

U. S. NUCLEAR REGULATORY COMMISSION

REGION III

Docket No. 70-7001

Observation Report No. 70-7001/96004 (DNMS)

Facility Operator: United States Enrichment Corporation

Facility Name: Paducah Gaseous Diffusion Plant

Location: 5600 Hobbs Road
P. O. Box 1410
Paducah, KY 42001

Dates: June 26 through August 19, 1996

Inspectors: K. G. O'Brien, Senior Resident Inspector
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EXECUTIVE SUMMARY

United States Enrichment Corporation Paducah Gaseous Diffusion Plant NRC Observation Report 70-7001/96004 (DNMS)

Authority Statement: The Department of Energy (DOE) and the Nuclear Regulatory Commission (NRC) have agreed to cooperate to facilitate the NRC obtaining information and knowledge regarding the gaseous diffusion plants and the United States Enrichment Corporation's (USEC) operation thereof through observation/inspection activities during the interim period before the NRC assumes regulatory responsibility. This report is a summary of NRC observations for the period stated. Each of the observations was communicated to the DOE Site Safety Representatives during and at the end of the observation period.

All items were discussed and reviewed with the DOE Site Safety Representatives to allow for their future followup and evaluation, as they deem appropriate. The inspectors determined that the facility continued to operate in a safe manner. An Executive Summary follows:

Plant Operations

- Continuing weaknesses were observed in the area of operability assessments.
- Weaknesses in operations contributed to the temporary loss of product withdrawal capabilities; product stream enrichment beyond administrative limits; and the development of an inappropriate valve lineup for the movement of enriched materials.

Maintenance and Surveillance

- Safety system surveillance procedure weaknesses led to the conduct of unnecessary maintenance and the incorrect recording of performance data. Non-rigorous review of safety system surveillance data concluded with the inappropriate return to service of a safety system. As a result, a safety system was maintained out of service longer than the time necessary to perform the required surveillance.
- Untimely and ineffective implementation of the maintenance work control process contributed to work arounds in response to a non-functioning lube oil pump.

Engineering

- Management conducted an internal Safety System Functional Inspection of the autoclaves which appeared effective at identifying issues requiring resolution in order to clarify both the system design bases and current operational practices.

- Weaknesses in the development and control of some engineering activities resulted in the conduct of an incomplete engineering surveillance and contributed to the temporary loss of Building 310 product withdrawal capabilities.

Plant Support

- Emergency Plan personnel accountability procedure changes were incorrectly implemented such that some necessary training was not conducted and changed information was not incorporated into some corollary documents.

REPORT DETAILS

I. Operations

01. Conduct of Operations¹

01.1 General Comments

The inspectors observed selected activities to confirm that the facility was being operated safely and in conformance with guiding programs and procedures. These activities were confirmed by direct observation, facility tours, interviews, discussions with management and staff, and review of facility records.

01.2 Operability Assessments

a. Inspection Scope

The inspectors reviewed several operability assessments made during the observation period. The assessments involved the offsite public warning system, the feed autoclaves, and the product withdrawal Normetex pumps.

b. Observations and Findings

1. Offsite Public Warning System

On August 3, 1996, during the conduct of routine periodic testing, the plant staff identified problems with the public warning system. Specifically, some warning sirens failed; 1) daily polling, a test of system electronics between the plant and the sirens, and 2) the monthly operational test, a three minute, full sounding of the sirens.

Following each failure, instrument maintenance (IM) staff evaluated the involved sirens to determine the failure cause. Corrective actions were taken to address identified problems and post maintenance testing (PMT) was performed. The PMT for polling failures was a repeat of the required polling process. The PMT for these operational failures was a polling test and a public address test. The inspectors noted that the PMT for monthly testing failures may not ensure that the system is operable. Specifically, the PMT was not a repeat of the monthly operational test and plant data indicated that some recent successful polling tests were immediately followed by failed monthly operational tests.

¹Topical headings such as 01, M8, etc., are used in accordance with the NRC standardized inspection report outline contained in NRC Manual Chapter 0610. Individual reports are not expected to address all outline topics, and the topical headings are therefore not always sequential.

When notified of these events, the inspectors inquired as to the compensatory measures required for a non-functioning public warning siren and the basis for use of the polling/growl test as an acceptable PMT. The staff indicated that specific compensatory measures were not required for occasions when the system was not immediately returned to service. The staff also indicated that the PMT was chosen based upon past practice.

The inspectors reviewed the current site emergency plan procedure CP4-SF-SF1102, "Operation and Testing of the Public Warning Sirens", Revision 0, Change B, and noted that the procedure did not include compensatory measures for a non-functioning system. This approach appeared inconsistent with the system's public warning function, as described in the site emergency plan. The procedure did include acceptance criteria for the monthly operational testing; however, these criteria were not used following maintenance trouble-shooting of the system on August 3, 1996. Although aware of this conflict, the plant declared the system functional later that same day.

During subsequent discussions with the staff, the inspector was informed that the operational-failure PMT was chosen so as to avoid offsite notifications. Specifically, plant procedure CP-EP-EP5056, "Emergency Notifications," Revision 0, required local radio station and the county government notifications for non-routine activations. Such a non-routine activation would have been required to perform the monthly operational test outside of the normal testing timeframe.

2. Feed Autoclave Vacuum Valve

On August 12, 1996 during feeding operations in Building 333A, the staff observed steam emitting from the 4S autoclave vacuum relief valve. The valve served as a vacuum break for cool down operations and as a containment isolation valve in the event of a release of uranium hexafluoride within the autoclave. Based upon the observed steam emissions, the staff determined that the valve may not be able to perform its intended safety function, declared the autoclave inoperable, and initiated shutdown of the autoclave.

The inspectors noted that current DOE Operating Safety Requirements (OSRs) and the NRC Technical Safety Requirements (TSRs) both allowed the current heating cycle to continue, provided the redundant containment isolation valve was operable. The inspectors determined that the staff was not fully aware of and did not take the OSR allowance into consideration at the time the autoclave was declared inoperable.

Following autoclave shutdown, the plant declared the containment function inoperable pending repairs/replacement of the involved vacuum relief valve.

3. East Normetex Pump

On August 15, 1996, the residents reviewed the recently completed east Normetex pump annual safety system surveillance data and identified some inconsistencies. Specifically, the inspectors noted that the pump was declared operable and deemed available for service; however, two high discharge pressure safety system components were not within the procedure acceptance criteria. The inspectors highlighted these findings to facility and plant management. Subsequently, management reviewed the findings, noted their inconsistency with the "as-left" acceptance criteria, and determined that the surveillance was not acceptable. Following this review, the Plant Shift Superintendent (PSS) declared the pump inoperable and initiated actions to recalibrate the system.

During followup discussions, the inspectors noted that management was not fully aware that the original surveillance procedure "as-left" values were within the acceptance range for "as-found" data. Management also was not aware that the pump was still within the acceptance window for the last full calibration in 1995. Consideration of these facts, which indicated that the pump was still operable, and the current plant status, which indicated decreased operations flexibility, may have resulted in a decision to delay the system recalibration.

c. Conclusions

In these cases, management and staff actions indicated a continuing weakness in the area of operability assessments. A complete understanding of the pre-defined acceptance criteria for declaring systems either operable or inoperable was not evident. In addition, actions in response to the siren monthly testing failures indicated a willingness to work around an operability question.

01.3 West Normetex Pump Trip

a. Inspection Scope

At 10:25 p.m. on August 14, 1996, the west Normetex product withdrawal pump tripped on high discharge pressure. Concurrent with the trip, the east Normetex pump was out of service for surveillance and minor maintenance. This placed the plant in a full recycle mode. As a result, an unplanned increase in the cascade enrichment occurred. The inspectors reviewed the circumstances leading up to the event, the trip, and the immediate actions taken in response to the changing plant conditions.

b. Observations and Findings

Through a review of logs and discussions, the inspectors determined that prior to the trip the product withdrawal facility was operating in an unusual configuration. Specifically, the facility had only one of the two product withdrawal pumps operational, the side accumulator was being used for temporary product storage during cylinder changes, and only one of two withdrawal positions was available. This combination of conditions was the result of a number of operations, maintenance, surveillance, and engineering issues converging at a single point in time.

The inspectors noted that no single operations entity appeared to have considered the impact of the concurrent activities on facility safety prior to authorizing their start. Some examples included:

- operations accepted level indicator equipment deficiencies and weak staff log keeping practices which prevented real time knowledge of either product or side accumulator levels;
- operations authorized engineering modifications to the number two condenser, preventing use of the normal product accumulator, without provisions to elevate staff awareness of and sensitivity to the much smaller side accumulator volume;
- operations approved the conduct of routine annual calibrations and minor maintenance to the east Normetex pump concurrent with other equipment outages which significantly limited their ability to respond to anomalies and to monitor normal operations during cylinder changes, and;
- operations accepted an informal engineering equipment functionality position which was contrary to a previous PSS operability determination for the number three withdrawal position.

In addition, the inspectors determined that operations staff, the cascade coordinator, and the plant shift superintendent did not question apparent anomalies in plant operations leading up to the trip. Some examples included:

- the facility staff and cascade coordinator did not question the bases for maintaining the number three withdrawal position out of service though a previous PSS assessment declared it operable, and;

- the facility staff did not question slow completion of the annual surveillance until approximately eight hours after it should have been done.

At the time of the pump trip, the operators noted some anomalies in control room alarm indications. During their response to the trip and investigation of these anomalies, the staff was able to identify that the trip most likely occurred as a result of the overfilling of the side accumulator. This resulted in a back-pressure on the pump discharge in excess of the operational trip set-point. This set-point was slightly less than the safety system trip set-point; therefore, a safety system actuation did not occur. The bases for the operational trip and its relationship to the safety system set-point were issues identified for resolution in the NRC Compliance Plan.

Positive verification of trip cause was hindered by the lack of real-time control room accumulator level indication, weak product cylinder status log keeping, and tripping of the Normetex pump lube oil pump. The latter item was further compounded by an indication relay failing mid-position. As a result, the staff was unable to take timely corrective actions for pump restart.

During the time that both Normetex pumps were inoperable, the cascade continued to enrich the product stream. In an effort to control the situation, management initiated efforts to route material from the top of the cascade to storage drums in other buildings. A valving order was prepared for this activity using a standing procedure. Although the order was never fully implemented, due to restart of the west Normetex pump, the Department of Energy (DOE) Site Safety Representative (SSR) reviewed the order and determined that it was not consistent with the procedural requirements. Implementation of the order would have resulted in material enriched greater than one percent being sent to plant areas not currently authorized for these materials.

c. Conclusions

Weaknesses in Building 310 operations and operation's control of facility activities significantly contributed to the temporary loss of all product withdrawal capabilities; enrichment of the product stream beyond the administrative limit, and; the development of a valving order inconsistent with current criticality controls.

II. Maintenance and Surveillance

M1. Conduct of Maintenance and Surveillance

M1.1 General Comments

During routine tours of plant facilities, the inspectors observed the general material condition of plant equipment and some in-progress maintenance activities. The inspectors also reviewed some maintenance records and maintenance-related nonconformance reports. The focus of the observations was to assess the overall performance of maintenance activities relative to approved procedures, guides, and industry codes or standards.

M3.1 East Normetex Pump Annual Surveillance

a. Inspection Scope

During August 13-15, 1996, the plant staff conducted the annual product withdrawal facility east Normetex pump safety system surveillance. The inspectors discussed the evolution with the involved staff and reviewed the surveillance materials.

b. Observations and Findings

The inspectors determined that the procedure pre-authorized some maintenance activities. The staff indicated that these activities would be in response to the surveillance results and did not require further operations approval or notification, which is normally required for maintenance activities. During this surveillance, maintenance staff twice initiated the replacement of a system component based upon surveillance results. Through followup discussions with engineering staff, the inspectors determined that these maintenance activities were necessitated by a procedure error vice a failed component. The staff did not make this observation until after the system was out of service for approximately five times the normal surveillance time period. This time delay contributed to the forced recycle operations discussed in Section 01.3.

During review of the surveillance results, the inspectors noted that some of the "as-left" values were inconsistent with the procedure acceptance criteria. Specifically, some of the values were outside of the "as-left" acceptance range, though within the "as-found" acceptance range. A full review and acceptance of the results by both the craft and operations management occurred prior to the inspectors' review.

The inspectors informed management of the apparent discrepancies. As a result, the management elected to declare the pump inoperable and to repeat the surveillance. The second set of "as-found" data were within the allowable "as-left" ranges. The results appeared

to indicate that a simple misrecording of data had occurred. The inspector noted that the procedure structure included some weaknesses which could have facilitated this error.

c. Conclusions

Weaknesses in a safety system surveillance procedure contributed to the conduct of an unmonitored activity, the performance of unnecessary maintenance, and the incorrect recording of safety system performance data. Non-rigorous operations and maintenance reviews of safety system surveillance performance data allowed a pump to be inappropriately returned to service.

M3.2 Building 337 Lube Oil Pump Replacement

a. Inspection Scope

On August 12, 1996, the plant experienced problems with a Building 337 cascade lube oil pump motor necessitating its replacement. The inspectors followed the work and management's handling of the associated issues.

b. Observations and Findings

On August 13, 1996, during the morning turnover meeting, the plant PSS informed management of problems experienced the previous night with a Building 337 lube oil pump motor. The PSS also indicated that repair and replacement of the motor had been declared an "emergency" evolution. This designation was based upon PSS concerns that failure of the redundant lube oil motor/pump could result in the prompt shutdown of a portion of the cascade. Prompt, unplanned cascade shutdowns have the potential to cause problems during restart including some very limited outgassing of UF₆.

As a followup to the morning meeting, the inspectors reviewed the timing and status of the evolution. The inspectors noted that Building 337 logs indicated that the motor tripped at approximately 3:00 p.m. on August 12, 1996 and that electrical maintenance (EM) was dispatched to trouble-shoot the occurrence. As a part of these efforts, a maintenance service request was initiated and proper permits/tagouts were developed and implemented. At approximately 10:40 p.m., trouble-shooting and associated testing was completed. Operations attempted to restart the motor; however, this effort was unsuccessful. The inspectors noted that the logs indicated a shift, at this point, in efforts. The new focus was to identify a replacement motor and to remove the installed equipment.

At 2:10 a.m. on August 13, 1996, the PSS declared the evolution "emergency" maintenance and authorized removal of the motor and its transport to the motor shop for rebuilding. Rebuilding was scheduled to begin on the day shift. The PSS indicated that motor rebuilding was necessary due to the staff inability to locate an acceptable onsite replacement.

During followup discussions with the PSS, the inspector was informed of perceived timing difficulties, as a result of maintenance work process requirements, that would delay removal and transport of the motor for rebuilding. Specifically, the PSS considered the time required to develop and implement the work package too long. Factors considered by the PSS in his decision included: 1) the low safety significance for removal and transport of the motor and; 2) the perceived high safety significance associated with an unplanned shutdown of a portion of the cascade.

During a further review, the inspectors determined that the original maintenance service request, initiated after the motor first tripped, was available for use by the PSS to remove the motor. However, some authorization signatures had not been obtained at the time of the "emergency" declaration. In addition, management indicated that a replacement motor was located onsite approximately eight hours after the "emergency" declaration.

c. Conclusions

The PSS' declaration of the motor replacement evolution as an "emergency" activity was not consistent with the equipment's lack of safety significance or the minimal safety consequences of redundant equipment failure. Untimely and ineffective implementation of the maintenance work control process contributed to the use of a work around, the declaration of the evolution as an emergency activity.

III. Engineering

E1. Conduct of Engineering

E1.1 General Comments

Throughout the observation period, the inspectors observed facility engineering activities, particularly the engineering organization performance of routine and reactive site activities, including identification and resolution of technical issues and problems.

E1.2 Autoclave Safety System Functional Inspection (SSFI)

a. Inspection Scope

During the inspection period the plant staff completed an internal Safety System Functional Inspection (SSFI) of the feed and sampling autoclaves. The inspectors monitored the progress of the internal inspection and reviewed some results.

b. Observations and Findings

The inspectors met with the SSFI team and discussed some of the SSFI findings. The inspectors noted that each of the findings were evaluated, at the time of discovery, for safety significance and were recorded in the problem reporting system. Based upon a sampling review of the findings, the inspectors determined that the inspection was broad-based and of sufficient depth to identify safety issues. The inspectors noted that a majority of the issues were related to weaknesses in the current autoclave technical design bases.

One SSFI item raised some immediate safety questions. The item involved potential weaknesses in original "design basis" accident calculations and the resultant impact on the autoclave shell and gasket's ability to perform their intended function. In response to the item, engineering staff developed further background information which appeared to support continued operations consistent with the guidance of NRC Generic Letter 91-18. The inspectors and the DOE Site Safety Representative reviewed the information and had no further safety questions.

c. Conclusions

Management's conduct of an internal autoclave SSFI was a positive initiative focused on clarifying the bases for both original system design and current plant operations. Prompt evaluation, tracking, and resolution of the developed issues was evident based upon a sampling inspection.

E1.3 Criticality Accident Alarm System (CAAS) Audibility Testing

a. Inspection Scope

In an effort to resolve a number of past CAAS design and operability issues, plant staff initiated an audibility mapping program. During the observation period, the inspectors were briefed on and evaluated these efforts.

b. Observations and Findings

The CAAS system engineer briefed the inspectors and the DOE SSRs on their efforts to resolve a number of outstanding CAAS issues. During the discussions, the inspectors were informed of an ongoing effort to quantify CAAS horn sound levels throughout the plant. The system engineer provided an overview of the program and indicated that infield activities were being performed by site industrial hygiene personnel.

As a result of the briefing, the inspectors discussed the process with the industrial hygiene staff and engineering management. Through these discussions, the inspectors determined that the current program was not being conducted per an engineering evaluation or using required procedures. In addition, the inspectors noted that the survey results may be technically insufficient to resolve the outstanding system performance issues. Specifically, sound levels were not recorded in some areas and the data collection process did not address the sound impacts of varying equipment operating loads or configurations. These items were discussed with the system engineer.

c. Conclusions

The CAAS audibility mapping program, undertaken to resolve system design and operability questions, was not rigorously developed, did not employ formal procedures to ensure consistent results, and did not consider all factors affecting the usefulness of data collected.

E1.4 Building 310 Engineering Work In Progress

a. Inspection Scope

As a result of the Normetex pump trip discussed in Section 01.3, the inspectors reviewed Building 310 engineering activities in progress.

b. Observations and Findings

The inspectors discussed with operations and engineering staffs, the amount and type of ongoing engineering work in Building 310. Active engineering work included:

- the resolution of operability concerns associated with the number 3 withdrawal position;
- the resolution of structural integrity issues associated with the UF₆ condenser piping;

- the resolution of long term equipment failures including the product and side withdrawal accumulator level indicators, and;
- the resolution of Normetex pump cooling system problems.

The inspectors reviewed the timing and operational impacts of these activities and noted that their concurrent execution placed the facility in a position of increased risk. Specifically, the time available for cycling withdrawal cylinders decreased to less than three hours, and the time during which only one withdrawal pump was available increased from four to thirty-six hours.

The inspectors determined that neither engineering nor operations staff was actively controlling the number or type of engineering activities occurring in the facility. In addition, the inspectors noted that the engineering products did not specifically include or provide to operations compensatory measures for either the individual or combined impact of ongoing activities.

In addition, the inspectors learned that some engineering and operations staff were aware of conflicting engineering/operation direction relative to routine use of the number three withdrawal position; however, no action was taken nor was the issue raised for resolution.

c. Conclusions

Weak engineering oversight of Building 310 engineering activities and engineering products, which did not include information to operations on their impact, contributed to the temporary loss of Building 310 product withdrawal.

IV. Plant Support

P3. Emergency Preparedness Procedures and Documentation

P3.1 Personnel Accountability

a. Inspection Scope

The inspectors reviewed the plant procedure, CP2-EP-EP5030, "Personnel Accountability," Revision 1, dated 5/31/96, to assess its application and implementation.

b. Observations and Findings

The inspectors reviewed the procedure changes and procedure control records to assess training requirements for the recent procedure change. The procedure change control records indicated that pre-implementation training was required. However, the

records did not identify which individuals or groups required the training. The procedure change package also did not include any evidence that the prerequisite training was conducted prior to the procedure effective date. Through discussions, the inspectors identified several individuals and some groups, affected by the procedure change, that were neither aware of nor had received training on the procedure. This was a repeat finding of a previous weakness in the procedure change process.

The inspectors also determined that the revised procedure information was not incorporated into the site access training manual used by NRC personnel for site specific training.

During a technical content review of the procedure, the inspectors determined that the building accountability process may not be achievable in that some personnel were not required to sign in and out of buildings.

c. Conclusions

Changes to the personnel accountability procedure were incorrectly implemented such that some necessary training was not conducted and information was not incorporated into some corollary documents. In addition, the current personnel accountability process did not appear achievable.

V. Management Meetings

X1. Exit Meeting Summary

The inspectors met with facility management representatives and the DOE Site Safety Representatives throughout the observation period and on August 19, 1996. The likely informational content of the observation report with regard to documents or processes reviewed was discussed. Information highlighted during these meetings is contained in the Executive Summary. No classified or proprietary information was identified.

PARTIAL LIST OF PERSONS CONTACTED

Lockheed Martin Utility Services (LMUS)

- * S. A. Polston, General Manager
- * H. Pulley, Enrichment Plant Manager
- * J. M. Brown, Engineering Manager
- * W. E. Sykes, Nuclear Regulatory Affairs Manager
- T. B. Hudson, Plant Shift Superintendent Manager

United States Enrichment Corporation

- * J. A. Labarraque, Safety, Safeguards and Quality Manager
- * J. H. Miller, Vice President - Production

United States Department of Energy (DOE)

- * G. A. Bazzell, Site Safety Representative
- * C. H. Booker, Site Safety Representative

Nuclear Regulatory Commission (NRC)

- * K. G. O'Brien, Senior Resident Inspector
- * J. M. Jacobson, Resident Inspector
- G. L. Shear, Fuel Cycle Branch Chief
- M. L. Horn, PGDP Project Manager

* Denotes those present at the routine resident exit meeting held on August 19, 1996.

Other members of the plant staff were also contacted during the observation period.

ITEMS OPENED, CLOSED, AND DISCUSSED

Opened

None

Closed

None

Discussed

None

Certification Issues

None