on each fire pumper truck. In addition, a reserve supply of AFFF was stored at the firehouse. The inspectors determined that the key equipment necessary to successfully mitigate a combustible liquid fire was available for firefighting operations.

### Offsite Fire Department Assistance

The inspectors reviewed mutual aid agreements established between the certificate holders and nearby city or town fire departments and noted that 11 agreements for assistance (excluding Pike Forest Fire Department) had been established in accordance with the Portsmouth Emergency Plan.

The certificate holder indicated that the average response time from the notification of offsite fire departments to the arrival of fire trucks and personnel at the plant's was within 20 to 30 minutes. On the basis that the availability of the process building automatic sprinkler systems and an onsite fire department for initial response (e.g., an average of 6 minutes), the inspectors determined that the response time of the offsite fire departments was adequate.

## **c. Conclusions**

The licensee has provided, through the combination of an onsite fire department and offsite fire department assistance, reasonable assurance of an adequate emergency response for suppression of a major fire at the plant.

## **5. Corrosion of Sprinklers**

### **a. Scope**

The inspectors reviewed the adequacy of certificate holder's actions to characterize the scope of corrosion affecting the plant fire protection systems, the progress in the determining the possible root cause(s) of the corroded sprinklers, and the evaluation of safety significance. The inspectors performed a walkdown inspection of systems, interviewed with plant employees, and reviewed documentation and records related to the scope of this inspection.

**b. Observations and Findings****Assessing the Scope of Corrosion Affecting Plant Automatic Sprinkler Systems**

The certificate holder has performed two walkdown inspections of all automatic sprinkler systems in Buildings X-326, X-330, and X-333, served by the HPFWS, to determine the extent of the corrosion affecting automatic sprinkler systems. The walkdown inspections were completed in 1998 and 1999. As a result of the inspections, the certificate holder identified approximately 617 sprinkler heads with external mineral deposits on the fusible links, affecting 159 of 247 automatic sprinkler systems in the three main process buildings.

Approximately 600, or 98 percent, of the identified corroded sprinklers had been replaced. The certificate holder plans to continue replacement of the remaining corroded sprinklers and to perform additional walkdown inspections during the first two quarters of 2000. The inspectors reviewed the walkdown documentation and findings and noted that the walkdown inspections appeared thorough. Also, the reduced time between second walk-down completed in September 1999 and that planned for 2000 was considered appropriate.

In determining the impact of corrosion on other automatic sprinkler systems on the plant site, the certificate holder had performed a number of building surveys and inspections (e.g., Buildings X-342, X-344A, X-700, etc.), which concluded that corrosion did not appear to affect the automatic sprinkler systems on the sanitary and fire water system (SFWS). The inspectors reviewed the building survey and inspection reports from 1997 to the present and verified that corroded sprinklers were not identified. The inspectors also performed walkdown inspections of Buildings X-342, X-344A, X-700, and X-705 and determined that the certificate holder's conclusion that the corrosion of sprinklers did not affect systems on the SFWS appeared valid.

Overall, the inspectors determined that the certificate holder's efforts to determine the scope of the corrosion affecting automatic sprinkler systems were adequate.

**Investigation of Possible Root Cause(s)**

**Preliminary Results From Laboratory Investigations:** The certificate holder provided samples of the corroded sprinklers to the onsite metallurgical laboratory and FMRC for metallurgical analysis. FMRC's analysis was still underway and had not been submitted to the certificate holder. On the basis of the plant laboratory's x-ray spectroscopy results, completed on November 11, 1999, it was concluded that the most probable cause of the corroded heads was general corrosion of the sprinkler head gaskets exposed to elevated temperature and stagnant water conditions during 40 years of service. The certificate holder estimated that the average gasket corrosion rate ranged from 0.00011 inch per year to 0.00022 inch per year. The certificate holder indicated that other forms of corrosion (e.g., pitting, intergranular, etc.) were considered less likely because of a lack of evidence at the present time.

The inspectors noted that the preliminary conclusions and corrosion rates appeared reasonable, but the certificate holder's investigation was not complete at this time, as discussed below.

Actions Pending for the Investigation of Root Cause(s): The certificate holder had begun collecting water samples at the influent point of the HPFWS in September 1999 to determine the aerobic and anaerobic bacteria levels in the water (i.e., an indicator of possible microbiological influenced corrosion). The inspectors reviewed the test procedures and found them to be appropriate. The HPFWS water sample results did not indicate the presence of bacteria. The inspectors noted that the results were not conclusive because of limited samples and the need for additional sampling at different locations to address the differences in water quality of the building automatic sprinkler systems from that of the HPFWS.

The certificate holder had planned to collect additional water samples at various locations throughout sprinkler systems in the three main process buildings. The inspectors performed walkdown inspections to review the locations of sampling points and noted that they appeared to be appropriate. However, the inspectors noted weaknesses with the investigation because of a lack of plans to perform the following analyses to ensure gathering of additional information to conclusively determine (or to eliminate potential) causes of the corrosion:

- Full water analysis (free acid/base, pH, etc.)
- Boroscopy of the HPFWS piping and sprinkler piping
- Removal of sections of the pipes for complete metallurgical analysis
- Additional bacteria readings at the HPFWS influent points

The certificate holder has revised its sampling plan to incorporate the above information. In general, the inspectors noted that the certificate holder's investigation efforts to determine the root cause(s) of the corrosion appeared to be reasonable.

#### Safety Implications of Corroded Sprinklers

The inspectors reviewed the overall impact of the corrosion of sprinklers and the certificate holder's actions to determine the potential impact on safety performance and on the established safety basis for safe plant operations. The inspectors identified the following possibilities that could negatively affect the overall reliability of the building automatic sprinkler systems:

- The increased pressures needed to discharge water through the opening of sprinklers could exceed the original design hydraulic parameters and could reduce performance reliability.
- The unknown conditions of corrosion tubercles in the sprinkler piping (i.e., reduced internal pipe diameters) could also negatively affect the original design hydraulic parameters.
- The increased unavailability of the building automatic sprinkler systems, as a result of increased frequency of maintenance could cumulatively reduce overall performance reliability (i.e., render them unavailable to perform intended functions).
- The potential of continued unavailability of sprinklers systems in the future could further reduce overall reliability of performance over time.

In addition, the inspectors raised the following safety and process concerns:

- The cumulative safety impact of corroded sprinklers (i.e., the availability and reliability of the building automatic sprinkler systems) on the SAR assumptions and the potential changes to assumed risk have not been determined.
- The impact on the margin of safety established by the current TSR because of increased and recurring entry into TSR limiting conditions for operation mode and the increased reliance on compensatory measures has not been determined.
- The answers as to whether the current TSR for building automatic sprinkler systems were intended and/or adequate for addressing the resulting recurring system inoperability because of the corrosion of the sprinklers is unknown.
- The plant processes (e.g., problem reporting, safety screening by safety screening committee, tracking and trending of corrective actions maintenance work control, etc.) did not appear adequate to capture the cumulative impact of a recurring problem, and none of the plant processes led to a safety evaluation of the impact on the established safety basis or risk.

The inspectors found that the certificate holder had not evaluated any of the above possibilities to ensure the reliability of the process building sprinkler systems had not been adversely reduced, to determine the cumulative impact of the corroded sprinklers on the SAR assumptions, or to determine the impact of the corroded sprinklers on the margin of safety established by the TSRs for safety of operations.

The certificate holder acknowledged the safety issues and concerns identified by the inspectors. The certificate holder added a commitment to the plant's corrective actions tracking system (PR-PST-99-03546) to evaluate these concerns by January 10, 2000. The certificate holder also planned to review the plant processes to improve them or to establish lessons learned to ensure that the potential cumulative safety impact of recurring problems would be recognized and appropriately evaluated. The certificate holder's completion of the evaluation of reliability of the building automatic sprinkler systems, the cumulative impact of corroded sprinklers on the SAR assumptions, and the impact of corroded sprinklers on the margin of safety established by the TSRs for safety of operations will be tracked as **URI 70-7002/1999-208-02**.

### **c. Conclusions**

- The certificate holder has adequately determined the scope of the corrosion affecting automatic sprinkler systems at the plant. The certificate holder has preliminarily concluded that general corrosion appeared to be the root cause of the corroded sprinklers.
- The inspectors identified a weakness in the need to perform additional sampling and analysis to conclusively determine root cause(s) of the corroded sprinklers. Overall, the certificate holder's investigative efforts appeared adequate.
- The inspectors found that the certificate holder has not evaluated the reliability of the building automatic sprinkler systems, had not determined the cumulative impact of

corroded sprinkler on the SAR assumptions, and had not determined the impact on the margin of safety established by the TSRs for safety of operations.

## 6. Inspection Follow-up Items

**URI 70-7002/98-202-01:** This URI was related to whether the potential fire exposure hazards from hydraulic fluid underneath the autoclaves in Building X-344A had been adequately evaluated to determine potential consequences to autoclaves and safety systems and components (SSCs) and also whether such accident was bounded by current SAR. The certificate holder had completed an evaluation and documented it in a report titled "Fire Hazards Assessment of Buildings X-342A and X-344A ." However, the inspectors identified the following inadequacies with the evaluation during a walkdown inspection of Building X-344A:

- Description of the number of hydraulic reservoirs and total quantity of hydraulic fluid
- Description of a "dead-man" switch that would depressurize hydraulic fluid in piping
- Assumption of a lack of ignition sources
- Characterization of the ignitability of hydraulic fluid release at 1200-1400 psi
- Characterization of the combustibility of the fire hazards of hydraulic fluid

The inspectors noted that the inadequacies resulted in an inadequate technical bases for conclusions by the certificate holder (i.e., a fire was not credible) and led to no additional evaluation of potential fire consequences. The certificate holder's assurance of the quality of the engineering evaluation appeared inadequate.

Because of the inadequacies, the inspectors further reviewed SAR bases and determined the potential fire exposure hazards resulting from a hydraulic fluid pool or a pressurized mist fire would be bounded by existing accident scenarios that considered externally caused rupture of autoclaves. The inspectors noted that SSCs described in SAR Sections 3.2.1.1.1 and 4.2.4 would address consequences of a hydraulic liquid pool or a localized pressure spray fire that may increase the autoclave's temperatures or pressures. The inspectors also noted that the presence of automatic sprinklers over the autoclaves should provide cooling and minimize the potential consequences of a fire. The certificate holder planned to revise engineering evaluations to correct inadequacies. However, the inspectors considered the safety concerns resolved; therefore, **URI No. 70-7002/98-202-01 was closed.**

**IFI 70-7002/98-202-02:** This IFI was related to the discovery of sprinklers with mineral deposits and the need to determine the effect of mineral deposits on sprinkler actuation and performance, the root cause of the deposits, and the possible impact of the deposit on the sprinkler piping. The certificate holder has determined that the mineral deposits were a result of the corrosion of the sprinkler gasket that allowed water to leak from the sprinklers. The plant laboratory, the sprinkler manufacturer, and an independent testing laboratory tested actuation temperatures of corroded sprinklers and determined that they would operate at their design actuation temperatures. However, the certificate holder needed to determine root cause(s) of corrosion and the potential corrosion impact on the interior of the sprinkler piping. Therefore, **IFI 70-7002/98-202-02 remains open.**

**IFI 70-7002/98-202-03:** This IFI concerns the basis for minimum staffing of fire department and the inconsistency in the staffing required between the SAR and the TSR. The certificate holder determined that the minimum staffing indicated in the TSR appropriate. The minimum staffing is consistent with National Fire Protection Association standard and provides an initial response to a design basis lube oil fire. A corrective action has been identified and entered into the

plant's corrective action program to update SAR Chapter 5.4.5 to indicate a staffing level that is consistent with the TSR. The inspectors considered this action acceptable and found no further concerns; therefore, **IFI 70-7002/98-202-03 was closed.**

**IFI 7002/98-202-04:** This IFI was related to the testing of the automatic startup capability of the lube oil sump pump to ensure removal of fuel and water from a lube oil pit. The certificate holder has revised Plant Procedure XP2-SS-FS-6221, "Testing and Inspection of Lube Oil Sump Pump System." However, the certificate holder indicated that the testing of the automatic startup of the sump pumps was in progress and had not been completed. The performance of the tests was slowed because of concerns about possible damage to sump pumps during testing (i.e., leaky check valve). **IFI 70-7002/98-202-04 remains open.**

## **7. Exit Meeting Summary**

The inspectors communicated observations and findings to the licensee throughout the inspection and presented the final results to licensee management during an exit meeting on December 17, 1999. The certificate holder acknowledged the findings presented and committed to address them as discussed in the inspection report. The inspectors re-exited on December 27, 1999, to elevate the inspection finding related to assurance of lube oil supply isolation equipment to a URI.



**PARTIAL LISTING OF PERSONS CONTACTED****United States Enrichment Corporation**

* M. Brown	General Manager
+ J. Boyce	Systems Engineering
* J. Cox	Site and Facility Support Manager
L. Cutlip	Systems Engineering Manager
D. Davison	Operations Manager
* D. Fogel	Regulatory Engineer
A. Hoffman	Systems Engineering
* W. Jenkins	Utilities Operations
* R. Lawton	Safety Safeguards and Quality Manager
D. Mathews	Operations
+ S. May	Section Operations Manager
+ P. Miner	Nuclear Regulatory Affairs Manager
* J. Robinson	Fire Services
M. Richies	X-326 Operations Manager
S. Scholl	Regulatory Engineer
*+T. Sensue	Regulatory Engineer
+ E. Wagner	Safety Analysis Engineer
*+K. Zimmerman	Fire Protection Manager

**NRC Personnel**

* C. Blanchard	USNRC Resident Inspector
* D. Harland	USNRC Senior Resident Inspector

\* Indicates those attending exit meeting on December 17, 1999

+ Indicates those participated in re-exit telephone conference call on December 27, 1999

**INSPECTION PROCEDURES USED**

IP 88055 Fire Protection

**ITEMS OPENED, CLOSED, AND DISCUSSED****Opened**

70-7002/1999-208-01	URI	Certificate holder evaluation of the safety implications and the development and implementation of appropriate ITM for adequate assurance of equipment and functions relied on by operators (or firefighters) to stop the fuel supply to a lube or hydraulic oil fire.
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70-7002/1999-208-02      URI      The certificate holder's completion of evaluation of the reliability of the building automatic sprinkler systems, cumulative impact of corroded sprinklers upon the SAR assumptions, and the impact of the corroded sprinklers on the margin of safety established by the TSR for safety.

**Closed**

70-7002/98-202-01      URI      Determination of whether the potential fire exposure hazards from hydraulic fluid underneath the autoclaves in Building X-344A had been adequately evaluated and bounded by current SAR assumptions and resulting consequences.

70-7002/98-202-03      IFI      Establishment of the basis for minimum staffing of the fire department and clarification of inconsistency between minimum staffing described in the SAR and the TSR.

**Discussed**

70-7002/98-202-02      IFI      Investigation of the impact of corroded sprinklers on system performance and the possible impact on the interior of sprinkler piping, determination of the root cause(s) of corrosion, and the development and implementation of corrective actions.

70-7002/98-202-04      IFI      Development and completion of testing of automatic start-up of the lube oil sump pump to remove fuel and water in the event of a fire in a lube oil pit.

**LIST OF ACRONYMS AND ABBREVIATIONS**

AFFF	aqueous film forming foam
FMRC	Factory Mutual Research Corporation
HPFWS	high pressure fire water system
IFI	inspection follow-up item
ITM	inspection, testing, and maintenance
MPFL	maximum potential fire loss
NRC	Nuclear Regulatory Commission
PORTS	Portsmouth Gaseous Diffusion Plant
SAR	safety analysis report
SFWS	sanitary and fire water system
SSC	safety systems and components
TSR	technical safety requirements
UF <sub>6</sub>	uranium hexafluoride
URI	unresolved item

ROUTING AND TRANSMITTAL SLIP

DATE: January 13, 2000 DOCUMENT NAME: Portsmouth Disk:

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	<u>SIGN AND/OR CONCUR</u>	<u>DATE</u>
1. T. Harich	_____	<u> / /</u>
2. P. Lee	_____	<u> / /</u>
3. A. Wong	_____	<u> / /</u>
4. W. Schwink	_____	<u> / /</u>
5. P. Ting	_____	<u> / /</u>