U.S. NUCLEAR REGULATORY COMMISSION

Inspection Report No.	70-7001/97-202
Docket No.	70-7001
Facility Operator:	United States Enrichment Corporation
Facility Name:	Paducah Gaseous Diffusion Plant
Observations At:	Paducah, KY
Inspection Conducted:	March 24 to April 18, 1997
Inspectors:	Garrett Smith, FCOB Don Stout, FCLB
Approved By:	Philip Ting, Chief Operations Branch Division of Fuel Cycle Safety and Safeguards, NMSS

Enclosure

EXECUTIVE SUMMARY

PADUCAH GASEOUS DIFFUSION PLANT
NRC INSPECTION REPORT
70-7001/97-202

Introduction

NRC performed a routine, announced chemical process safety inspection of the U.S. Enrichment Corporation (USEC) Paducah Gaseous Diffusion Plant (PGDP) at Paducah, KY, from March 24 to April 18, 1997. The inspection was performed by staff from NRC Headquarters. The focus of this inspection was on the effectiveness of the facility's chemical process safety program, specifically focusing on the highest risk chemicals and their use on site.

During the entrance meeting, the inspectors asked plant engineers and management to identify what they viewed as the highest chemical risks on site. Their response was Fluorine (F_2), Chlorine (CL_2), Chlorine Trifluoride (CIF_3) and liquid Uranium Hexafluoride (UF_6).

Major programmatic portions of the chemical process safety program which were reviewed during the inspection included:

- Operating Procedures
- Detection and Monitoring
- Chemical Safety Training
- Maintenance and Inspection
- Site Wide Safety Practices

Significant Findings and Conclusions

- The plant Safety Analysis Report accident analysis and emergency plan do not adequately reflect the concentration of Nitric acid that is currently used in the C-400 building. Also, the procedures used to handle Nitric acid at the C-400 building were inadequate and had been placed on hold.

- The existing job hazard analysis (JHA) program was not being maintained, as required by plant procedures. Based on the deficiencies noted by NRC, the management at both GDPs committed to review and upgrade their JHA programs.

DETAILS

1.0 Plant Tours

a. Inspection Scope

Tours were conducted in the following areas the Cascade Buildings (C-331, C-333, C-335, C-337), Cascade Feed (C-333A, C-337A), Tolling/Sampling (C-360), Fluorine (C-410K) and Chlorine Trifluoride Storage (C-350), Product and Tails Withdrawal (C-310 and C-315), Recirculating Cooling Water (RCW) Pumphouses (C-631, C-637), Decontamination Facility (C-400), Technical Services Building (C-710), Maintenance and Warehouse (C-720). The purpose of these tours was to inspect areas where high risk chemicals are stored and used.

b. Observations and Findings

During a tour of the C-335 Area Control Room (ACR), discussions with operators indicated that they were aware of the hazardous chemicals in their work area particularly UF_6, ClF_3, and F_2. Of the five operators questioned none had experienced a chemical release. An operator in the C-335 ACR, demonstrated the control valve for operating the ClF_3 and F_2 and knew the location of isolation valves for these gases at their respective storage locations. The chemical safety knowledge demonstrated by the operators was appropriate.

During a tour of the C-720 Warehouse, it was noted that several types and classes (i.e., corrosive or flammable) of chemicals were being stored in Toxic Stores Rooms #1 and #2. Additionally, the inspectors noted that several of these chemicals were excised from inventory and appeared to have been in storage for several years. The inspectors asked what steps were taken to prevent incompatible chemicals from being stored in these two rooms. The certificatee responded that there was not a formal evaluation process for determining incompatibility, but relied on warehouse personnel asking for guidance if there was a question regarding chemical incompatibility. Although there was not an immediate compatibility issue with chemicals stored in the rooms on the day of the inspection, this appears to be a weakness.

During a tour of C-400 Decontamination Facility, it was noted that ion exchange (IX) equipment was located adjacent to #5 Dissolver. Plant personnel explained that the IX unit is used as a final processing unit to remove any technetium that remains after processing through the dissolvers or the ferrous sulfate precipitation system and that this equipment was first used in June 1996. During a review of the Safety Analysis Report (SAR) it was noted that there was not any mention of this process in the facility and process description section of the SAR (specifically, Section 3.8, "Chemical Facilities").

The inspectors observed fluorine cylinder delivery by the vendor, calibration and functional test of chlorine detectors at (C-611) Water Treatment Facility, filling and

transfer of a 500-gallon Sulfuric Acid Portable Storage Tank. There were not any observed discrepancies. Operations personnel were experienced and displayed knowledge of safety rules and procedure requirements.

During a tour of the Products Withdrawal Facility, inspectors noted preparations for maintenance activities associated with a control valve. The work involved removal of a valve subassembly which required operations personnel to remove arsenic from the valve prior to maintenance performing their work. The inspectors reviewed the process used to conduct this work. Arsenic is handled through an Exposure Control Plan that is controlled by the Industrial Hygiene Program and through the Safe Work Permit program. It appears that evaluations were conducted prior to beginning the work and monitoring was conducted during the work activities.

c. Conclusions

General plant conditions and housekeeping throughout the plant were adequate. The storage of chemicals in the C-720 Warehouse Toxic Stores rooms does not have a formal evaluation process for determining the possible incompatibility for any new chemicals that would be stored in these rooms.

2.0 Operating Procedures (88058)

a. Inspection Scope

The inspectors reviewed operating procedures (OPs) to determine if chemical operations with licensed material, or operations with chemicals that could affect the safe handling of licensed material, are conducted in a safe manner and that OPs are up-to-date and reflect current plant practices.

b. Observations and Findings

The inspectors reviewed procedure UE2-OS-PS1031, Revision 3, "UE Policy and Procedure Control Process." The purpose of this procedure is to implement the procedure program defined in Section 6.11 of the SAR and is used for both the Portsmouth and Paducah Gaseous Diffusion Plants (GDPs). This procedure contains information regarding procedure hierarchy, and procedure types, and includes the process for verification and approval authority and periodic review. It also requires that chemical safety issues be considered during procedure development at the facilities.

The inspectors reviewed procedure CE-14, Revision 0, "Chlorine Trifluoride, Fluorine, and Mixed Gas Emergencies." This procedure adequately outlines the steps necessary to control the accidental release of ClF_3, F_2 and mixed gas. The procedure introduction states that each ClF_3 cylinder contains 180 pounds of ClF_3. Further investigation indicated that the correct weight was actually 160 pounds of ClF_3 per cylinder. This discrepancy is important because if the weight had been 180 pounds per cylinder, then the OSHA Process Safety Management (PSM) threshold quantity of 1000 pounds

would have been exceeded at the three satellite storage areas. The facility administratively controls inventory by limiting the amount of ClF_3 in the designated satellite storage yard or supply area to less than 1000 pounds in each location. By procedure, six cylinders are the maximum allowed in each of the three C-742 satellite storage locations and three full cylinders are maximum allowed in the C-350 supply area. The total amount of ClF_3 on site could exceed 3500 pounds, which does not require PSM coverage as long as no more than 1000 pounds is stored together in one location. The incorrect ClF_3 weight in this procedure was pointed out to facility personnel for resolution.

The inspectors reviewed procedure CN-27, Revision 1, "Handling and Storage of Chlorine Trifluoride, Fluorine, and Mixed Gases." The procedure contains detailed steps, caution statements, references to JHAs, and appears to be adequate to safely handle and store ClF_3, F_2 and mixed gas.

During review of the operation of the C-400 facility #5 dissolver, it was noted that the bulk nitric acid delivery system, described in Section 3.8.5.1-3 of the SAR, was out of service due to a break in the dip leg on the 11,000 gallon bulk storage tank. The current method of adding Nitric acid to the dissolver required the operators to use 2 liter bottles of 70% nitric acid. Additionally it was observed that this addition method, was not mentioned in the procedures CP4-CU-CH2113, Revision 1, "Uranium Precipitation for Discard" or CP4-CU-CH2351, Revision 0, "Nitric Acid Handling, C-400". This was pointed out to the certificatee who initiated Problem Report PR-CO-97-1972 and a "Procedure Hold" on both of the procedures.

The accident analysis section of the SAR (Section 4.3.7.1.7) states that the partial pressures of the nitric acid and water used at the Paducah plant are 0.56 and 14.4 mm Hg, respectively, at 85 degrees F. According to Perry's Chemical Engineering Handbook, Sixth Edition, this equates to 50% nitric acid. Section 1.1 of the facilities emergency plan states that nitric acid at 33% concentration is delivered by truck and is stored in an 11,000 gallon tank located outside of the C-400 building. Discussions with plant personnel and a review of procurement documents indicate that 70% nitric acid had been used in this system and is currently being stored in the 11,000 gallon tank. The existing plant conditions regarding the use of Nitric acid in the C-400 building appear to be outside of the documented accident analysis. The Justification for Continued Operation (JCO) for Issue 2 of the Compliance Plan, "Update the Application Safety Analysis Report," states that USEC will address risks more severe than those submitted in the SAR in accordance with 10 CFR 76.9(b) and 10 CFR 76.68. Therefore, the requirements state that a 76.68 determination will need to be performed prior to nitric acid use, and the completion of this determination as well as the resolution of the procedure hold and problem report, will be reviewed during a future inspection and tracked as **Inspector Followup Item (IFI) No. 97-202-01.**

c. Conclusions

The procedures that were reviewed were adequate, except where noted, and included appropriate precautions, warnings and safety equipment requirements for expected chemical hazards.

The SAR does not adequately reflect the concentration of nitric acid that is currently used in the C-400 building. As of the end date of this inspection, the procedures used in nitric acid handling had been placed on hold.

3.0 Detection and Monitoring (88060)

a. Inspection Scope

The inspectors reviewed the detection and monitoring program to ensure that the facility has detection and monitoring devices available to alert plant personnel of leaks involving the highest risk chemicals on site, and that calibrations and appropriate functional tests of the detectors and monitors are carried out, as required.

b. Observations and Findings

UF_6 Process Gas Leak Detectors

The inspectors reviewed the records for the functional tests for the feed and tails withdrawal (C-333A and C-315) UF_6 Process Gas Leak Detectors (PGLD). The successful completion of these functional tests are Technical Safety Requirements (TSRs). In the cascade, UF_6 PGLD are only tested for equipment that is operating above atmospheric pressure (TSR Surveillance Requirement 2.4.4.1-2) and during the inspection, only parts of the C-333 cascade building were operating above atmospheric pressure. Based on a review of records, tests were conducted in accordance with the TSR surveillance requirements for all detectors.

Fluorine detectors at C-410D and C-410K

During a review of the detection and monitoring of fluorine, it was noted that the alarms for C-410D and C-410K produce a local alarm at C-410K (C-410K horn and blue flashing light outside building) and a remote alarm at the C-400 office (to a computer terminal, which is only manned during dayshift). The previous fluorine generation facility (prior to 1994) would send an alarm to the C-300 Building "Central Control Room." A decision was made not to connect the new fluorine supply (C-410K) alarms to C-300. This practice is different from the alarm for the ClF_3 storage area C-350. The alarm for the C-350 area sends a signal to both the C-335 Cascade building Area Control Room (ACR) and the C-300 building. This difference was pointed out to the certificatee and the question was asked why there were different alarm locations for these two gases when both are equally toxic to humans (Immediate Danger to Life and Health (IDLH) of 20 ppm for ClF_3 and 25 ppm for F_2). At the end of the inspection, engineering was evaluating the technical basis for this system not alarming at the C-300 building. This evaluation will be reviewed during a future inspection and will be tracked as **IFI 97-202-02**.

Also, the inspectors questioned the accuracy of the computed program used in the C-400 office to calculate pounds of F2 in the storage tanks. The inspectors reviewed the April 29, 1997, letter to Mr. Vernon Shanks discussing the algorithm utilized by

C-400 fluorine computer to calculate C-4100 fluorine tank inventory. These calculations are based on sound engineering principles and seem to adequately calculate pounds of fluorine. However, the transfer of this information to the computer code and any control of the computer code had not been documented. The review of the actual computer code and any software control measures will be reviewed during a future inspection and tracked as **IFI No. 97-202-03**.

ClF_3 detectors at C-350

Existing procedures require a manual hydrofluoric acid (HF) level determination to be performed by plant personnel prior to entering the C-350 building. This measurement is required because although the existing system is functioning and calibrated to ensure accuracy, the system is old and has been deemed unreliable. Upgrades to the existing detection system have been initiated. The completion of the installation of the new system will be reviewed during a future inspection and tracked as **IFI No. 97-202-04**.

Chlorine leak detectors

During tours of the chlorine systems the inspectors noted that all calibration stickers reviewed were up to date and current. Inspectors reviewed functional test records for previous year, and no problems were identified.

c. Conclusions

The detection and monitoring program is functioning and functional tests were performed per the applicable requirements.

4.0 Training (88061)

a. Inspection Scope

The inspectors reviewed Paducah's chemical safety training program to verify that the plant has established a training program that: provides training on safety and health hazards, Material Safety Data Sheets (MSDSs), and personal protective equipment; identifies training requirements; qualifies instructors; measures performance of the program; maintains records; and, ensures that safe work practices are adequately covered.

b. Observations and Findings

The inspectors attended the Hazard Communication (HAZCOM) portion of the General Employee Training (GET) that is required every two years. Class handouts were clear and informative and could be used as a reference document for students when accessing MSDSs. The handout would be helpful because MSDSs are maintained on a computer database with only one hardcopy being maintained on the plant site. The

instructor provided practical examples of plant hazards and memory aids for remembering the chemical hazard diamond for health, fire and reactivity. The class provided useful information on general chemical hazards.

The inspectors reviewed procedure UE2-TR-TR1030, Revision 2, "Conduct of Training." This document provides guidance on the overall training program that includes training for individuals relied upon to operate, maintain or modify the GDPs in a safe manner. The Training Group reports to the Training Manager and is responsible for GET, Operations and Maintenance, Training Records, Training Instructor/Developer Qualification, Fire and Emergency Management Training, and other functional areas. The group interfaces with First Line Management and Subject Matter Experts to coordinate training development and implementation for functional areas. The Training Section Manager ensures that: event reports and lessons learned that effect training are incorporated into new or existing training modules; scheduling of initial, remedial and continuing/refresher training, and determines effect of procedure changes and configuration management changes on training materials.

The inspectors reviewed training modules, 102.01.11, "Use of Procedures", 601.20.05, Revision 0, "UF_6 Releases", and 601.06.05, "Chemical Treatment of the RCW". The inspectors also reviewed Instructor Guide 204.01.04, Revision 0, "Process Safety Management for Fluorine (F_2) and ClF_3 Systems Maintenance Overview." These modules appeared to be adequate in discussing chemical hazards, and most included a test to determine the knowledge of trainees.

Procedure UE2-PS-PS1031, "UE Policy and Procedure Control Process," requires that training review and approve plant procedures prior to issuance.

Additionally, the inspectors reviewed the training records for three members of the Training Department staff to ensure that they had been properly trained and were currently qualified. Training records for personnel working in the Warehouse Chemical Stores, an ACR operator, and a Recirculating Cooling Water (RCW) operator were also reviewed. Persons were asked about chemical hazards in their respective work areas. All were familiar with the chemical hazards in their work areas and were cognizant of where information could be obtained if they had questions on chemicals or chemical safety. No discrepancies in the training areas were noted.

c. Conclusions

The training program adequately addresses chemical safety hazards that are directly involved with or could effect the processing of licensed material. No discrepancies were noted.

5.0 Maintenance and Inspection (88062)

a. Inspection Scope

The inspectors reviewed the maintenance program to determine whether the certificatee has developed maintenance procedures and schedules and whether they are being followed. This program should identify the applicable safe work procedures and practices such as lockout/tagout, safety and health work permits, release of equipment from operations, and the return of that equipment to service.

b. Observations and Findings

The Work Control (WC) group is a separate functional group from the Maintenance Department and is responsible for monitoring and scheduling preventive maintenance (PM) for TSR surveillances, and items that require calibration and/or functional tests.

The WC group is also responsible for creating the work packages that are required for Instrument Maintenance personnel to conduct authorized work. Discussions with Instrument Technicians indicated that no work is performed unless an approved work package has been provided. A work package was reviewed for the monthly functional test for fluorine detectors at C-410D and C-410K. The work package had a coversheet that contains work description, permits that are required, management reviews/approval, permission to start work, and a work accepted requirement. The package also contained an instruction sheet, a prior to job start check sheet that the first line manager must review, and a copy of the procedure used by the Instrument technicians who perform the work. The package appeared complete and contained signatures, as required.

The WC group also issues to the responsible functional group a Surveillance Task Sheet (STS) that identifies the equipment or system that is due for service or PM. After the work package has been completed, the STS must be signed by the Operations Area Manager and returned to the WC group where this information is entered into the Computerized Maintenance Management System, which is a computer database that keeps tracks of items that require service.

The inspectors inquired if there was a backlog of items on PM list. First Line Supervisors with the Instrument Maintenance group indicated that a PM backlog does exist. Based on the inspectors observations and review of records, there is not any evidence that the UF_6 Process Gas Leak Detection TSR surveillances or functional tests on ClF_3, F_2, or Cl_2 have been missed during the past 12 months.

c. Conclusions

The Preventive Maintenance program does control and schedule the required maintenance of alarms used to monitor hazardous chemicals used at the facility. The work package issued by the Work Control group appears to adequately address safe work practices.

6.0 Site Wide Safety Practices (88059)

a. Inspection Scope

The inspectors reviewed the program for Job Hazard Analysis (JHAs).

b. Observations and Findings

The following JHAs were randomly selected and reviewed because of their chemical hazard potential:

- JHA G-4, "Handling and Storage of ClF_3, Mixed Gas and F_2," dated 7/11/95;
- JHA G-7, "Treatment of Process Equipment with Mixed Gas and F_2," dated 5/10/95;
- JHA H-2, "Operation of Chlorine Feed Systems at RCW Pumphouses," dated 6/24/92; and
- JHA H-11, "Sulfuric Acid Handling," dated 6/24/92.

According to procedure CP2-SH-IS1057, Revision 0, "Job Hazard Analysis Program," dated 3/27/97, the purpose of this procedure is to provide methods and techniques to analyze each job or operation to determine potential hazardous conditions. Additionally, the procedure is intended to provide a systematic means of converting the experience and knowledge of those who supervise and those who perform the work into safe job practices. The procedure also requires Group Managers' to review and approve each JHA originating in their group for accuracy and completeness.

All of the JHAs mentioned above, contained an inaccurate reference or obsolete practice. It was pointed out that although the inconsistencies were of low safety significance, it was clear that the JHA program defined in procedure CP2-SH-IS1057 was not being adequately implemented on site. Based on these deficiencies, Mr. Steve Polston and his counterpart at Portsmouth committed to upgrade the JHA programs at both facilities. Management also committed to reviewing JHA books and removing obsolete JHAs, identifying key requirements in JHAs, and incorporating them into procedures, and deleting references to JHAs in procedures. To implement this program upgrade Paducah will convert procedure CP2-SH-IS1057, "Job Hazard Analysis Program" to a UE2 level procedure that will apply to both Paducah and Portsmouth. Progress on resolving these issues will be reviewed during a future inspection and will be tracked as Inspector Follow up Item **IFI 97-202-05**.

c. Conclusion

The existing JHA program was not being maintained, as required by plant procedures. Based on the deficiencies noted by NRC, the management at both GDPs committed to review and upgrade their JHA programs.

MANAGEMENT MEETINGS

Exit Meeting Summary

Inspectors met with PGDP management representatives throughout the inspection. The exit meeting was held on April 18, 1997. No classified or proprietary information was identified. The following is a list of exit meeting attendees:

S. Polston, USEC/LMUS
W. Sykes, USEC/LMUS
K. O'Brien, NRC/SRI/PGDP
J. Jacobson, NRC/RI/PGDP
G. Smith, NRC/NMSS
D. Stout, NRC/NMSS
L. Albritton, USEC/LMUS
R. Everett, USEC/LMUS
S. Shell, USEC/LMUS
D. Snow, USEC/LMUS
G. Giltner, USEC/LMUS
S. Gunn, USEC/LMUS
V. Shanks, USEC/LMUS
K. Potter, USEC/LMUS
R. Gross, USEC/LMUS

LIST OF ACRONYMS USED

ACR	Area Control Room
CL_2	Chlorine
ClF_3	Chlorine Trifluoride
F_2	Fluorine
GET	General Employee Training
GDP	Gaseous Diffusion Plant
HF	Hydrofluoric Acid
IDLH	Immediate Danger to Life and Health
IFI	Inspector Follow-up Item
IX	Ion Exchange
JCO	Justification for Continued Operation
JHA	Job Hazard Analysis
MSDS	Material Safety Data Sheet
OP	Operating Procedure
PGDP	Paducah Gaseous Diffusion Plant
PGLD	Process Gas Leak Detector
PSM	Process Safety Management
RCW	Recirculating Cooling Water
SAR	Safety Analysis Report
STS	Surveillance Task Sheet
TSR	Technical Safety Requirement
UF_6	Uranium Hexafluoride
WC	Work Control