U. S. NUCLEAR REGULATORY COMMISSION
REGION II

Docket No.:	70-1151
License No.:	SNM-1107
Report No.:	70-1151/97-03
Licensee:	Westinghouse Electric Corporation
Facility:	Commercial Nuclear Fuel Division Columbia, SC 29250
Inspection Conducted:	May 27-30, 1997
Inspectors:	C. Bassett, Senior Fuel Facility Inspector D. Ayres, Fuel Facility Inspector
Accompanying Personnel:	G. Humphrey, Resident Inspector, Oconee
Approved by:	E. McAlpine, Chief Fuel Facilities Branch Division of Nuclear Materials Safety

Enclosure 2

EXECUTIVE SUMMARY

Commercial Nuclear Fuel Division

70-1151/97-03

Plant Operations

- The licensee's criticality safety evaluation (CSE) for the centrifuging process appeared adequate. However, operation of the centrifuges appeared to have been inadequate in the past in allowing process material to migrate into the housing area and cause bearing failures due to overfilling the slab tanks. Preventive maintenance did not include testing of the thermistor and amperage switch that could be indicative of machine bearing failures and result in a buildup of material in the bowl and scroll area.

- The licensee was implementing the configuration control program as required by procedure except in the area of updating drawings, loop sheets, and schematics. A large backlog of configuration control change forms existed that had not formally been closed out.

- The UF_6 vaporization CSE contained several outdated procedural references while relying heavily on procedural controls. The defense mechanisms claimed in the CSE did not always correlate with the contents of licensee-approved procedures and the CSE did not clearly address the possible causes of the initiating events. The CSE document was not updated through the issuance of supplements or other methods. Changes to the CSE and to operating procedures were not coordinated with each other.

Management, Organization, and Controls

- Although the plant will be experiencing a period of downsizing in the production area in the near future, this is not expected to affect management or the organizational structure at the facility.

Attachment:
Partial List of Persons Contacted
Inspection Procedures Used
List of Items Opened, Closed, and Discussed
List of Acronyms

Report Details

1. Plant Operations (03) (88020)

a. Conduct of Operations (03.01)

(1) Inspection Scope

The inspector reviewed the CSE, plant operation, and documentation of maintenance activities related to the centrifuging process.

(2) Observation and Findings

Process centrifuges were provided by the manufacturer with nine interlocks to prevent damage to the machines. The licensee evaluated these interlocks and determined them to be effective to prevent a buildup of process material within the centrifuge that would cause an upset in the process. This evaluation was performed in part to assess the aspects of a critical mass buildup in the machine.

The most conservative CSE assumed some solids buildup in the machine with a homogeneous UO_2 material of 5 percent by weight of U_{235} with a full reflection of 12 inches of water. The actual material is an ammonium diuranate (ADU) material with little reflection. To achieve a neutron multiplication factor of greater than 1.0 (actual 1.0286) the following extreme assumptions were necessary. These are listed in the following table with the actual operating parameters for comparison.

CENTRIFUGE AREAS	ASSUMPTIONS (expressed in percent solids)	ACTUAL OPERATING PARAMETERS (expressed in percent solids)
Feed	70 - 80	< 5
Scroll	70 - 80	< 20
Bowl	70 - 80	< 20
Housing	70 - 80	0
Slab Tank	70 - 80	< 65

To maintain the actual operating parameters, the machine must perform as designed. The CSE identified areas that challenge the machine's performance. One area involved the failure of the scroll to operate at a speed of approximately 50 RPM greater than that of the bowl. This is necessary to remove the solids from the bowl and scroll area and prevent a solids buildup in those areas. The licensee was unable to

verify the speed by the RPM indicator and utilized other operating data to verify proper operation of the machines. One data point used a hydro-motor interlock to terminate centrifuge feeds when the oil temperature exceeded 135 degrees F. A high temperature could suggest a scroll bearing failure and could result in an excessive material buildup. However, the thermistor that measures this temperature had not been tested to verify its accuracy. This issue of failure to test the accuracy of the thermistor will be identified as an Inspector Follow-up Item (IFI), IFI 70-1151/97-03-01, Follow-up on Testing of the Centrifuge Instrumentation.

A second centrifuge interlock was the hydro-motor amperage sensitive interlock that functioned to terminate centrifuge feeds at a current of greater than 19 amps. A current of this magnitude would be indicative of a scroll bearing failure and excessive material buildup in the bowl. The amperage switch had not been tested and this issue will be identified as another example of IFI 70-1151/97-03-02.

The licensee had experienced bowl bearing failures that appeared to result from a material buildup in the housing. The licensee determined that material enters the bowl area because of an overflow of the slab tank. The licensee is monitoring the levels in the slab tank more closely and this is expected to prevent the bearing failures experienced by eliminating material in the housing areas.

(3) Conclusions

The licensee's CSE for the centrifuging process appeared adequate. However, operation of the centrifuges appeared to have been inadequate in the past in allowing process material to migrate into the housing area and cause bearing failures due to overfilling the slab tanks. Preventive maintenance did not include testing of the thermistor and amperage switch that could be indicative of machine bearing failures and result in a buildup of material in the bowl and scroll area.

b. Facility Modifications and Configuration Controls (03.02)

(1) Inspection Scope

The inspector reviewed the configuration control program to ensure that it was implemented in accordance with the license application and applicable procedures and that it would function to maintain the safety bases stipulated in the nuclear criticality safety (NCS) evaluations.

(2) Observations and Findings

The inspector reviewed selected procedures detailing the facility configuration control program and the implementation thereof. Procedures reviewed included:

- TA-500, "Columbia Manufacturing Plant Configuration Control," Revision (Rev.) 6, dated February 6, 1997, and related controlled forms and sketches.

- RA-104, "Regulatory Review of Configuration Change Request," Rev. 8, dated September 1, 1994, and related controlled forms, sketches, guidelines, and check lists.

- RA-312, "Nuclear Criticality Safety Impact Determination for Proposed System Modifications," Rev. 0, dated July 25, 1996, and the associated controlled form.

- Maintenance and Calibration Procedure (MCP)-108111, "Regulatory Compliance for Maintenance and Contract," Rev. 3, dated July 2, 1996.

The inspector noted that the licensee was revising procedures TA-500 and RA-104 to eliminate the need for RA-312 and provide clearer instructions on completing and documenting a Configuration Control package. However, these revisions were not finished as of the date of the inspection and could not be reviewed.

The inspector also reviewed and discussed with licensee representatives the general documentation of the changes made to the plant that consisted of substituting an item, completing new construction, or modifying some equipment or system at the facility during the past four years. Change Control was documented by using Change Control Forms (CCFs), designated as TAF-500-1. The inspector reviewed the TAF-500-1 forms that had been generated and evaluated the information contained on the forms. Procedure TA-500 provided detailed the responsibilities of those involved with a project involving change or modification of the facility and instructions concerning what forms to fill out and what approvals were required. The inspector noted that the forms were generally filled out properly and that the appropriate approvals were obtained to authorize the tasks to be accomplished. However, the inspector also noted that many forms remained "open" and had not been closed out by the originators. In reviewing a recent memorandum from the Configuration Control Coordinator to the responsible engineers and managers, the inspector noted that there were 27 pages (with about 10 items per page) listing projects

that had not been closed. While most of the "open" projects were recent, i.e., from 1996 and 1997, some dated back to 1993. The issue closing out the TAF-500-1 forms in a timely manner was noted as an area for improvement for the licensee.

The inspector reviewed five specific completed CCFs which dealt with a modification or major project that required a NCS assessment, most recently designated as an "RA-312 review." The five CCFs reviewed were Docket Numbers 95-135, 96-042, 96-191, 96-220, and 96-299.

The inspector noted that the Procedure TA-500 gave general guidance on how to close out and fully document completion of a modification project using the CCF. Sections 7.2.10 and 11 of TA-500 gave the following guidance:

"[The] originator/project engineer completes and assures that all configuration documentation has been updated, assures that training is completed, and implements the change or substitution in accordance with plant procedures, TA-500, and RA-104 if applicable."

"[The] originator/project engineer informs the Configuration Control Coordinator when all "As-Built" conditions are documented and the project is completed per the procedure and signs the original TAF-500-1 form for project close out."

The inspector noted that the completed forms, and related documentation reviewed by the inspector, had been signed-off and that such matters as training, procedure upgrades, and the required NCS assessments had been completed as indicated on the forms, although one NCS assessment was not timely as noted in Inspection Report (IR) No. 96-202. However, it was also noted that, of the three CCFs that required updates or changes to such documents as piping and instrumentation diagrams (P&IDs), instrument loop sheets, and piping and electrical schematics, none was totally completed as required. The items that were typically not completed were the "As-Built" drawings of the new or modified systems. In reviewing the drawings, loop sheets, and schematics in the facility Configuration Control directory or drawing file, it was noted that, during the new construction or modification projects, "For Construction" drawings were generally developed and on file for reference, but after completion of the projects, the "As-Built" drawings were apparently not requested, finalized, and placed in the "released" drawings file or archive although the CCF had been signed by the originator indicating that all documentation had been updated and the project was closed. In two cases, the

drawings or schematics were eventually updated but at a later date and during a subsequent project. In another instance, the files indicated that the certain loop sheets should be "inactive" or deleted but the sheets were still in the "active" file. In yet another case, two of the drawings or schematics listed on the CCF did not exist or were deleted. In two instances, some drawings or schematics listed on the CCF had not been updated but there was no indication or explanation why an update was either not necessary or not completed.

The inspector informed the licensee that failure to follow procedure to ensure that the various drawings, loop sheets, and schematics were updated as required by procedure was an apparent violation (VIO) of Safety Condition S-1 and Chapter 3, Section 3.4.1 of the License Application (VIO 70-1151/97-03-02).

(3) Conclusions

The licensee was implementing the configuration control program as required by procedure except in the area of updating drawings, loop sheets, and schematics. There was a large backlog of configuration control change forms that had not formally been closed out.

c. Implementation of Process Safety Controls (03.03)

(1) Inspection Scope

The NCS items associated with the uranium hexafluoride vaporization operation were reviewed to confirm the NCS limits and controls were implemented and maintained.

(2) Observations and Findings

The licensee's nuclear CSEs identify certain defense elements for ensuring that $k_{eff} \leq 0.95$ for any single expected process upset. The CSE for the UF_6 vaporization operation was reviewed to derive a list of criticality safety controls identified as defense elements to the initiating events associated with these credible process upsets. The UF_6 vaporization CSE identified thirty-one (31) possible initiating events (IEs), each having a number of defenses to guard against its occurrence. Most of the defenses were found to be in place and most appeared to be adequate. However, some issues of concern surfaced throughout the CSE document.

Most (about 80 percent) of the identified defenses dealt with administrative controls and procedural compliance, and about half of the initiating events had only administrative/procedural controls listed as defenses. This heavy reliance on administrative controls is in contrast to the philosophy in the license application which states that administrative controls are the least preferred method of criticality safety control.

The CSE mentions that no alarms exist to warn operators that a UF_6 cylinder is overweight. Instead, a cylinder must be recognized by an operator as above the weight limit described in operating procedures for this situation to be detected. Although the likelihood of receiving an overweight UF_6 cylinder is low, the consequences of processing it in the vaporization system are potentially severe may warrant an engineered control or alarming interlock to provide more depth to the defense against this group of initiating events.

The inspector reviewed the four operating procedures referenced throughout the initiating events for the UF_6 vaporization section of the CSE. Two of the referenced procedures (Chemical Operating Procedure (COP)-851002 and COP-851011) had been changed from chemical operating procedures to transportation and logistics operating procedures and given new procedure numbers (TR-300 and TR-305 respectively). The procedure most referenced in the UF_6 vaporization section of the CSE (COP-810101) was split into five smaller, task-oriented procedures (now COPs 810097 through 810101). Although these changes render most of the procedural references throughout this section of the CSE obsolete, the superseding documents were easily traced via the licensee's Electronic Procedure System.

In addition to incorrect procedure numbers, other aspects of the CSE were also found to be outdated. The inspector compared the instructions contained in the operating procedures with the administrative controls claimed as defenses to initiating events in the UF_6 vaporization section of the CSE. The inspector found that in some cases, the instructions in the procedures did not fully correspond with the defenses listed in the CSE. These discrepancies were largely wording differences between the procedures and the CSE, or were due to the CSE referencing outdated procedural requirements.

Section 6.4.1 of the approved License Application states that the CSE is "essentially a subset of the Integrated Safety Analysis (ISA) defined in Chapter 4.0." Chapter 4.0 of the approved license application states that the ISA will be maintained in "real-time." Thus, the CSE should also be

maintained as a real-time document to a practicable extent. Discussions with the licensee on this subject revealed supplements had been developed for portions of the CSE to correspond with certain process changes. However, these supplements were not attached to, contained in, nor referenced by the CSE document. Also, supplements were not issued for instances where procedural changes affected references in the CSE. To maintain the CSE as a near real-time document, the licensee should include or reference within the CSE any supplements produced which modify the CSE document. In addition, changes to referenced documents that affect the accuracy of the CSE should be documented in the CSE or in an attached supplement. The licensee was informed that inclusion of appropriate supplemental information with the CSE document will be reviewed during a future inspection and will be tracked by the NRC as IFI 97-03-03.

Also during the review, the inspector found that, occasionally where procedural compliance was claimed as a defense, how the procedural instructions provided such a defense to the initiating events was not apparent. For example, one initiating event assumes the operators apply leak detection fluid properly to the UF_6 line connections but still fail to detect the leaks. The possible causes of this event listed in the CSE include poor lighting and leaks occurring in hard-to-see places. However, no specific procedural instructions (such as using flashlights or mirrors for dim or hard-to-see areas) existed to defend against these causes. Unless procedural instructions clearly and specifically provide a defense against the causes of an initiating event, they should not be used as a claim toward preventing the event. This type of defense could be considered nonexistent.

The inspector also found that in other instances no actual procedural requirements to perform the actions needed to implement administrative controls existed. For example, the initiating events dealing with high UF_6 pressures and high condensate conductivity claim that operators monitoring these process parameters are a defense to their occurrence. Although these parameters are available to production floor and control room operators, no procedural requirements exist for them to be monitored at a specified frequency, and no record is made of their observance. Therefore, these types of defenses are not verifiable and could also be considered nonexistent.

Safety-significant computerized controls consisted of electronic interlocks that initiated responses to process upsets. The inspector reviewed documentation that showed that interlocks associated with the UF_6 vaporizer CSE were all tested and verified as operational (including subsequent

actuation of appropriate mechanical devices) within the past year. The inspector determined that this functional testing was adequate to show functionality.

(3) Conclusions

The inspector concluded that the UF_6 vaporization section of the CSE contained several outdated procedural references while relying heavily on procedural controls. The inspector also concluded that the defense mechanisms claimed in the CSE did not always correlate with the contents of licensee-approved procedures or did not clearly address the possible causes of the initiating events. Overall, the CSE document needs to be updated through the issuance of supplements or other methods. Changes to the CSE and to operating procedures also need to be better coordinated with each other. These issues will be examined further at future inspections.

2. Management, Organization, and Controls (05) (88005)

a. Organization Structure (05.01)

(1) Inspection Scope

The inspector reviewed the organization structure to ensure that no significant changes had been made or were anticipated that would adversely affect operational safety and to ensure that management was aware of their responsibilities concerning safety.

(2) Observations and Findings

The inspector discussed the current and future structure of the organization that was in place at the facility with the Acting Plant Manager, the Manager of Regulatory Affairs, and the Manager of Manufacturing. Although downsizing was anticipated in the near future, this was thought to affect mainly those in production positions due to the shutdown of two Chemical Conversion Lines and one Pellet Production Line and placing the lines in "mothballs. No restructuring of management positions or span of control was anticipated.

(3) Conclusions

Even though the plant will be experiencing a period of downsizing in the production area in the near future, this is not expected to affect management or the organizational structure at the facility.

3. Followup on Previously Identified Issues (03.08) (92701)

a. Inspection Scope

The inspector reviewed the licensee's actions regarding Inspector Followup Item 70/1151/97-02-02, the failure to have a detailed facility procedure for the testing of a CSE-identified control.

b. Observations and Findings

The inspector observed that the licensee had updated its preventive maintenance procedure to include a list of steps to be performed by licensee personnel for preparing the boiler for inspection by a contractor. It also included a list of steps for the contractor to perform during the inspection. Included in the contractor's instructions was the requirement to check the high/high water cut out float switch system for blockage, damage, wear, and freedom of movement. An instruction was also included to test the alarm functionally.

c. Conclusions

The licensee's preventive maintenance instructions for the boiler high/high level cut out meets the requirement for having a facility procedure for testing a CSE-identified control. This IFI is considered closed.

4. Exit Interview M1

On May 30, 1997, the inspection scope and results were summarized with licensee representatives. The inspector discussed in detail the routine program areas inspected, and the findings, including the violation for failure to update drawings, loop sheets, and schematics as required by the Configuration Control procedure, TA-500.

The licensee did not identify any of the materials provided during the inspection as proprietary.

ATTACHMENT

PARTIAL LIST OF PERSONS CONTACTED

Licensee Personnel

*J. Bush, Manager, Manufacturing
*R. Ervin, Senior Engineer, Technical Services
*R. Fuller, Senior Engineer, Plant Systems Engineering
*J. Goodwin, Senior Engineer, Plant Systems Engineering
*W. Goodwin, Manager, Regulatory Affairs
R. Jacobs, Team Manager, Chemical Conversion
*E. Keelen, Acting Plant Manager / Manager, Product Assurance
*N. Kent, Senior Engineer, Regulatory Affairs
*J. Heath, Manager, Regulatory Engineering & Operations
*N. Parr, Manager, Chemical Process Engineering
*T. Shannon, Technician, Regulatory Affairs
T. Wells, Configuration Control Coordinator, Plant Systems Engineering
*D. Williams, Criticality Safety Engineer, Regulatory Affairs
*R. Williams, Advisory Engineer

*Denotes those present at the exit meeting on May 30, 1997.

Other Personnel

Other licensee employees contacted included engineers, technicians, mechanics, operators, and security and office personnel.

INSPECTION PROCEDURES USED

Procedure Number	Title
IP 88005	Management, Organization, and Controls
IP 88020	Operations Review

LIST OF ITEMS OPENED, CLOSED, AND DISCUSSED

Opened

Item Number	Type	Description and Discussion
70-143/97-03-01	IFI	Follow-up on Testing of the Centrifuge Instrumentation.
70-143/97-03-02	VIO	Failure to update the drawings, loop sheets, and schematics listed on various CCFs as required by procedure TA-500.
70-143/97-03-03	IFI	Followup on the licensee's actions to include the appropriate supplemental information with the appropriate CSE documents.

Closed

Item Number	Type	Description and Discussion
70-143/97-02-02	IFI	Followup on the licensee's actions regarding the failure to have a detailed facility procedure for the testing of a CSE-identified control.

Discussed

Item Number	Type	Description and Discussion
None		

LIST OF ACRONYMS

ADU	Ammonium diuranate
CCF	Change Control Form
CFR	Code of Federal Regulations
COP	Chemical Operating Procedure
CSE	Criticality Safety Evaluation
IE	Initiating event
IFI	Inspector Follow-up Item
IP	Inspection Procedure
IR	Inspection Report
ISA	Integrated Safety Analysis
NCS	Nuclear Criticality Safety
NRC	Nuclear Regulatory Commission
MCP	Maintenance and Calibration Procedure
P&ID	Piping and instrumentation diagram
RA	Regulatory Affairs
Rev.	Revision
RPM	Revoluations per minute
VIO	Violation