April 2, 2001

Mr. J. Morris Brown
Vice President - Operations
United States Enrichment Corporation
Two Democracy Center
6903 Rockledge Drive
Bethesda, MD 20817

SUBJECT: NRC OPERATIONAL READINESS REVIEW INSPECTION REPORT 07007001/2001-002(DNMS) (PADUCAH) AND NOTICE OF VIOLATION

Dear Mr. Brown:

This refers to the inspection conducted on February 20 through March 2, 2001, at the Paducah Gaseous Diffusion Plant. The purpose of the inspection was to evaluate the revised operational approach and the completed modification activities associated with the High Assay Upgrade Project (HAUP) to determine if the facility could operate safely with a maximum enrichment output of 5.5 weight percent (wt%) uranium-235. The enclosed report presents the results of this inspection.

This inspection was an examination of activities conducted under your certificate as they relate to safety and compliance with the Commission's rules and regulations and with the conditions of your certificate. Within these areas, the inspection consisted of selected examination of procedures and representative records, observations of activities, and interviews with personnel.

Overall, we concluded that your staff was acceptably completing HAUP activities. Appropriate procedures were used during the design review, installation, and testing of the modifications needed to support the HAUP. Your staff also was integrating the new modifications into the routine maintenance and surveillance programs. However, the inspectors identified multiple examples of your staff not following all of the requirements of your work control procedure.

Based on the results of this inspection, the NRC has determined that three violations of NRC requirements occurred. These violations were evaluated in accordance with the "General Statement of Policy and Procedure for NRC Enforcement Actions" (Enforcement Policy), NUREG-1600. The current Enforcement Policy is included on the NRC's web site at www.nrc.gov/OE. The violations are cited in the enclosed Notice of Violation (Notice) and the circumstances surrounding them are described in detail in the subject inspection report. The violations are being cited in accordance with Section VI.A.8.a of the Enforcement Policy because your staff failed to identify the violations. While your staff failed to identify the specific examples of work control issues cited, your Operational Readiness Review performed under the auspices of your Quality Assurance organization identified many of the precursors to these violations, namely, insufficient attention to detail in completing procedural requirements. Of

concern was the sheer number of examples identified by your QA organization. Given the examples the NRC identified in addition to your own, we conclude that effort is warranted to improve your staff's attention to detail in meeting NRC requirements.

For violations 1 and 2 in the enclosed Notice, the NRC has concluded that information regarding the reason for violations, the corrective actions taken and planned to correct the violations and prevent recurrence is already adequately addressed on the docket in the enclosed Inspection Report 07007001/2001-002(DNMS). However, for violation 3 associated with your work control process, a response is required. Your response should follow the instructions specified in the enclosed Notice when preparing your response, which should specifically address what actions you are taking to ensure that your staff complies with all provisions of required procedures. In addition, you should respond to violations one and two if the enclosed report does not accurately reflect your corrective actions or your position. In that case, or if you choose to provide additional information, you should follow the instructions specified in the enclosed Notice. The NRC will use your response, in part, to determine whether further enforcement action is necessary to ensure compliance with regulatory requirements.

In accordance with 10 CFR 2.790 of the NRC's "Rules of Practice," a copy of this letter, its enclosures, and your response will be made available electronically for public inspection in the NRC Public Document Room or from the Publicly Available Records (PARS) component of NRC's Agencywide Documents Access and Management System (ADAMS). ADAMS is accessible from the NRC Web site at http://www.nrc.gov/NRC/ADAMS/index.html (the Public Electronic Reading Room).

We will gladly discuss any questions you may have about this inspection. Please direct your questions to Monte Phillips, Acting Branch Chief, at (630) 829-9806.

Sincerely,

/RA/
Cynthia D. Pederson, Director
Division of Nuclear Materials Safety

Docket No. 07007001
Certificate No. GDP-1

Enclosures: 1. Notice of Violation
2. Inspection Report 07007001/2001-002(DNMS)

See Attached Distribution

DOCUMENT NAME: G\:Sec\PAD2001-002.wpd **See previous Concurrence**

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NOTICE OF VIOLATION

United States Enrichment Corporation
Paducah Gaseous Diffusion Plant

Docket No. 07007001
Certificate No. GDP-1

During an NRC inspection conducted from February 20 through March 2, 2001, violations of NRC requirements were identified. In accordance with the "General Statement of Policy and Procedure for NRC Enforcement Actions," NUREG-1600, Revision 1, the violations are listed below:

1. Technical Safety Requirement (TSR) 3.11.5 requires, in part, that where double contingency is not met, TSRs shall be established, implemented, and maintained to prevent criticality from occurring.

   Contrary to the above, as of December 6, 2000, the certificatee failed to establish, implement, and maintain TSRs on operations where double contingency was not met. Specifically the certificatee:

   a. failed to establish a TSR for intrusion of sprinkler water into open Planned Expeditious Handling (PEH) equipment when double contingency for this upset scenario had not been established;

   b. failed to establish a TSR for spacing violations involving removed PEH equipment when double contingency for this scenario had not been established; and

   c. failed to establish a TSR for disassembly of PEH centrifugal pumps in Building C-400 when double contingency for this operation had not been met.

   This is a Severity Level IV violation (Supplement VI). **(VIO 07007002/2001-002-01)**

2. Technical Safety Requirement 3.9.1 requires, in part, that written procedures shall be implemented to cover the programs specified and described in TSRs 3.11 through 3.19 and 3.23. TSR 3.11.1 states that a Criticality Safety Program shall be implemented and shall address procedure requirements. Step 6.1.5.B of Procedure CP2-EG-CF1030, "Q/AQ-NCS/AQ Item Identification, Documentation, and Control," Rev. 3, requires the use of Appendix B to this procedure to identify for control those structures, systems, or components (SSCs) credited with providing Q, AQ-NCS(Augmented Quality-Nuclear Criticality Safety), or AQ (Augmented Quality) functions.

   a. Section I.C of Appendix B requires that engineered SSCs that provide a double-contingency protection against an unplanned nuclear criticality, as defined by approved NCSE/NCSA, are identified as AQ-NCS.

   b. Section II.B.2.f of Appendix B requires that, if an alarm must function to induce operator action as described in the safety-related criteria, then the alarm sensing instrumentation and each component of the system that provides the alarm are bounded as AQ-NCS.

Contrary to the above:

a. As of December 6, 2000, the certificatee failed to identify a dike, a filtrate tank, and a dividing wall as AQ-NCS when these components and features were identified in the nuclear criticality safety approval NCSA 400-006 (for the Building C-400 Spray Booth) as providing double contingency protection against an unplanned nuclear criticality.

b. As of March 1, 2001, the certificatee failed to bound each component of the system that provides the alarm for a Normetex pump trip when the certificatee failed to bound the visual Alarm Window A1 as AQ-NCS. The alarm was to prompt operators in the C-310 Area Control Room to take action if the Normetex pump tripped as described in NCSE 041.

This is a Severity Level IV violation (Supplement VI). **(VIO 07007001/2001-002-02)**

3. Technical Safety Requirement 3.9.1 requires, in part, that written procedures shall be implemented to cover the programs specified in TSR 3.11 through 3.19. TSR 3.15 requires a Maintenance Program that addresses Work Control. The work control process is described in CP2-GP-GP1032, "Work Control Process."

a. Step 6.9.3 of CP2-GP-GP1032, Revision 5, states that work package revisions are required when a work package change alters scope, intent, method of performance, or post-modification test of the work package.

b. Step 6.10.3 of CP2-GP-GP1032, Revision 5, states that for modifications, Engineering approval is required for test start to ensure proper post-modification testing requirements are identified.

c. Step 6.10.4 of CP2-GP-GP1032, Revision 5, states that if, during performance of work, a post-modification test fails due to portions of work not being performed satisfactorily, then the service manager (SM) shall ensure that "FPMT" [failed post maintenance/modification test] is circled as a reason for rework on the work package task history form.

Contrary to the above:

a. During implementation of Work Order ZW0 0001746, from June 2000 to November 2000, plant staff failed to revise the work package prior to changing the method of performance when plant staff deviated from the work package and installed rupture disk block valve RDC1-BV-2 in horizontal piping instead of in vertical piping.

b. For Work Order Tasks R 9908680-01, R 0014323-18, and R 0014323-19, engineering approvals for test starts were given on February 2, 2000, for the first task and on January 12, 2001, for both the remaining tasks even though the installations were not complete and the tests could not start on those dates.

c. For Work Order Tasks R 0014323-19 and R 0014323-18, the SM failed to ensure those failed post maintenance tests that occurred on February 2, 2001, had “FPMT” circled as a reason for rework on the work package task history form.

This is a Severity Level IV violation (Supplement VI). **(VIO 07007001/2001-002-03)**

The NRC has concluded that information regarding the reasons for the first two violations, the corrective actions taken and planned to correct the violations and prevent recurrence, and the date when full compliance will be achieved are already adequately addressed on the docket by Inspection Report 07007001/2001-002(DNMS), enclosed. However, for the third violation, pursuant to the provisions of 10 CFR 2.201, the United States Enrichment Corporation is hereby required to submit a written statement or explanation to the U.S. Nuclear Regulatory Commission, ATTN: Document Control Desk, Washington, DC 20555, with a copy to the Regional Administrator, Region III, and a copy to the NRC Resident Inspector at the Paducah Gaseous Diffusion Plant within 30 days of the date of the letter transmitting this Notice of Violation. This reply should be clearly marked as a "Reply to a Notice of Violation" and should include for each violation: (1) the reason for the violation, or, if contested, the basis for disputing the violation or severity level; (2) the corrective steps that have been taken and the results achieved; (3) the corrective steps that will be taken to avoid further violations; and (4) the date when full compliance will be achieved. Your response may reference or include previous docketed correspondence, if the correspondence adequately addresses the required response. If an adequate reply is not received within the time specified in this Notice, an order or a Demand for Information may be issued as to why the license should not be modified, suspended, or revoked, or why such other action as may be proper should not be taken. Where good cause is shown, consideration will be given to extending the response time. You are also required to reply to the first two violations if the description in the inspection report does not accurately reflect your corrective actions or your position.

If you contest this enforcement action, you should also provide a copy of your response, with the basis for your denial, to the Director, Office of Enforcement, United States Nuclear Regulatory Commission, Washington, DC 20555-0001.

Under the authority of Section 182 of the Act, 42 U.S.C. 2232, this response shall be submitted under oath or affirmation.

Because your response will be made available electronically for public inspection in the NRC Public Document Room or from the Publicly Available Records (PARS) component of NRC’s document system (ADAMS), to the extent possible, it should not include any

personal privacy, proprietary, classified, or safeguards information so that it can be made available to the public without redaction. ADAMS is accessible from the NRC Web site at http://www.nrc.gov/NRC/ADAMS/index.html (the Public Electronic Reading Room). If personal privacy or proprietary information is necessary to provide an acceptable response, then please provide a bracketed copy of your response that identifies the information that should be protected and a redacted copy of your response that deletes such information. If you request withholding of such material, you must specifically identify the portions of your response that you seek to have withheld and provide in detail the bases for your claim of withholding (e.g., explain why the disclosure of information will create an unwarranted invasion of personal privacy or provide the information required by 10 CFR 2.790(b) to support a request for withholding confidential commercial or financial information). If safeguards information is necessary to provide an acceptable response, please provide the level of protection described in 10 CFR 73.21.

In accordance with 10 CFR 19.11, you may be required to post this Notice within two working days.

Dated this 2nd day of April, 2001

U.S. NUCLEAR REGULATORY COMMISSION
REGION III

Docket No:	07007001
Certificate No:	GDP-1
Report No:	07007001/2001-002(DNMS)
Licensee:	United States Enrichment Corporation
Facilities:	Paducah Gaseous Diffusion Plant
Location:	5600 Hobbs Road P.O. Box 1410 Paducah, KY 42001
Dates:	February 20, 2001, through March 2, 2001,
Inspectors:	M. P. Phillips, Senior Fuel Cycle Inspector (Team Leader) C. A. Blanchard, Senior Resident Inspector D. C. Morey, NMSS Senior Criticality Safety Inspector D. E. Roth, Fuel Cycle Inspector
Approved By:	M. P. Phillips, Acting Chief Fuel Cycle Branch Division of Nuclear Materials Safety

EXECUTIVE SUMMARY

United States Enrichment Corporation
Paducah Gaseous Diffusion Plant
NRC Inspection Report 07007001/2001-002(DNMS)

OVERALL SUMMARY

Overall, NRC concluded that the United States Enrichment Corporation (USEC) was acceptably completing High Assay Upgrade Project (HAUP) activities. Appropriate procedures were used during the design review, installation, and testing of the modifications needed to support the HAUP. USEC also was integrating the new modifications into the routine maintenance and surveillance programs. However, the inspectors identified multiple examples of USEC not following all of the requirements of work control procedure.

SAFETY OPERATIONS

Nuclear Criticality Safety

- The inspectors determined that supporting analyses reflected the current or proposed plant configuration, that underlying assumptions were adequate, and that controls were available and reliable for the proposed HAUP operations. Two violations were identified regarding the failure to have Technical Safety Requirements (TSR) for singly-contingent scenarios and the failure to identify equipment relied upon for criticality safety as Augmented Quality-Nuclear Criticality Safety (AQ-NCS.) Other than the violations, the inspectors did not identify any additional safety concerns affecting operations at higher assay during the Operational Readiness Review (ORR) of criticality safety. (Section 2.1)

Plant Operations

- The inspectors identified some isolated procedural issues involving level of detail, but concluded, for the most part, that procedures provided clear and understandable instructions. Additionally, the inspectors concluded that operators possessed a commitment and understanding for strict compliance with procedural actions. (Section 2.2)

FACILITY SUPPORT

Design and Modification Control

- The design and modification control program was sufficient to ensure that unauthorized and unapproved process modifications were not made. The programs and procedures to control modifications at the facility were acceptable. The guidance contained in the programs was sufficient to implement the design changes associated with the HAUP. (Section 3.1)

As-Built and Design Comparison

- The as-built configuration generally matched the design specifications, and the modifications for the HAUP were generally installed in accordance with the work packages. However, the inspectors identified a violation for an unreviewed field change and for an incorrect designation of the safety-related control room alarm. The violations were not safety-significant. (Section 3.2)

Operator Training

- The inspectors concluded that plant staff's training organizational structure was sufficient to facilitate the proper training of plant staff responsible for safe operation, maintenance, and modification of the GDP. The plant staff's training program provided reasonable assurance that the operators assigned to the various jobs were fully qualified. However, the effectiveness of the training was adversely affected by its execution. Plant staff were using an approved method to enhance operator confidence for infrequently performed evolutions. (Section 3.3)

Maintenance Program

- The procedures and controls used to incorporate the preventive maintenance and surveillance tasks into the maintenance program for the HAUP modifications were appropriate. The inspectors did not identify any issues based on a review of a sample of scheduled work. Plant staff used vendor information when available, and documented historical experience otherwise. Plant staff independently identified that maintenance tasks for the newly installed Normetex pump had not been developed. (Section 3.4)

SPECIAL INSPECTION TOPICS

Installation Controls

- The inspectors determined that HAUP modifications used appropriate materials of construction; that modifications were performed (with one exception) in agreement with design requirements; that maintenance or work procedures were invoked and followed; and that no significant deviations from design requirements were implemented. The inspectors determined that installation controls were adequate to assure that plant modifications were acceptably implemented to support safe operations at higher assay. (Section 4.1)

Post-Installation Testing and Controls

- Overall, post-modification testing was adequate, and complied for the most part with the appropriate procedures. Discussions showed that the tests considered design basis information such as accidents and system interactions. However, the inspectors identified two examples of a violation for failure to follow the work control procedure while authorizing or documenting post-modification tests. The two examples were not safety-significant. (Section 4.2)

Self-Assessment Capabilities

- The certificatee's internal operational readiness review (IORR) was comprehensive and evaluated all of the modifications that had been made to the facility to support the HAUP. Given the large number of findings it was apparent that a programmatic weakness existed with individuals not paying sufficient attention to detail to ensure all procedural requirements were implemented. Although the IORR did not identify deficiencies that were subsequently identified by the NRC's examination of the same work, the inspectors concluded that this was due to the IORR identifying so many issues during the associated surveillance of a modification that a few were missed given the volume of deficiencies identified. (Section 4.4)

Report Details

1.0 Background

The United States Enrichment Company (USEC), or certificatee, submitted an amendment request to change the enrichment output of the Paducah Gaseous Diffusion Plant (PGDP) from 2.75 wt. percent uranium-235 (U-235) to 5.5 wt. percent. The staff of USEC prepared a "High Assay Upgrade Project (HAUP)" for the modifications to the process, procedures, and plant design needed for the enrichment change. The purpose of this inspection was to evaluate the revised operational approach and the completed modification activities associated with the HAUP.

Several plant processes have been modified or revised because of the HAUP. The revised processes involved cascade process equipment, laboratory equipment and procedures, maintenance processes, onsite transportation activities, and radioactive waste processing and storage. The inspectors considered the risk and safety-significance of modifications, and based on that consideration, selected the following modifications for the focus of this inspection:

C-335 Cross Over;
Seal Exhaust/Wet Air Pump System Upgrades;
Building C-400 Spray Booth;
Building C-310 Normatex Pumps (Product Withdrawal);
Rupture disks for the C-310 Accumulators and Condensers;
30B Cylinder Handling Modifications at C-360;
C-360 Condensate Tank System Isolation;
Raw Cooling Water (RCW) Control Valve Replacement; and
RCW/Freon (R-114) Delta-P Switch Installation on Coolant Systems;

The Office of Nuclear Materials Safety and Safeguards reviewed some 55 Nuclear Criticality Safety Evaluations (NCSEs) and Nuclear Criticality Safety Analyses (NCSAs) deemed to be the most safety-significant. Inspections were conducted during the past year on the implementation activities associated with these NCSE or NCSA changes. This inspection focused on the modifications made to the facilities and equipment to support the HAUP, including changes made to the operational procedures for the facility. The inspection reviewed NCSE and NCSA upgrades only as necessary to resolve open issues from the previously-completed inspections in that area.

2.0 SAFETY OPERATIONS

2.1 Nuclear Criticality Safety

2.1.1 Scope

The inspectors reviewed plant preparations affecting criticality safety for the HAUP. The inspectors interviewed plant staff and reviewed documentation to identify dominant risks and dominant controls associated with the proposed equipment and operational changes. The inspectors completed a crosscutting review of NCSA/Es and their implementing procedures to determine that HAUP operations could be safely conducted within the scope of the facility safety basis as described by the Compliance Evaluation Report (CER), and that all NRC requirements were met.

2.1.2 Observations and Findings

CAAS Coverage

The inspectors determined that Criticality Accident Alarm System (CAAS) coverage was not affected by modifications supporting HAUP. All HAUP operations and modifications were performed in areas covered by the existing CAAS. The inspectors determined that the minimum accident of concern upon which CAAS coverage was based was not a function of assay and was, therefore, not affected by operations with increased enrichment. The certificatee performed a supporting calculation in SAR Section 4.4.5 using 5.0 wt% assay in a model that yielded 1.3×10^{18} fissions. Certificatee NCS staff performed a calculation with the same model using 5.5 wt% assay and demonstrated that a lower fission yield occurred (1.1×10^{18} fissions) because the critical configuration at the slightly higher assay occurred at slightly less mass. The inspectors determined that because this yield was in the same magnitude as the previous yield, the minimum accident of concern remained bounded and that CAAS coverage was not affected by the proposed assay change.

Operations Review

The inspectors reviewed readiness in the following areas that had been determined to be risk-significant during the license review of the HAUP amendment request or were identified by the inspectors to involve dominant risks:

- NCSA GEN-10, Removal and Handling of Contaminated Equipment from the Cascade at PGDP;
- NCSA GEN-12, Handling, Transport, Storage, Disassembly and Decontamination of Small Vacuum Pumps and Datum Pumps in C-400;
- NCSA GEN-10-01, Dry Air, Nitrogen Systems for Purging Off Stream/Shutdown UF_6 Equipment;
- NCSA GPS-19, Centrifugal Pump Disassembly at Building C-400;
- NCSA GPS-25, Disassembly and Repair of Process G-17 Valves;
- NCSA GEN-001, General Plant Limits for Activities at PGDP;
- NCSA 400-06, C-400 Spray Booth;
- NCSA 409-001, C-409 Uranium Precipitation;
- NCSA CAS-002, Operation and Maintenance of the UF_6 Cascade;
- NCSA CAS-011, Shutdown of the Cascade With and Without Inventory; and
- NCSA 310-003, NORMETEX Pumps Used for UF_6 Withdrawal.

Based on the completion of the above reviews during this inspection, and completion of reviews of HAUP-related NCSE/As during prior inspections, all areas the inspector identified as risk-significant for the HAUP have been inspected.

Removal and Handling of Large Cascade Equipment

The inspectors observed operations to remove a cascade compressor in Building C-310. The inspectors determined that NCSA controls in place for these operations were acceptable to assure criticality safety at operations with 5.5 wt% uranium-235 (^{235}U). The HAUP license review revealed several scenarios where double contingency to prevent a criticality was not clearly presented (See Section B.8 of Appendix B to the Compliance Evaluation Report (CER)). Subsequently, the NRC determined and the

certificatee agreed that the scenarios were only truly doubly-contingent for uncomplicated handling (UH) deposits, but were singly-contingent for planned expeditious handling (PEH) deposits. A PEH deposit was defined as a deposit that exceeds the safe mass limit under optimal conditions. The safe mass limit was the maximum quantity of ^{235}U that can be present and still assure that a criticality cannot occur. One example of a scenario that was singly-contingent was that associated with the intrusion of water into open Planned Expeditious Handling (PEH) equipment during fire sprinkler activation. These scenarios were not identified as singly-contingent in the controlling NCSA/Es and were, therefore, not addressed by a Technical Safety Requirement (TSR). TSR 3.11.5 requires, in part, that in those instances where double contingency has not been met, TSRs shall be established, implemented, and maintained to prevent criticality from occurring. The failure to address these scenarios with a TSR was an example of a violation of TSR 3.11.5 (**Violation (VIO) 07007001/2001-02-01a**).

The cause for the violation was the certificatee's reliance on the unlikeliness of the event (explosion of a cutting torch compressed gas cylinder as an example) to provide double contingency. Subsequently, the certificatee submitted amendment requests to modify TSRs 2.5.4.3 and 3.12 to address the above concerns. The NRC staff reviewed these TSRs. NRC licensing staff concluded that, based on the modifications made to TSRs 2.5.4.3 and 3.12, and the methodology for identifying PEH equipment, PEH equipment operations may be performed safely.

Dry Air and Nitrogen Systems

The inspectors observed dry air equipment in Building C-600 and discussed emergency actions with cascade operators and the Plant Shift Superintendent (PSS) in order to determine that NCS controls from NCSA GEN-001, General Plant Limits, were available and reliable. Dry air production supported the dominant NCS control on cascade operations, which was the prevention of moderator intrusion into cascade deposits. The dry air system was used to purge the cascade and could rapidly introduce moderator into large equipment containing fissile deposits. The inspectors determined that NCSA controls in place for these operations were available and reliable and were, therefore, acceptable to assure criticality-safety at operations with higher assay.

Building C-400 Decontamination Operations

The inspectors observed implementation of NCSA GEN-12 controls on the handling of small pumps and associated waste in Building C-400 during repeated walkdowns during prior inspections. The inspectors observed that the controls involved primarily handling and spacing of pumps and using proper waste containers. The inspectors determined that the controls in place were acceptable to assure criticality safety at operations with higher assay (5.5 wt% ^{235}U).

The inspectors observed the centrifugal pump and process G-17 valve disassembly areas at Building C-400 and discussed NCSA GPS-19 and GPS-25 controls with operators and NCS engineers. The inspectors noted that the license review of the HAUP amendment application had identified that centrifugal pump disassembly was not doubly contingent for PEH pump scenarios, including a scenario where fissile material rearrangement occurred in the pump and scenarios involving the introduction of various moderators into the pump. The certificatee agreed with the finding and proposed a TSR to address the singly contingent scenario. TSR 3.11.5 requires, in part, that in those instances where double contingency has not been met,

TSRs shall be established, implemented, and maintained to prevent criticality from occurring. However, the C-400 PEH equipment maintenance scenarios that were not doubly contingent were not identified and addressed by TSRs. The failure to identify and cover the singly-contingent scenario with a TSR was an additional example of a violation **(VIO 07007001/2001-02-01b)**. The cause of the violation was that the certificatee's staff had not clearly articulated the barriers provided to determine double-contingency, but had relied on a defense-in-depth argument to justify why the upset would not occur. Upon developing the NCSE/A in accordance with the certificatee's current program, the singley-contingent nature of the operation was recognized. The inspectors determined that, with the addition of the TSR, NCSA controls in place or proposed for Building C-400 decontamination operations involving the centrifugal pumps were acceptable to assure criticality safety at operations with higher assay.

Centrifugal compressor disassembly in C-400 was covered by NCSA GPS-019 for which license reviewers had identified safety concerns regarding single contingent operations. These safety concerns were left unresolved in the preliminary HAUP CER because the certificatee had committed to revise the NCSA to address the concerns. The inspectors reviewed the revised NCSA for acceptability with respect to operations at higher assay. The inspectors determined that the NCSA assumptions and required controls had been revised to reflect the specific concerns raised during the license review. The inspectors determined that parameters involved in centrifugal compressor disassembly were addressed and that the controls were acceptable to ensure safety during operations with 5.5 wt% ^{235}U. The inspectors performed a walkdown of the centrifugal compressor and G-17 valve disassembly areas in Building C-400 and determined that NCSA and TSR controls in place or proposed for these operations were acceptable to assure criticality safety at operations with higher assay.

C-400 Spray Booth

C-400 spray booth operations were identified during the license review as risk-significant for higher assay operations. The inspectors identified that the transfer of solution from the spray booth to uranium recovery operations was a dominant NCS risk. The inspectors walked down Building C-400 spray booth operations, interviewed operations and NCS staff, and reviewed modification work packages to determine the dominant controls on the risks of this operation. The dominant risk of the uranium solution transfer was that solution with assay higher than 1.5 wt% would be transferred to unsafe geometry vessels in Building C-400. The dominant control on this risk was identified as the interlocks on the transfer valve from the solution storage tanks. Two switches, which were too far apart to be turned by one person, must be turned simultaneously in order to place the valve in position to allow the transfer. The valve would then automatically return to a line-up for Building C-409 after being lined up to C-400 for ten minutes. The inspectors determined that these controls were adequately implemented to assure criticality safety at operations with higher assay.

The inspectors noted that modifications to the spray booth included removing the automatic spray system from the spray booth. This modification included physical isolation of the water heater and condenser from the spray booth but not the solution filters that were also no longer required. The filters were demonstrated to be safe for normal and upset conditions due to their size and so were left in the system with the valves closed. The inspectors questioned whether the potential for accumulation of fissile solution in these pipes and inadvertent transfer had been adequately reviewed.

The inspectors also questioned why analyses of the filters and upsets involving the filters were not included in NCSE 015. The certificatee responded that the filters and associated piping were analyzed in NCSA-015 as a normal condition filled with fissile solution. The inspectors determined during walkdowns that the abandoned filters were indeed filled with unknown solution. The inspectors determined that there was no reasonable path for the solution to become involved with routine solution transfers to uranium recovery and, therefore, there was no safety concern with the filters and piping. The inspectors determined that leaving the filters connected to the solution transfer system was bounded by existing analysis and controls.

NRC's licensing staff identified the omission of three items relied on for criticality safety from the list of Safety Related Items (SRIs) during the review of NCSA 400-006. The missing items were the nitric acid tank dike, the required spacing of ten feet between the open-top filtrate storage tanks and the spray booth storage tanks, and the dividing wall between the spray both equipment and the disassembly pit. The certificatee subsequently identified these items as SRIs and identified them as augmented quality-nuclear criticality safety (AQ-NCS) structures. Technical Safety Requirement (TSR) 3.9.1 requires, in part, that written procedures shall be implemented to cover the programs specified and described in TSRs 3.11 through 3.19 and 3.23. TSR 3.11.1 states that a Criticality Safety Program shall be implemented and shall address procedure requirements. Step 6.1.5.B of Procedure CP2-EG-CF1030, "Q/AQ-NCS/AQ Item Identification, Documentation, and Control," Rev. 3, requires the use of Appendix B to this procedure to identify for control those structures, systems, or components (SSCs) credited with providing Q, AQ-NCS, or AQ functions. Section I.C of Appendix B requires that engineered structures, systems, or components (SSCs) that provide a double-contingency protection against an unplanned nuclear criticality, as defined by approved NCSE/NCSA, are identified as AQ-NCS. However, as of December 6, 2000, the certificatee failed to identify a dike, a filtrate tank, and a dividing wall as AQ-NCS when these components and features were identified in the nuclear criticality safety approval NCSA 400-006 as providing a double contingency protection against an unplanned nuclear criticality. The failure to identify safety related equipment as AQ-NCS was a violation **(VIO 07007001/2001-02-02a)**. Subsequently, by letter dated December 26, 2000, the certificatee adequately responded by making the above SSCs AQ-NCS.

C-409 Modifications

The inspectors performed walkdowns at Building C-409 to evaluate modifications to the uranium recovery equipment in that facility. Modifications to the uranium recovery equipment in the facility consisted primarily of installation of ancillary equipment such as valves and instruments to implement new or modified criticality safety controls. The inspectors determined that NCSA controls in place for the uranium recovery operations were adequate to assure criticality safety during operations with higher assay.

Cascade Operations

As part of an effort to upgrade cascade operations to meet double contingency, the certificatee implemented broad changes to cascade operations. These changes included installation of sampling manifolds on the R-114 headers and the development

of a sample conditioner to facilitate moisture sampling of the R-114 system; installation of differential pressure (DP) switches on purge and evacuation RCW condensers and high speed cell condensers (29 areas); designation of motor load alarms, ammeters, and remote cell trip alarms as SRIs; and new controls to verify flowmeter flow rate, valve lineup, and R-114 level checks for the tops booster pump in Building C-310. The inspectors determined that the R-114 moisture sampling and RCW DP switch installations were risk significant for cascade operations due to the widespread procedure changes required for implementation. The inspectors performed walkdowns of these modifications in Building C-310 and determined that the new NCSA controls implemented by the RCW and R-114 modifications were adequate to assure criticality safety during operations with higher assay.

NCSA GEN-037

The preliminary HAUP CER discussed NCSA GEN-037, "Remediation of NCS Violations," with respect to the fact that it did not appear to meet the SAR criteria for an NCSA. The inspectors determined that recovery from upsets involving criticality safety controls has specific SAR and TSR requirements that do not now appear to defer to NCSA derived processes. The certificatee did not agree with this determination but did agree that the NCSA was not required for recovery from upsets because the information contained in the NCSA was available in the supporting NCSE-025 and the implementing procedure CP2-EG-NS1041 both of which may be used in compliance with existing SAR and TSR requirements. The certificatee agreed that withdrawal of NCSA GEN-037 would not affect use of the information to recover from upsets involving criticality safety. The certificatee agreed that the NCSA would be withdrawn within the next year.

Validation

Inspection Report 98-204 identified the following three-part weakness with the Paducah validation that was discussed in detail in the report and had not been formally addressed by the certificatee:

- USEC had not provided sufficient justification for the use of the 2% administrative margin above 5% assay.

- USEC incorrectly combined uncertainty with the administrative margin so that the total margin of safety was based only on bias plus administrative margin. PGDP TSR 3.11.4 required the total margin of safety to include bias, uncertainty, and the administrative margin.

- USEC had not provided sufficient justification for the selection and use of new benchmarks from 5 wt% to 9.83 wt%. The report should have justified the use of mixed oxide (MOX) criticals near 5 wt% and the UO_2 pin criticals above 5 wt% by an appropriate method such as neutron spectrum analysis.

The inspectors determined that the certificatee validation report, KY/S-221, had been revised twice since Inspection 98-204, and an additional revision was in preparation. The initial revision subsequent to Inspection 98-204, Revision 3, added data from a correlation study that demonstrated extremely low correlation between the validation benchmark data. The inspectors determined that the lack of correlation along with comparison of the Average Energy Group (AEG) parameter between benchmarks resolved the third issue by showing that none of the new criticals display a trend against

any key parameter and that the new criticals have a neutron spectrum that was reasonably related to the other criticals. At the request of the inspectors, certificatee staff recalculated the bias and upper safety limit (USL) with various criticals removed and demonstrated that no significant change resulted in the magnitude of the bias. The MOX criticals were used to extend the range of validation to 0.711 wt%, which does not impact calculation of dominant risk safety limits. The inspectors determined that the UO_2 pin benchmarks at 5.19 wt%, 7.01 wt%, 7.41 wt%, and 9.83 wt% were from the International Handbook of Evaluated Criticality Safety Benchmark Experiments, NEA/NSC/DOC(95)03/IV, and were acceptable for validating dominant risk safety limit calculations due to their clear resemblance to other uranium compounds.

Technical Safety Requirement 3.11.4 requires an USL of 0.9634. The revised validation report Table 10 showed the USL resulting from revised validation was well within this limit. Additional data provided relating benchmarks to the parameter's AEG, and moderator to fissile isotope ratio (H/X) provided additional justification of the 2% administrative margin. Because the minimum USL described in the validation report was 0.9652, the inspectors concluded that the total administrative margin resulting from the current TSR was 2.18 percent, which was adequate for safe operations up to 5.5 wt% and resolved the first issue.

The inspectors noted that the revised validation report contained a detailed description of the confidence interval method based on the single point or "collapsed" USL statistical derivation that certificatee NCS staff used. The collapsed method was used because the validation correlation study showed no trends with respect to key parameters. The inspectors determined that the confidence interval or "band" adequately incorporated required uncertainties thereby resolving the second issue. The validation was adequate to support NCS limits and controls at operations with higher assay.

Near Term Plant Changes

The inspectors interviewed plant staff and reviewed NCSA/Es and their implementing procedures to identify any additional failure mechanisms involving dominant risks associated with higher assay operations that had not previously been identified. The inspectors identified processes that would be added or changed immediately subsequent to HAUP implementation in order to determine that all higher assay safety issues have been effectively identified and addressed and to identify any additional failure mechanisms associated with higher assay operations that had not previously been identified.

The certificatee had an area in Building C-400 for disassembling centrifugal compressors in preparation for cleaning exposed to assays above 1 percent. There was no approved NCSA for this operation and compressors exposed to greater than 1% assay were not currently disassembled or cleaned. The inspectors determined that with the assay change, approximately one third of the cascade would be exposed to greater than 1% assay and the certificatee would not be able to operate more than two years without cleaning centrifugal compressors exposed to more than 1% assay. The NCSA for this process was available but had never been approved under the NRC certificate and was found to be unacceptable during license review of the HAUP. The certificatee stated that a new NCSA was in preparation and would be subjected to change review subsequent to implementation. Although not being performed at the time of the inspection, the inspectors determined that the compressor disassembly operation was a known change that was substantially affected by the higher assay both in scope and

substance. The development of an acceptable centrifugal compressor disassembly NCSA will be tracked as **Inspection Follow-up Item (IFI) 07007001/2001-02-04**.

The certificatee had installed equipment to wash cylinders exposed to greater than 2% assay in Building C-409 but had not yet developed an NCSA for this operation. Cylinders must be washed in order to perform periodic hydrostatic testing. The certificatee had not decided at this point whether cylinder washing would be performed in C-409 or whether new cylinders would be purchased. The inspectors determined that the C-409 cylinder wash operation was a known change directly related to higher assay operations that was not currently supported by an acceptable NCSA. The development of an acceptable NCSA for the C-409 cylinder wash will be tracked as **IFI 07007001/2001-02-05**.

The certificatee moved non-fissile operations out of the C-710 uranium analysis laboratory and planned to move some of the sub-sampling operations into the old uranium analysis laboratory. The certificatee also planned to send liquid uranium salvage directly to C-409, removing several intermediate handling steps. These changes would require substantial modifications to laboratory procedures affecting dual sampling controls for criticality safety. The inspectors determined that the C-710 laboratory efficiency upgrades could not be implemented prior to development of an acceptable NCSA to support the operational upgrades. The revision of the C-710 laboratory NCSAs to support operational upgrades will be tracked as **IFI 07007001/2001-02-06**.

The certificatee planned to upgrade C-400 general maintenance requirements to include the C-409 facility. The C-409 facility was constructed specifically for operations with higher assay, and maintenance of the facility was, therefore, directly related to HAUP. There was no associated existing NCSA for this operation that addressed the higher assay that could be present. The upgrade of the C-400 General Maintenance NCSA requirements will be tracked as **IFI 07007001/2001-02-07**.

In order to be used, the UF_6/Freon separation unit in building C-335 would need to have its NCSE/NCSA upgraded from a 1.3% assay limit to approximately a 3.0% assay. This was the maximum assay that the current equipment geometry would support. This upgrade would also involve a change to a TSR. Although this equipment was optional for use in the event of a large cascade leak, certificatee staff stated that they planned to make the equipment ready subsequent to HAUP. The inspectors determined that the UF_6/Freon separation unit upgrade would require a revised NCSE/NCSA and TSR prior to implementation. The revision of the UF_6/Freon separation unit NCSA to support operational upgrades will be tracked as **IFI 07007001/2001-02-08**.

2.1.3 Conclusions

The inspectors determined that supporting analyses reflected the current or proposed plant configuration, that underlying assumptions were adequate, and that controls were available and reliable for the proposed HAUP operations. Two violations were identified regarding the failure to have TSRs for singly-contingent scenarios, and the failure to identify equipment relied upon for criticality safety as AQ-NCS. Other than the violations, the inspectors did not identify any additional safety concerns affecting operations at higher assay during the ORR review of criticality safety.

2.2 Plant Operations

2.2.1 Scope

The inspectors reviewed a representative selection of procedures that had been modified as a result of HAUP to ensure that the procedures contained clear instructions and covered all operational steps in the process. The inspectors walked-down and discussed with operators select passive engineering and administrative NCS controls, industrial safety, operational parameters, and responsibilities required to safely perform cognizant operations. The performance of operators was observed for compliance to procedural requirements and demonstrated knowledge of specific safety controls associated with their respective activities. The preceding inspection activities were performed on the following HAUP installations and modifications:

- Building C-400 Spray Booth;
- Building C-310 Seal Exhaust/Wet Air Pump;
- Building C-310 Installation of Third Product Withdrawal Pump;
- Building C-335 Moisture Control in R-114 Systems; and
- Building C-337A Operation and Surge/Relief Drums and Process Piping.

2.2.2 Observations and Findings

Building C-400 Spray Booth

The inspectors discussed the NCS controls associated with the safe operation of the spray booth with cognizant operators. Operators were knowledgeable of the NCS controls addressed in the precautions and limitations section of Procedure CP4-CU-CH2108, "Operation of the C-400 Spray Booth," Revision 13. However, the inspector identified a weakness in that two operators did not readily understand the significance of a PEH deposit. Specifically, Procedure CP4-CU-CH2108, Section 8.1, "Placing Equipment in the Spray Booth," verified that the component did not contain a PEH deposit. Section 8.1 required the operators to reference Appendix D, "Safe Mass Chart," to determine where the components mass and assay fell on the safe mass chart. During initial discussions with the inspectors, the operators explained that as long as all the appropriate paper work accompanied the component to be cleaned it did not matter whether the plotted mass and assay fell above or below the safe mass line. However, during the step-by-step walk-down of Procedure CP4-CU-CH2108, the operators clearly understood that Step 8.1.8 would not allow them to move a component with a PEH deposit into the spray booth. The inspectors noted that the precautions and limitations of Procedure CP4-CU-CH2108 did not address PEH deposits.

The inspectors reviewed the guidance provided to transfer from the spray booth tanks to either the C-400 receiving tanks or C-409 acidifying tanks per Procedure CP4-CU-CH2108. The inspectors noted that the level of detail in Procedure CP4-CU-CH2108 was not consistent. As noted in the previous paragraph, the steps to verify that the component did not contain a PEH deposit were clear and detailed. However, Section 8.6, "Transfer Solutions from Tank Set(s) to C-400 Receiving Tanks," did not specify a method to evaluate the quantity of solution in the spray booth tanks or the remaining capacity in the C-400 receiving tanks to ensure that the C-400 receiving tanks were not over-filled. The operators explained the method to measure the amount of solution in the spray booth tanks, which was determined by "C-400 Spray Booth Tanks Conversion Chart Capacity Charts," in Procedure CP4-CU-CH2108. Also, the operators referenced Procedure CP4-CU-CH2111, "Operation of the Contaminated Solution Receiving and Storage Facility," for guidance in evaluating the remaining

capacity in the C-400 receiving tanks. However the inspectors noted that Procedure CP4-CU-CH2108 did not reference the use of Procedure CP4-CU-CH2111.

The inspectors reviewed plant staff's actions to address the operators' lack of knowledge concerning PEH deposits and the inconsistencies in the spray booth operational guidance. The Chemical Operations Facility Manager stated that operators were expected to understand the significance of a PEH deposit and agreed there was inconsistent operational guidance in Procedure CP4-CU-CH2108. Assessment and tracking reports (ATRs) were issued for both concerns the following day. In addition, the Building Chemical Operations Facility Manager instructed all chemical operators on the NCS-significance of a PEH deposit and was revising Procedure CP4-CU-CH2108 to include the following:

- address PEH deposits in the Precaution and Limitations section;
- change the title of Section 8.1 to communicate explicitly that the following steps were to verify that the component was UH and not PEH; and
- clarify the methods to ensure that the amount of solution transferred from the spray booth tanks did not exceed the available capacity of the receiving tank (C-400 or C-409 acidifying).

As a follow-up to the PEH knowledge deficiency, the Training Manager identified a generic plant wide issue with some functional area's basic NCS training. Specifically, the Training Manager stated that some of the basic training for general NCS requirements did not address in sufficient detail an always safe mass of uranium. At the conclusion of the inspection, plant management was reviewing its approach for training the ideas and concepts related to PEH equipment in other functional areas on a generic basis.

Product Withdrawal

The inspectors discussed the NCS controls associated with the operation of the Building C-310 product and side withdrawal system with cognizant operators. The operations reviewed included the following:

- placing the condensers and accumulators in service for normal product withdrawal;
- Valve alignment for different product withdrawal positions;
- Connecting a cylinder and pigtail to a withdrawal position and filling a cylinder;
- Continuous assay sampling;
- Seal Exhaust/Wet Air; and
- Field assay sampling.

In discussions with the inspectors, each operator was very knowledgeable of NCS controls associated with the systems and equipment. In addition, operators recalled significant operating parameters for process systems and specified equipment. During walk-downs of systems, operators readily identified radiological and industrial safety requirements, isolation valves, main control breakers, NCS engineered controls, and critical instrumentation associated with safely operating systems and equipment. Specifically, operators explained that to date the operations of the side and withdraw pumps had not changed significantly with the addition of the third side and withdraw pump. The operators explained and illustrated valving manipulations to place different pumps in service. In addition, the inspectors determined that operators were aware of

the new NCSA requirements to document the bellows and pump lube oil parameters in the ACR narrative log per Procedure CP4-CO-CN2021a, “Operation of the C-310 Normatex Pump.”

Inspectors reviewed the requirements that would be in effect for continuous assay sampling, field assay sampling, filing cylinders, condenser and accumulator operations, and the burping of product cylinders. The inspectors discussed these operations with operators during walk-downs of the activities. Operators were knowledgeable of the precautions and limitations for each operation and demonstrated a thorough knowledge of the equipment and operating parameters associated with the safe operation of the systems and equipment. For example, operators knew the parts per million (ppm) limit on the purge vent, what actions were required to mitigate excedences, and what adjustments in the cascade would reduce the quantity of gases on the cascade to be purged. The inspectors verified that the operators described actions were as specified in the associated procedural steps.

Moisture Control in R-114 System

The inspectors discussed the implementation of Procedure CP3-CO-CO2029, “Moisture Control in R-114 Systems,” with operators. Operators stated that the training provided for using the moisture meter was conducted before many of the changes to the meter were completed. Operators stated that this gave them an uncomfortable feeling to communicate procedural requirements without first verifying that the procedural steps had not changed. However, a walk-down of select procedural steps indicated that the operators were knowledgeable of equipment operation. Additionally, the operators were aware that shift engineers had been trained to operate the moisture meters and were available to assist in the operation. The inspectors noted that Procedure CP3-CO-CO2029 did not address the generic NCS requirement for checking the water in R-114 before placing a cell at a negative or when the differential pressure alarm between the R-114 and RCW activated. However, operators were cognizant of the NCS requirements of measuring the moisture content in R-114.

Seal Exhaust and Wet Air Stations

The inspectors determined that the operation of the seal exhaust and wet air pumps had not changed significantly as a result of the equipment modifications made to support HAUP. However, there were several NCS controls imposed by the NCSA for the operation of the seal exhaust and wet air pumps. These NCS controls included spacing requirements and container size limitations within the equipment controlled area. Operators demonstrated a detailed working level knowledge of these NCS controls.

Building C-337A Operations and Swirl Meter Replacement

The inspectors reviewed procedure changes made to address Building C-337A operations and the use of the swirl meter. The changes were made to support HAUP. The inspectors also discussed the revised procedures with operators during a walk down of the procedures. Operators were knowledgeable of fundamental NCS requirements such as double contingency and NCS control factors. Operators clearly stated that they were responsible for maintaining the pressure and temperature in the surge drums and knew the limits for both. In addition, operators knew the normal operating temperature and pressures associated with the surge drums and explained in detail the process to evacuate and address pressure transients in the surge drums.

During walk-down activities with operators, the inspectors noted a potential work-around required to support the HAUP. Specifically, operators would need to be careful in the loading of autoclaves to ensure that at no time would the operator need to move a cylinder containing product over an autoclave loaded with a cylinder that contained product at an assay above 1.0 wt% ^{235}U. This was because the cranes in Building C-337A can not currently be utilized to move cylinders above autoclaves loaded with cylinders that contain the product at an assay above 1.0 wt% ^{235}U or greater because of the brakes on the crane. The certificatee was in the process of developing a modification to the south crane braking system that would allow subsequent movement of cylinders above autoclaves loaded with cylinders that contain the product at an assay above 1.0 wt% ^{235}U or greater. Once the brake modification has been implemented on the south crane, the crane will be capable of being approved to move cylinders above autoclaves containing product at an assay above 1.0 wt% ^{235}U. In the mean time, operators will be required to perform a loading scheme to ensure compliance with Procedure CP2-CO-CA2031, “Operations of Overhead Cranes.” Procedure CP2-CO-CA2031 Section 8.13.11 B, did not allow operators to move a cylinder over an autoclave containing a liquid cylinder enriched to 1.0 wt% ^{235}U or greater. This may result in additional cylinder handling.

The inspectors noted four different ways to comply with NCSA GEN-038 to isolate a UF_6 pipe while an autoclave was left open. In discussions with the inspectors, operators commented that the four methods were confusing. As a follow up, the inspectors noted that building management had recommended a hardware modification to simplify the method to achieve compliance with NCSA GEN-038 for isolating UF_6 piping. In addition, the inspectors observed that one of the two small instrument vacuum pumps was located next to an exterior wall that required a posted buffer zone and posting outside the building to comply with NCS spacing requirements.

2.2.3 Conclusions

The inspectors identified some isolated procedural issues involving level of detail, but concluded, for the most part, that procedures provided clear and understandable instructions. Additionally, the inspectors concluded that operators possessed a commitment and understanding for strict compliance with procedural actions.

3.0 FACILITY SUPPORT

3.1 Design and Modification Control

3.1.1 Inspection Scope

The inspectors reviewed the design and modification program at the facility. The inspectors assessed the procedures for approving, reviewing, authorizing, implementing, verifying, and documenting modifications. Procedures reviewed included the following:

CP2-EG-CF1030, "Q/AQ-NCS/AQ Item Identification, Documentation, and Control;"

CP2-EG-EG1033, "Temporary Modification Control;"
CP2-EG-EG1046, "Design Change Process;"
CP2-GP-GP1032, "Work Control Process;"
CP3-EG-EG1075, "Technical Reviews;"
UE2-RA-RR1036, "Plant Change Reviews;"
UE2-TO-EG1031, "Nuclear Modification Design Control;" and
UE2-TO-EQ1030, "Request for Engineering Services."

The inspectors reviewed the portions of the modification packages associated with the HAUP and interviewed plant staff responsible for the HAUP to determine that all procedural requirements were met.

3.1.2 Observations and Findings

Procedures UE2-TO-EQ1030, "Request for Engineering Services," UE2-TO-EG1031, "Nuclear Modification Design Control," and UE2-RA-RR1036, "Plant Change Reviews" established controls for plant and design changes. These programs were acceptable to ensure that plant changes were made only after appropriate reviews and approvals.

The inspectors sampled implementation of reviews and authorizations in the design for the HAUP modifications. The inspectors also reviewed the documented safety evaluations for the modifications, and discussed design calculations and assumptions used to support the modifications. The inspectors did not identify any issues or findings.

The inspectors reviewed the process and documentation of updates to the associated Boundary Definition Manuals (BDMs). The BDMs documented the boundaries between safety-related and non-safety-related equipment. The inspectors noted that the design packages indicated that the BDMs were updated. Plant staff also showed the inspectors that the status of updates to the BDMs was being tracked during the daily communication and teamwork meetings. The procedural controls appeared adequate. However, the inspectors identified some issues related to implementation of the procedures for designating safety-related equipment as "Q/AQ-NCS/AQ" (see Section 2.1.2, “C-400 Spray Booth,” and Section 3.2.2, “Normatex Pump Walkdown”).

The inspectors also assessed the process for changes to the design packages, including field changes. The program was acceptable. The inspectors concluded that documentation in the design packages showed that the field change process was followed on most occasions. However, as discussed in Section 3.2.2, “Relief Piping Walkdown” of this report, the inspectors identified one issue of a change being made to the design without prior receipt of written approval and an associated field change.

The inspectors also reviewed the training records of three engineers involved in the HAUP. The inspectors did not identify any issues or findings concerning the qualifications for the three engineers reviewed by the inspectors.

3.1.3 Conclusions

The design and modification control program was sufficient to ensure that unauthorized and unapproved process modifications were not made. The programs and procedures to control modifications at the facility were acceptable. The guidance contained in the programs was sufficient to implement the design changes associated with the HAUP.

3.2 As-Built and Design Comparison

3.2.1 Inspection Scope

The inspectors reviewed portions of the implementation of the following HAUP modifications:

C-335 Cross Over;
Seal Exhaust/Wet Air Pump System Upgrades;
Building C-310 Normatex Pumps (Product Withdrawal);
Rupture Disks for the C-310 Accumulators and Condensers;
30B Cylinder Handling Modifications at C-360; and
RCW/R-114 Delta-p Switch Installation on 29 Coolant Systems.

The inspectors verified whether the plant design (as described in the engineering drawings, the safety analysis report, and other documents) was updated in a timely and accurate manner.

The inspectors also reviewed the following Work packages (or Work Order Tasks) to ensure compliance with TSR and regulatory requirements, and to verify that the work completed was as specified in the associated design documentation:

9908680-01, Provide Maintenance Support of the Installation of a 3" Feed Crossover Line in C-335;
9912541-02, HAUP Install Oil Mist Eliminator at the C-337 SE/WA Station for Position/Pump#1;
9912541-08, HAUP Install Oil Mist Eliminator at the C-337 SE/WA Station for Position/Pump#7;
0014323-18, HAUP-delta P, Install/test the C-310 Cell 8 Normal Condenser RCW/R-114 Differential Pressure Switch Panel;
0014323-19, HAUP-delta P, Install/test the C-310 Cell 8 Interpump Condenser RCW/R-114 Differential Pressure Switch Panel; and
0014323-66, HAUP-Delta P Install Delta P on the C-310 Cell 8 Interpump Condenser and Cell 8 Normal Condenser.

3.2.2 Observations and Findings

Generally, the design requirements, physical configuration, and facility documentation were consistent. The design packages contained information that demonstrated incorporation of the design changes into the facility documentation such as the SAR and plant drawings. In addition, a comparison of the descriptions and drawings of the modifications with the documentation showed that the physical configuration and the documentation generally matched. However, as described below, the inspectors identified some exceptions.

Relief Piping Walk-down

The inspectors used drawing M5E-ZA0840-A01, Revision 0, to walk-down the ASME [American Society of Mechanical Engineers] Code Relief Piping Modification in Building C-310. The drawing showed that rupture disk block valve RDC1-BV-2 was in the

vertical piping downstream from rupture disk RDC1. However, the inspectors observed that the actual installation was in the horizontal piping. Plant staff documented this in ATR 01-1120. Plant staff concluded that communications between the maintenance staff and the engineering staff had resulted in the maintenance staff believing that engineering had verbally approved the moving of the valve, but the engineering staff believing that the maintenance staff would re-contact engineering if the valve needed to be moved.

Step 6.9.3 of CP2-GP-GP1032, "Work Control Process," Revision 5, specifies that work package revisions are required when the work package change alters the method of performance of a work package. Contrary to the above, during execution of Work Order ZW0 0001746, from June of 2000 to November of 2000, plant staff failed to revise the work package before changing the method of performance when plant staff deviated from the work package and installed rupture disk block valve RDC1-BV-2 in horizontal piping instead of in vertical piping. This was an example of a violation **(VIO 07007001/2001-002-03a)**.

After the inspectors identified this violation, plant staff issued Engineering Change Request/Notice ECR/ECN number ECN-2001-1333 to document the field change and to revise the affected drawing M5E-ZA0840-A01 and associated analyses. The plant staff concluded that the as-found position was acceptable, and that the drawing should be revised.

The inspectors concluded that the violation was caused by inattention to detail in the work control process and lack of clear communications between engineering and maintenance.

Normetex Pump Walk-Down

The inspectors, accompanied by the system engineer, performed a walk-down of the Normetex side withdrawal pump. The inspectors noted that some instrument tags and nameplates were not installed, and that handwritten labels had been placed on some equipment. The system engineer followed-up and identified other instrument tags and nameplates shown on installation drawings that were missing from components and cabinets. The system engineer documented the issue in ATR 01-1127, and plant staff entered the appropriate labeling requests into the work control process. The inspectors concluded that the unlabeled equipment probably would not have led to an error during operations or maintenance, so the inspectors considered the failure to install the tags and labels according to the installation drawings to be a minor issue, not subject to formal enforcement. The issue was, however, an example of inattention to detail.

During the walk-down of the Normetex pumps, the inspectors verified that items designated as safety-related (Q, AQ-NCS, or AQ) on the installation drawings were appropriately designated in the plant's configuration, procedures, and Boundary Definition Manuals, and that procedures existed to address the SRIs. The inspectors reviewed the control room indications for the Normetex side-withdrawal pump, and noted that no alarm response procedure existed for Annunciator alarm window A5, "Lube Oil High Pressure Shutdown," although the alarm was listed as AQ-NCS on the system drawings.

The staff concluded that Alarm Window A5 was unnecessary and that Alarm Window A1, "Side Withdrawal Normetex Pump Shutdown," provided the relevant information.

The plant staff also noted that the two original Normetex pumps did not have Alarm Window A5. For each of the three pumps, the corresponding Alarm Window A1 was relied upon to alert the operator when the pump shut down, thereby prompting the operator to shut, or verify shut, the discharge block valve to support criticality analyses in accordance with the alarm response procedure. The inspectors agreed with the plant staff that Alarm Window A1 would prompt the operators to take appropriate actions, and that a separate procedure for Alarm Window A5 was not needed.

The plant staff explained that NCSE 041, Rev. 01, "Normetex Pumps for UF6 Product Withdrawal at the PGDP," credited Alarm Windows A1 and A5 for nuclear safety, and that Alarm Window A1 was designated as AQ-NCS, just like Alarm Window A5.

However, the inspectors reviewed the Boundary Definition Manual for Alarm Window A1 and discovered that only the annunciator horn had been designated as AQ-NCS, while Alarm Window A1 was not designated as safety-related. Section II.B.2.f of Appendix B to procedure CP2-EG-CF1030, "Q/AQ-NCS/AQ Item Identification, Documentation, and Control," stated that if an alarm must function to prompt operator action, then **all** components that provide the alarm are to be bounded as AQ-NCS. The failure to identify Alarm Window A1 as a component bounded as AQ-NCS was considered to be an additional example of a violation **(VIO 07007001/2001-002-02b)**. Plant staff documented the issue in ATR 01-1178. The inspectors concluded that the failure to designate the alarm window as AQ-NCS was an example of inattention to detail.

Coolant System Walkdown

The inspectors walked-down portions of the RCW/R-114 Differential Pressure Switch modification. The inspectors noted that one of the pressure sensing lines was not continuously sloped down. The inspectors discussed this with the system engineer. The system engineer determined that the Design Installation and Verification Specifications (DIVS) AZ3030-J002 specified that the instrument tubing should be oriented sloping down to the process connection while attempting to avoid traps in the tube routing. Plant staff documented this in ATR 01-1127, concluded that the slope did not present an immediate concern, and scheduled the line to be repositioned. The inspectors considered failure to assure that the line was sloped down to be an example of inattention to detail.

3.2.3 Conclusions

The as-built configuration generally matched the design specifications, and the modifications for the HAUP were generally installed in accordance with the work packages. However, the inspectors identified a violation for an unreviewed field change and for an incorrect designation of the safety-related control room alarm. The violations were not safety significant.

3.3 Operator Training

3.3.1 Inspection Scope

The inspector reviewed select HAUP training activities to ensure that the training modules were effectively communicated to plant staff. The inspectors also reviewed plant staff's training program structure to ensure that the program adequately prepared

individuals to safely operate, maintain, or modify the GDP and for compliance with regulatory requirements.

3.3.2 Observations and Findings

The inspectors noted that 10 CFR 76.95, "Training," required plant staff to establish, implement, and maintain a training program for individuals relied upon to operate, maintain, or modify the GDPs in a safe manner. In addition, 10 CFR 76.95 required plant staff to develop the training program using a systems approach to training (SAT). Technical Safety Requirement, Section 3.4, "Training," and SAR Section 6.6, "Training," specified the SAT elements required for the training program to comply with 10 CFR 76.95.

The inspectors reviewed the training program structure and discussed the program with the Training Manager. The inspectors noted that Procedure CP2-TR-TR1032, Revision 3, "Conduct of SAT Training," clearly stated the training program structure. The inspectors noted that the training organization was based on a centralized training staff that reported to the Training Manager. The centralized training staff consisted of technical trainers, administrative personnel and mid-level managers. The centralized staff were responsible for assisting functional managers in the design, development, implementation, and auditing of training programs for the areas listed in SAR Section 6.1," Training Program Organization and Administration." The training staff also provided training hardware, ensured that the SAT process was followed for programs identified in Section 6.6 of the SAR, and implemented for the cognizant functional training programs. The training review groups typically identified what constituted required initial, on-the-job, and continuing training for individuals relied upon to safely operate, maintain or modify the plant. Additionally, the inspectors determined that NCS trainers had recently been assigned to the plant to evaluate plant staff's knowledge and performance associated with NCS activities.

The inspectors reviewed select training modules and associated training documentation for compliance with regulatory and certificatee requirements. The inspectors determined that the training modules reviewed met the systems approach to training requirements as required by 10 CFR 76.95; TSR, Section 3.4; and SAR, Section 6.6. Plant staff had developed a systematic analysis for each operation reviewed that included:

- needs/initial job analysis;
- identification of personnel and public safety hazards, safeguards of special nuclear material, and potential environmental issues, and
- a final exam that attested that plant staff understood the enabling objectives of the training class.

The inspector selected random operator names and reviewed their training status for the operations of the Building C-400 spray booth and moisture meter. Some of the operators had been trained prior to procedure revisions. The inspectors determined that in each of the cases where the operators had been trained prior to procedure revisions the operators were not allowed to perform associated activities until they were trained on the changes. Additionally, the inspectors determined that the training department's computer database accurately documented select training course attendance logs and that operators had received the required training for the activity being performed.

The inspectors reviewed the implementation of the training program. The inspectors observed that the length of time of some training courses was excessive. Specifically, some training classes were conducted in one 12-hour shift rather than broken apart into several smaller periods. Operators stated that the one 12-hour shift approach to training was overwhelming. Additionally, the inspectors noted that a time lag of several months occurred between some training and the actual implementation of the training. During this time lag, some procedures were revised several times. Operators stated that this was confusing because at times they forgot the sequence of changes. The inspectors noted that plant staff had terminated operations until training was completed for a procedure change. The inspectors noted that shift briefings were generally used to address procedural changes, which were the least controlled training method. However, during discussions with the inspectors, operators stated that they performed all cognizant activities with in-hand procedures and would terminate any activity that they did not understand. Additionally, operators stated that the training clearly articulated the safety issues with the operation of cognizant equipment and systems.

The inspectors discussed the above training concerns with select plant management. The inspectors determined that plant staff had implemented Procedure CP2-CO-CO1036, “Control of Infrequently Performed Tests or Evolutions,” in August of 1999. The purpose of the procedure was to introduce increased management awareness and involvement in infrequently performed tests or evolutions. An example where plant staff used the procedure to ensure the safe execution of an infrequently used process was discussed in NRC Inspection Report 07007001/2000-001, dated February 6, 2000. Plant management stated they recognized the weakness in the implementation of some training and would continue to use the actions of Procedure CP2-CO-CO1036 and refresher training until plant staff were comfortable with operations that would be new or different as a result of the HAUP.

3.3.3 Conclusions

The inspectors concluded that plant staff’s training organizational structure was sufficient to facilitate the proper training of plant staff responsible for safe operation, maintenance, and modification of the GDP. The plant staff’s training program provided reasonable assurance that the operators assigned to the various jobs were fully qualified. However, the effectiveness of the training was adversely affected by its execution. Plant staff were using an approved method to enhance operator confidence for infrequently performed evolutions.

3.4 Maintenance Program

3.4.1 Inspection Scope

The inspectors reviewed the integration of the HAUP modifications into plant staff's normal surveillance test and preventive maintenance programs. Documents reviewed included the modification packages for the appropriate systems, the "Preventive Maintenance Revision/Request" forms for the modified systems, and the following procedures:

CP2-GP-GP1033, "Preventive Maintenance Program;"
CP2-GP-GP1037, "Technical Safety Requirements Surveillance Program;" and
CP2-EG-EG1046, "Design Change Process."

The inspectors also reviewed the incorporation of vendor information into the maintenance programs. The reviews were to determine whether equipment maintenance would be completed in accordance with NRC requirements.

3.4.2 Observations and findings

The procedures contained guidance directing licensee personnel to identify any preventive maintenance tasks impacted by the modifications. The inspectors discussed the development of the tasks, the bases for the tasks, and conformance to the SAR by the engineering staff. The inspectors did not identify any issues or findings.

The inspectors reviewed planning and scheduling of functional tests and identified no concerns or issues. The inspectors reviewed sample tests and determined that the tests had acceptance criteria and that plant staff had formal requirements for returning the items to service. The planned tests also met the requirements in the TSR.

The inspectors reviewed plant staff's use of manufacturers' instructions in the development of preventive maintenance. Procedures required that the plant staff consult the manufacturer's information when available, and the plant staff followed the procedures. Plant staff stated that manufacturers did not always have applicable information (for example, vendor information for alarm calibrations of the coolant low pressure and high temperature alarms was not available). In those instances when the manufacturer did not have applicable information, plant staff used documented historical experience to develop a preventive maintenance schedule.

The inspectors reviewed the methodology for planning and scheduling preventive maintenance, and discussed the planning with cognizant staff. The inspectors also reviewed examples of the "Preventive Maintenance Request (PMR)" forms used to approve and implement new preventive maintenance tasks associated with the HAUP modifications. The requests included the bases for the tasks. During the review, the inspectors discovered that there were no new items in the schedule to support the newly-installed Normetex pump. Licensee staff informed the inspectors that plant staff had independently discovered the same issue a few days earlier, and had documented it in ATR 01-0945, dated February 20, 2001. The inspectors did not identify any additional issues or findings.

3.4.3 Conclusions

The procedures and controls used to incorporate the preventive maintenance and surveillance tasks into the maintenance program for the HAUP modifications were appropriate. The inspectors did not identify any issues based on a review of a sample of scheduled work. Plant staff used vendor information when available, and documented historical experience otherwise. Plant staff independently identified that maintenance tasks for the newly-installed Normetex pump had not been developed.

4.0 SPECIAL INSPECTION TOPICS

4.1 Installation Controls

4.1.1 Scope

The inspectors reviewed plant HAUP modifications to determine that quality assurance (QA) requirements controlling the installation of equipment were met for the 17 specific modifications associated with HAUP. The inspectors reviewed this area by selecting those modifications involving dominant risks and controls that were primarily modifications intended to support criticality safety limits.

4.1.2 Observations and Findings

The inspectors interviewed plant staff and reviewed NCSA/Es and their implementing procedures to identify plant operations with substantive changes in operations or equipment involving dominant risks resulting from HAUP. The inspectors determined that four specific modifications involved dominant risks or dominant controls or were associated with the availability and reliability of dominant controls intended to upgrade cascade operations to meet double contingency requirements. The four specific modifications were as follows:

- Seal Exhaust and Wet Air Station Modifications;
- C-400 Spray Booth Modifications;
- C-409 Uranium Precipitation Modifications; and
- RCW and R-114 Delta Pressure Modification

Seal Exhaust and Wet Air Station Modifications

These modifications involved changing the sight glass and overflow line on the station pump, removing the external oil separators, reducing the volume of the internal oil separators and reducing the volume of the oil mist eliminators. Modifications to the station pump were performed at all stations while modifications on the external equipment, the oil separators and mist eliminators, were not performed at Building C-333, which will not see the increased assay. The inspectors performed walkdowns at all facilities during the course of the readiness review and license review inspections and determined that installation was complete and that design requirements were met. The inspectors reviewed documentation to determine that procedures were adequately followed during installation and QA requirements were met.

The inspectors identified problems with the QA documentation of the first pump station in Building C-337 in that many extra welds had been performed and the final QA sign-off was not made. The certificatee stated that the modified equipment was manufactured at Building C-337 and that a fit-up had been performed on the first pump station installation. The missing QA signatures were identified during the certificatee's readiness review and appropriate corrective action was taken to assure QA department management that QA procedures would be followed. No other issues were noted by the inspectors. The inspectors performed an additional walkdown at Building C-337 of all modifications at that station and determined that all equipment was installed in accordance with design requirements using appropriate materials and work procedures. The inspectors reviewed material tags and determined that the certificatee system for assuring material specifications was adequate to assure that design specifications had been met.

C-400 Spray Booth Modifications

These modifications involved filling in the pump pit and relocating the pit equipment; removal of the abandoned spray header; removal of the fixed spray equipment; isolation

of five supply valves from fissile solution; isolation of the heated spray solution system from fissile solutions and steam; and the addition of two pump switches and two pressure indicators. The inspectors determined that these modifications were intended to eliminate unsafe geometry collection points and implement criticality safety controls on solution transfers. The inspectors performed a walkdown of all modifications and determined that all equipment was installed in accordance with design requirements using appropriate materials and work procedures. The inspector reviewed the documentation and determined that quality hold points on selected welds were imposed and followed. The inspectors reviewed material tags and determined that the certificatee system for assuring material specifications was adequate to assure that design specifications had been met.

C-409 Uranium Precipitation Modifications

These modifications involved the installation of instruments, valves, a deflector over the pre-coat tank, a new chute from the rotary filter, an overflow line from the vacuum filter, and a filtrate discharge filter to implement double contingency for the uranium precipitation operations. The inspectors performed a walkdown of all modifications and determined that all equipment was installed in accordance with design requirements using appropriate materials and work procedures. The inspector reviewed documentation and determined that quality hold points on selected welds were imposed and followed. The inspectors reviewed material tags and determined that the certificatee system for assuring material specifications was adequate to assure that design specifications had been met. During the walkdown, the inspectors noted that four valves identified as sample valves in the design package had been renumbered and installed as drain valves. These valves were listed in the valve line-up but were not on the flow diagram in the operating procedure. Certificatee operations staff agreed to identify the valves as sampling or drain and assure that the valves were properly labeled and shown on the procedure flow diagram.

RCW and R-114 Delta Pressure Modification

These modifications involved installation of pressure connections on the RCW supply to the R-114 condensers, a pipe coupling, pipe nipple, and a valve to provide RCW pressure without affecting RCW operations and provide for installation of a differential pressure switch and alarm. The inspectors performed a walkdown of selected representative modifications in Building C-310 and determined that other than the exceptions identified in Section 3.2.2 above, the equipment was installed in accordance with design requirements using appropriate materials and work procedures. The inspectors reviewed material tags and determined that the certificatee system for assuring material specifications was adequate to assure that design specifications had been met.

4.1.3 Conclusions

The inspectors determined that HAUP modifications used appropriate materials of construction; were performed (with one exception) in agreement with design requirements; that maintenance or work procedures were invoked and followed; and that no significant deviations from design requirements were implemented. The inspectors determined that installation controls were adequate to assure that plant modifications were acceptably implemented to support safe operations at higher assay.

4.2 Post-Installation Testing and Controls

4.2.1 Inspection Scope

The inspectors reviewed the post-installation testing and controls for the HAUP. The inspectors reviewed the testing requirements listed in the design packages and discussed the bases for the tests, including the design bases, with cognizant personnel. The inspectors also assessed procedure adherence during the testing process.

4.2.2 Observations and Findings

Overall, the testing of the modifications was technically adequate. Discussions with engineering staff determined that the tests developed by the staff considered the safety-functions of the modifications during testing development. The inspectors questioned the staff about the accidents and transients that the equipment was likely to experience. The staff described possible accidents and showed how the specified post-modification tests considered the accidents. The staff also considered the effects of the modifications on the operational performance of interfacing systems and added appropriate steps (such as placing a jumper before testing) to address interfaces. The modified systems and components were tested in accordance with approved procedures and instructions.

However, as discussed below, the inspectors identified two areas of weakness related to proper execution of the CP2-GP-GP1032, "Work Control Process." While these weaknesses did not affect the overall installation and testing of modifications, they were considered additional examples of inattention to detail.

Test Start Approval

Step 6.10.3 of the Work Control Process procedure stated that engineering approval signoff was required to start a post-modification test to ensure that the proper requirements were identified. This requirement was added in January of 1998 in response to a Notice of Violation issued by the NRC in 1997. During the review of the work packages, the inspectors noted several examples when engineering had given approval to start a post-modification test before maintenance staff had started installation of the particular modification. Discussions with engineering staff determined that the engineers did not understand the purpose of step 6.10.3, and engineering management was unaware that the work control process required this engineering hold point. Some engineers signed the approval for test start on the same day that they signed the pre-job approval for the modification, while others waited until construction was complete. As a result, engineers sometimes granted permission to start the post modification tests several months before the work was actually done. In contrast to the engineers' beliefs, the operations personnel who were interviewed believed that the presence of the signature meant that engineering staff had reviewed the as-built modification and had verified that the post-modification test was correct for the as-built configuration.

Plant staff documented the issue in ATR 01-1096. Subsequently, plant staff revised procedure CP2-GP-CP1032 to delete the requirement for a mandatory approval from engineering before starting PMT [Post Maintenance/Mod Test]. Plant staff concluded that the signature was redundant to the DIVS approvals, the initial engineering work package concurrence signature, and the certification by the service manager that those

work activities had been completed and were ready for PMT. The inspectors reviewed the procedure requirements associated with changing a design, and concluded that the engineering sign-off was redundant to other approval steps. However, the inspectors noted that in one instance plant staff failed to document that the DIVS had been revised on the post-modification testing sheet. In this example, the revision to the DIVS did not impact the post-modification test.

Step 6.10.3 of Revision 5 to CP2-GP-GP1032, "Work Control Process," stated, "For MODs [modifications], Engineering approval is required for test start to ensure proper PMT requirements are identified." Previous steps required that the installations of the modifications were complete so the modification could be tested. Contrary to the above, for Work Order Tasks R 9908680-01, R 0014323-19, and R 0014323-18, engineering approvals for test starts were given on 2/2/00, 1/12/01, and 1/12/01, respectively, although the installations were not complete (so testing could not start) on those dates. This was an example of a violation **(VIO 07007001/2001-002-01b)**.

Documentation of Failed Tests

The inspectors noted that two of the work packages reviewed contained vague references to failed post-modification tests in the narrative work history, but had no information in the preprinted portion of the work package used to document failed post-modification tests.

Work Order Tasks R 0014323-19, "HAUP-Delta P, Install/test the C-310 Cell 8 Interpump Condenser RCW/R114 Differential Pressure Switch Panel" and R 0014323-18, "HAUP-Delta P, Install/Test the C-310 Cell 8 Normal Condenser RCW/R114 Differential Pressure Switch Panel" both recorded in the narrative history that on February 2, 2001, "Step 6.2.4 of DIV[S] did not function correctly." Step 6.2.4 of the DIVS was part of the post modification acceptance tasks. However, the "Task History" for the work package had "N/A" across the preprinted section of "Apparent Failure Codes," "Repair Codes," and "Rework Codes," thereby documenting that no failure occurred and no rework was required.

Discussions with plant staff revealed that portions of the electrical work had been done incorrectly and required rework. The plant staff discovered the errors through the post-modification test. Troubleshooting on February 2 and February 3 found that field wiring designations made by electrical maintenance for the temperature switch and the alarm circuit had been reversed on the four panels. On February 8, 2001, plant staff documented the installation errors in ATR 01-0637.

Step 6.10.4 of Revision 5 to CP2-GP-GP1032, "Work Control Process," stated, "If during performance of work a PMT fails, SM [service manager] shall ensure: A. FPMT [failed post maintenance test] is circled as a reason for rework on work package task history form if PMT failed due to portions of work not being performed satisfactorily." Contrary to the above, for Work Order Tasks R 0014323-19 and R 0014323-18, the SM failed to ensure that failed post maintenance tests that occurred on 2/2/01 for each task were documented as described in Step 6.10.4. This was an example of a violation **(VIO 07007001/2001-002-01c)**.

4.2.3 Conclusions

Overall, post-modification testing was adequate, and complied for the most part with the appropriate procedures. Discussions showed that the tests considered design basis information such as accidents and system interactions. However, the inspectors identified two examples of a violation for failure to follow the work control procedure while authorizing or documenting post-modification tests. The two examples were not safety significant.

4.3 Open Item Review

4.3.1 **IFI 07007001/2000-009-02:** This IFI tracked implementation of controls on material flow to uranium recovery operations. During previous readiness review walkdowns of the Building C-400 cylinder wash, controls on the transfer of fissile solution to the Uranium Recovery Operations were not completely installed. The inspectors performed an additional walkdown of the Building C-400 operations and determined that the required controls were available and reliable as discussed above in the NCSA/E review. This item is closed.

4.3.2 **IFI 07007001/2000-009-03:** This IFI tracked completion of modifications to seal exhaust and wet air stations in the cascade. During the initial walkdown of the seal exhaust and wet air modifications, the inspectors observed that the work was not completed at all facilities as planned. The inspectors determined that not all modifications were required for Building C-333 but some modifications had been scheduled at that facility for maintenance uniformity. The inspectors determined that the seal exhaust and wet air modifications that were required for criticality safety during HAUP had been completed. This item is closed.

4.3.3 **IFI 07007001/2000-009-04:** This IFI tracked completion of the Building C-409 uranium precipitation modifications. During previous walkdowns of the C-409 modifications, installation and testing of new equipment was not complete. The inspectors performed an additional walkdown of the Building C-409 uranium precipitation equipment and determined that the modifications were complete and criticality safety controls adequately implemented. This item is closed.

4.4 Self-Assessment Capabilities

4.4.1 Inspection Scope

The inspectors reviewed the certificatee's "Higher Assay Upgrade Project Internal Operational Readiness Review," (IORR) dated February 27, 2001, to determine if the certificatee's self-assessment program was capable of identifying deficiencies associated with the HAUP modifications' implementation and to ensure compliance with the requirements of NQA-1, "Quality Assurance Requirements for Nuclear Facilities," 1989 edition.

4.4.2 Observations and Findings

Over the nine-month period from June 2000 through February 2001, the certificatee conducted its IORR, which consisted of a comprehensive evaluation of the activities associated with the implementation of the modifications to support the HAUP. The IORR was divided into two primary phases, initial surveillances and follow-up surveillances. Each surveillance assessed only completed work and each was

documented in a separate IORR surveillance report that was issued at the time the surveillance was completed. Surveillances were grouped into the following three categories: 1) NCSE/A requires a plant modification in order to demonstrate double contingency; 2) modifications needed for plant operational flexibility and not driven by an NCSE/A; and 3) NCSE/As that need to be updated to allow operation up to 5.5 wt.% assay, but which require no plant modifications. The initial surveillance phase consisted of 22 individual surveillances, each covering a discrete modification or NCSE/A conducted under the HAUP. The second phase consisted of 10 surveillances focusing on areas where the initial surveillance had identified significant deficiencies requiring corrective actions.

The criterion specified for the IORR was comprehensive, and included all requirements specified in NQA-1. The IORR identified numerous examples of deficiencies, including the following three programmatic deficiencies: 1) quality of work package documentation, 2) operator familiarity with modifications and revised NCS controls, and 3) the flowdown of requirements into procedures. The IORR issued 114 ATRs identifying deficient items requiring correction, including the three previous significant programmatic issues. Despite the limited amount of work being conducted to modify the plant for the HAUP, the number of deficient items averaged approximately five deficiencies per surveillance.

Overall, the IORR included the same modifications and associated implementation that was examined during the NRC's ORR inspection. Although the IORR identified multiple examples of inadequate documentation in work packages, these were not sufficiently corrected to preclude the NRC from identifying the same issue (see violation examples 07007001/2001-02-03). Also, with the exception of one item, none of the specific violation examples identified by the NRC's ORR inspection had been documented in the certificatee's IORR (for example, the IORR did not identify the mis-sloped tubing on the R-114/RCW modification nor the improper placement of the valve in the horizontal run versus the vertical run as shown on the drawing). The inspectors concluded this may have due to the sheer number of deficiencies available and identifiable to the IORR.

As noted in several areas of the NRC's report, inattention to detail was the cause of several examples of the violations identified by the NRC, especially involving the implementation of the work control procedure. Similarly, the certificatee's IORR identified multiple examples of the same type of problem. As such, facility management was in the process of addressing this programmatic deficiency. This was being conducted independently of the HAUP.

4.4.3 Conclusions

The certificatee's IORR was comprehensive and evaluated all of the modifications that had been made to the facility to support the HAUP. Given the large number of findings, it was apparent that a programmatic weakness existed with individuals not paying sufficient attention to detail to ensure all procedural requirements were implemented. Although the IORR did not identify deficiencies that were subsequently identified by the NRC's examination of the same work, the inspectors concluded that this was due to the IORR identifying so many issues during the associated surveillance of a modification that a few were missed given the volume of deficiencies identified.

5.0 Management Meetings

5.1 Exit Meeting Summary

The inspectors presented the inspection results to members of the facility management on March 2, 2001. The facility staff acknowledged the findings presented and indicated concurrence with the facts, as stated. The inspectors asked the plant staff whether any materials examined during the inspection should be considered proprietary. With the exception of plant drawings, no proprietary information was identified.

PARTIAL LIST OF PERSONS CONTACTED

United States Enrichment Corporation (USEC)

*H. Pulley	General Manager
*R. Helme	Engineering Director, Corporate
*S. Penrod	Enrichment Plant Manager
*K. Ahern	Engineering Manager
*L. Jackson	NRA Manager
*R. Starkey	Training Department Manager
*J. LaBarraque	Nuclear Safety and Quality Manager
*V. Shanks	Production Support Manager
*T. Hines	Project Engineer for High Assay Upgrade
*B. Tilden	Team Leader, Paducah Operational Readiness Review
*M. Venters	Nuclear Criticality Safety Manager
*J. Wittman	Work Control Manager
*A. Canterbury	Maintenance Manager
*D. Rogers	Chemical Operations Manager
*C. Hicks	Operations Manager

Department of Energy

*G. Bazzell	DOE Facility Representative

*Denotes those present at the exit meeting on March 2, 2001.

Other individuals were contacted in the course of this inspection who are not listed above.

INSPECTION PROCEDURES USED

IP 88063:	Management of Change

ITEMS OPENED, CLOSED, AND DISCUSSED

Opened

07007001/2001-02-01	VIO	Failure to have TSR for singly-contingent NCS scenarios
07007001/2001-02-02	VIO	Failure to identify safety related equipment as AQ-NCS
07007001/2001-02-03	VIO	Failure to follow work control procedural requirements
07007001/2001-02-04	IFI	Development of an acceptable centrifugal compressor disassembly NCSA
07007001/2001-02-05	IFI	Development of an acceptable NCSA for the C-409 cylinder wash
07007001/2001-02-06	IFI	Revision of the C-710 laboratory NCSAs to support operational upgrades
07007001/2001-02-07	IFI	Upgrade of the C-400 General Maintenance NCSA requirements
07007001/2001-02-08	IFI	Revision of the UF_6/Freon separation unit NCSA to support operational upgrades

Closed

07007001/2000-09-02	IFI	Implementation of controls on material flow to uranium recovery operations
07007001/2000-09-03	IFI	Completion of modifications to seal exhaust and wet air stations in the cascade
07007001/2000-09-04	IFI	Completion of the Building C-409 uranium precipitation modifications

Discussed

None

LIST OF ACRONYMS

ACR	Area Control Room
AEG	Average Energy Group
ASME	American Society of Mechanical Engineers
AQ-NCS	Augmented Quality-Nuclear Criticality Safety
ATR	Assessment and Tracking Report
BDM	Boundary Definition Manual
CAAS	Criticality Accident Alarm System
CER	Compliance Evaluation Report
DIVS	Design Installation and Verification Specifications
DP	Differential Pressure
GDP	Gaseous Diffusion Plant
HAUP	High Assay Upgrade Project
H/X	Moderator to Fissile Isotope Ratio
IFI	Inspection Follow-up Item
IORR	HAUP Internal Operational Readiness Review
MOX	Mixed Oxide
NCS	Nuclear Criticality Safety
NCSA	Nuclear Criticality Safety Approval
NCSE	Nuclear Criticality Safety Evaluation
NRC	Nuclear Regulatory Commission
ORR	Operational Readiness Review
PEH	Planned Expeditious Handling
PGDP	Paducah Gaseous Diffusion Plant
PMT	Post Maintenance/Mod Test
ppm	parts per million
QA	Quality Assurance
RCW	Recirculating Cooling Water
SAR	Safety Analysis Report
SAT	Systems Approach to Training
SRI	Safety Related Item
TSR	Technical Safety Requirement
UF_6	Uranium Hexafluoride
^{235}U	Uranium-235
USEC	United States Enrichment Corporation
USL	Upper Safety Limit
VIO	Violation
wt%	Weight Percent