



UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION II
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ATLANTA, GEORGIA 30323 0190

71155-81

Report No.: 70-1151/94-01

Licensee: Westinghouse Electric Corporation
Commercial Nuclear Fuel Division
Columbia, SC 29250

Docket No.: 70-1151 (Fuel Division)

License No.: SNM-1107

Facility Name: Columbia Nuclear Fuel Plant

Inspection Conducted: January 26 - February 5, 1994

Inspector: C. Bassett
C. H. Bassett, Fuel Facility Project Inspector

2/25/94
Date Signed

Inspector: E. D. Testa
E. D. Testa, Fuel Facility Inspector

2/25/94
Date Signed

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Radiation Safety Projects Section
Nuclear Materials Safety and Safeguards
Division of Radiation Safety and Safeguards

2/25/94
Date Signed

SUMMARY

Scope:

This reactive, announced inspection involved a review of the emergency response actions taken by the licensee following an event involving the release of uranium hexafluoride (UF_6) from [] at about 6:45 a.m. on January 26, 1994.

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Results:

As a result of the inspection, it was determined that the licensee responded appropriately to the emergency. The event was promptly classified, the emergency plan was implemented, and emergency brigade personnel responded as required. The results of the evaluations conducted by the Health Physics group indicated that those individuals who received exposure during the event received only a small fraction of the annual dose limits. The calculated site boundary doses were small percentages of the regulatory limits and site boundary air sample results supported the calculations. Following the event, the licensee immediately formed a Root Cause Analysis Team to investigate the incident and determine the facts and circumstances of the release. Initial findings of the team indicated that []

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in accordance with the Freedom of Information
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I which lead to the release of UF_6 gas in the Conversion Area. Corrective actions were subsequently taken by the licensee.

Within the scope of the inspection, one licensee identified non-cited violation was noted for failure to provide annual Emergency Director training for the initial responder who assumed the position of Emergency Director during the event on January 26, 1994 (Paragraph 3.c). An issue was also identified regarding improved guidance to Emergency Coordinators in the area of UF_6 release Emergency Plan Classification (Paragraph 4.c).

REPORT DETAILS

1. Persons Contacted

Licensee Employees

- *J. Fici, Plant Manager
- R. Fuller, Plant Systems Engineer, Technical Services
- *D. Goldbach, Manager, Chemical Process Engineering
- *W. Goodwin, Manager, Regulatory Affairs
- *J. Heath, Manager, Regulatory Operations
- R. Henry, Process Engineer, Chemical Process Engineering, Technical Services
- *J. Hooper, Safety Engineer, Regulatory Affairs
- *E. Keelen, Manager, Fuel Manufacturing
- *G. LaBruyere, Manager, Conversion Services
- *G. Lowder, Manager, Maintenance
- *S. McDonald, Manager, Technical Services
- D. Parker, Acting Manager, Nuclear Materials Management & Product Records, Regulatory Affairs
- E. Reitler, Manager, Regulatory Engineering, Regulatory Affairs
- L. Roeback, Process Engineer, Chemical Process Engineering, Technical Services
- C. Sanders, Manager, Nuclear Materials Management & Product Records, Regulatory Affairs
- *P. Stroud, Manager, Security
- *R. Williams, Technical Coordinator, Regulatory Affairs
- C. Wu, Advisory Engineer, Technical Services

Other licensee employees contacted during the inspection included supervisors, operators, medical personnel, security personnel and office personnel.

*Attended the exit interview on February 4, 1994.

2. Followup on the Event (88020, 88025)

a. Description of the Event

At approximately 6:45 a.m. on January 26, 1994, a Conversion Area operator noted that uranium hexafluoride (UF₆) was leaking from piping near [redacted]

The fire/emergency alarm was sounded, an announcement was made to evacuate the Chemical Area, and all processing of UF₆ gas was halted. Immediately following the sounding of the alarm, the Emergency Brigade was activated and began to assemble. Management was notified of the problem, an ALERT condition was declared, and notifications to State of South Carolina officials and to the NRC were made in accordance with the Site Emergency Plan. Emergency response personnel responded to the event and the release was terminated approximately ten minutes after it began.

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UF₆ gas, however, which had apparently become trapped in the insulation around the piping, continued to be released into the building. The gas leak was subsequently contained by placing a plastic "tent" over the piping and attaching a ventilation hose to the containment. At about 9:30 a.m., two NRC inspectors were dispatched from the regional office to the site to perform a reactive inspection of the event. The licensee initiated efforts to clean up the area affected by the release when the containment was in place over the piping and the ALERT was terminated at approximately 10:30 a.m. A Root Cause Analysis Team was immediately formed to investigate the event and determine the facts and circumstances of the UF₆ gas release. The NRC inspectors arrived on-site at approximately 2:30 p.m.

b. Initial Findings of the Root Cause Analysis Team

The team began investigating the event the afternoon following the release. A time line was constructed and causal factors were developed. The team initially determined that [REDACTED]

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and then to a release of UF₆.

Within 48 hours the team reached a preliminary conclusion about the apparent cause of the [REDACTED]. The team theorized that some type of contaminate had been accidentally introduced into the [REDACTED]

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The team theorized that the contamination could have resulted from:

- (1) Oil contamination in the [REDACTED]. The oil could have come from the piece of piping, called a "pigtail", used to connect the [REDACTED]
- (2) Water contamination in the [REDACTED]. The water could have been introduced into the line from the [REDACTED] system.

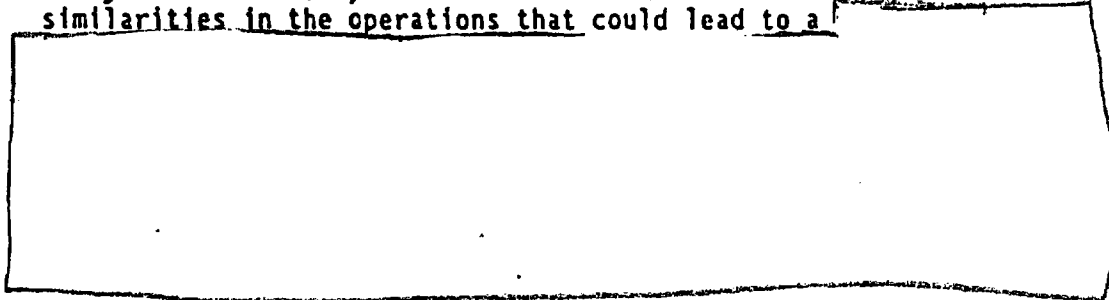
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Later, another potential problem was also noted. It was theorized that the [REDACTED] could cool, due to the failure of a steam trap, and the UF₆ gas could cool and solidify. This could lead to blockage of the piping and/or lead to a reaction of the solid UF₆ with a contaminate.

c. The Indirect Dry Route Process

With both the ADU conversion process and the Indirect Dry Route (IDR) process shut down due the event, the licensee began an analysis of the IDR process to insure that there were no similarities in the operations that could lead to a



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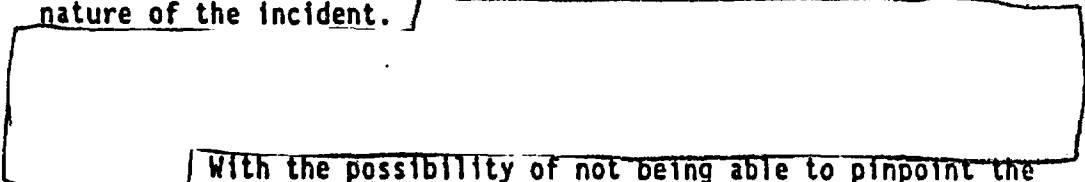
The licensee completed their analysis of the IDR process and reviewed their findings with the NRC. It was concluded that the IDR process could be restarted after the following actions had been completed: 1) leak check all the lines, 2) use only new pigtaills that were known to be free of contaminants, 3) check all the gages in the UF₆ portion of the process for leaks and ensure that they were filled with

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and 5) train all IDR team members on what occurred. Therefore, after it was verified by the NRC that these actions had been taken, IDR Line 1 was resumed operations on February 1, 1994, at about 1:10 a.m. IDR Line 2 also resumed operations on February 1 at about 2:15 a.m. No problems were encountered and both operated as designed.

d. Corrective Actions for ADU Lines 1-3

Through the investigation, the licensee found that they might not be able to determine the exact cause of the problem due to the nature of the incident.



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With the possibility of not being able to pinpoint the exact cause of the problem, the licensee took steps to address all the likely causes that had been developed that may have lead to the problem.

In order to restart ADU Conversion Lines 1-3, the licensee identified the following corrective actions:

- [

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- check all the [redacted] Ex.
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- [redacted]
- implement system and Operating Procedure changes to ensure the [redacted] remain free-flowing and that appropriate actions are taken upon indication of flow restriction. *
- install a new system that provides for [redacted] Ex.
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- complete operator training on the procedure changes and the restart conditions.

The inspectors reviewed [redacted]

[redacted] One inspector attended selected operator training sessions which reviewed the incident and the changes that had been made to the procedures. All the actions taken by the licensee appeared to be adequate.

The licensee also had the [redacted]

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Following completion of the above corrective actions, the licensee resumed operation of ADU Line 1 at 6:00 p.m. on February 4, 1994, and resumed operation of ADU Line 3 at 10:30 p.m. on February 4. The licensee indicated that ADU Line 2 which had not been operating at the time on the event, would not be restarted until after completion of other scheduled modification had occurred.

e. Corrective Actions for ADU Line 4

In order to restart ADU Conversion Line 4, the licensee identified the following corrective actions:

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- complete operator training on the procedure changes and the restart conditions.

The inspectors observed the [] on ADU Line 4. Some residue from inside the piping was obtained for further analysis. (This residue was subsequently sent off-site for analysis by X-ray diffraction and then by chemical means.) The inspectors had some questions concerning the [] on ADU Line 4. These questions formed the basis of a discussion between the licensee and the NRC during a management meeting held on February 9, 1994, at the Region II Office.

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As noted above, the inspectors also reviewed the []

Records were reviewed that indicated that the []

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The inspectors also reviewed the Operating Procedures. One inspector attended selected operator training sessions which reviewed the incident and the changes that had been made to the procedures. These training sessions covered the corrective actions for all the ADU Lines. All the actions taken by the licensee to that point appeared to be adequate.

3. Response to the Event (88020, 88025)

a. Emergency Response

The inspector reviewed the licensee's emergency response activities associated with the January 26, 1994 UF₆ release event classified as an ALERT. The licensee activated its Emergency Plan Titled "Site Emergency Plan Westinghouse Electric Corporation Commercial Nuclear Fuel Division", dated April 1990 as revised April 30, 1993. Section 3.1.2 of the Emergency Plan indicates that "an Alert is defined as a situation in which events may occur, are in progress, or have occurred that could lead to a release of radioactive or hazardous material to the environment but that the release is not expected to require a response by off-site organizations to protect persons off-site or result in any off-site consequences. Complete plant evacuation is not anticipated, although protective evacuations or isolation of certain plant areas may be necessary. Environmental sampling and some off-site monitoring may be required. Any releases are expected to be small fractions of the EPA Protective Action Guideline exposure levels. The emergency response organization will be mobilized, either in a standby mode that will activate some portions of the organization or full mobilization, depending upon the severity of the event." The UF₆ release met one of the example typical events falling in this classification. The examples of Classifiable Events, Section 3.1.5, Example 1. UF₆ Releases provides guidance to the Emergency Coordinators and Emergency Directors.

As noted above, the event was a UF₆ gas release on the [] which began at about 6:45 a.m. The fire alarm and Emergency Warning Light System (Blue Lights) were activated immediately. Operations were terminated in a timely manner, including shutting off all UF₆ gas (within 3 minutes for [] the affected line, and within 10 minutes for the remainder of the other operating lines).

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The inspector noted that the licensee promptly classified the event, expeditiously formed the requisite emergency organization, and made timely notification (at 7:10 a.m. [within 15 minutes]) to the South Carolina Department of Health and Environmental Control (SCDHEC) and to the NRC at 7:21 a.m. (about 11 minutes later). Operations were secured, the release promptly terminated, and in-plant and off-site monitoring implemented. Off-site dose estimates were performed and follow up Health Physics activities were carried out.

The notifications were appropriately performed using Procedure CSEP-0013 Revision 4 dated April 30, 1993 Attachment A. Evacuation of the Chemical Area was timely, and verbal accountability was completed at 7:10 a.m.

b. Health Physics Response

(1) Internal Exposure

Individuals in the vicinity of the release, or Emergency Brigade personnel who responded to the event, were evaluated by Health Physics for possible intake from the response. Nasal smears were obtained and the highest nasal smear was determined to be 9 disintegrations per minute (dpm), which is well within the 150 dpm investigational limit. Eleven individuals were placed on restriction, however, as a precaution. Urine samples submitted within 48 hours post-incident were screened by licensee medical staff for the presence of albumin (proteins). All bioassay results were negative or trace, and within normal parameters. Urine samples were also sent off-site for immediate radiometric analysis.

Detailed estimates of workers' intake, uptake, and dose were performed for three individuals; two were determined to be the most limiting individuals from a dose limit standpoint and the third a representative of the other restricted personnel. Dose estimates were performed using ICRP 30 methodology and the intake retention fractions as described in Regulatory Guide 8.9, "Acceptable Concepts, Models, Equations, and Assumptions for a Bioassay Program", and NUREG/CR-4884, "Interpretation of Bioassay Measurements". The estimates were based on the ALI and DAC values for Class D, U_{234} particles of 1.0 micrometer AMAD because the individuals were exposed to the transportable compound UO_2F_2 (the by-product of UF_6 hydrolysis in air). The enrichment (U_{235} by weight) of the material was determined to be 3.7%. Reference man physiology was also assumed.

The results of all medical tests and radiometric tests performed, and subsequent exposure estimates, indicated that

all individuals involved received exposures that were small fractions of the nephrotoxic limiting values and the annual dose limits. Preliminary exposure calculations for the maximally exposed individual showed a calculated exposure of approximately 0.04 Rem and 17 DAC hrs. These results are expected to be revised downward as final information is evaluated.

The inspector determined that appropriate portions of the following procedures were implemented:

- (a) Regulatory Affairs Procedure RA-204, Bioassay Program, Revision 7, dated May 6, 1993,
- (b) Regulatory Operations Procedure ROP-04-015, Bioassay program - Unusual Incidents, Revision 0, dated July 23, 1992, and
- (c) Regulatory Operations Procedure ROP-05-028, Issuing and Documenting Employee Work Restrictions, Revision 3, dated August 12, 1992.

(2) Air Sampling

The inspector reviewed in-plant air samples taken by the health physics staff at various sampling locations in the vicinity of the gas release. The first sample was taken at about 7:14 a.m. which was approximately 30 minutes after the start of the release. The sample was taken at HP Lab and additional samples were taken at additional sample locations in the chemical control area.

The inspector also reviewed the roof stack results for the most likely release points. Using the licensee's identification scheme, roof stack results from the following areas were reviewed: 1A, 1B, 4A, 4B (scrubber), 4E, #2 off gas, and #3 off gas. Environmental air sample results taken at about 0845 were reviewed. This sample was taken at the #3 Environmental Station beside the parking lot. Sample result values were within the expected values for a release of this nature. The total release for the roof stack effluent for January 26, 1994, was about 6.82 micro Curies (total for a 24 hour period) which is slightly less than about three times the average daily release value.

(3) Site Boundary Doses

The inspector reviewed the calculated site boundary doses and verified that the values were small percentages of regulatory limits. Site boundary air sample results support the conclusion of the release having been a small percentage of regulatory limits. Air sample results corrected for

decay of naturally occurring isotopes of Radon and its daughters show results which are indistinguishable from natural background fluctuations.

c. Licensee Critique of the Event

The inspectors attended the licensee critique of the event conducted on January 28, 1994. The critique appeared to be detailed and in-depth and identified areas for improvement. The licensee identified that a previously trained and qualified individual assumed the role of Emergency Director until relieved by the plant manager at about 8:06 a.m. The fact that the initial person acting as Emergency Director was not current in the required training was recognized immediately by two fully trained Emergency Director alternates who manned the Emergency Operations Center from the beginning of event. The two trained individuals acted in a support and advisory role during the event. Section 7.2.1 of the Emergency Plan states that "Members of the Emergency staff who may serve as alternates to the Emergency Director will receive annual training: Supervision of emergency teams, Interpretation of data and estimations of radiation exposure, Coordination and communication with off-site groups".

The inspector selectively reviewed training records for additional members of the emergency response organization who responded to the event. No additional examples of training lapses were found. Results of the inspection indicated that the lapse of training for the initial Emergency Director did not adversely affect the response of the emergency organization and the position was adequately supported by currently trained personnel. This violation will not be subject to enforcement action because the licensee's efforts in identifying and correcting the violation meet the criteria specified in Section VII.B of the Enforcement Policy.

Non-cited Violation (NCV) 70/1151/94-01-01: Licensee identified violation for failure to provide annual Emergency Director Training, as required by the site Emergency Plan Section 7.2.1, for the initial responder who assumed the position of Emergency Director.

4. Precursor Review

a. Similar Previous Event

The inspector, as a follow-up to the January 26, 1994 event, reviewed the operations's log and records to determine if any similar releases had occurred in the last six months. The logs listed that a small release occurred on January 17, 1994. The UNUSUAL INCIDENT RECORD for this event was UI#183. Also reviewed was the RED SHEET dated January 20, 1994 titled "SERIOUS POTENTIAL INJURY/INCIDENT NO. 94-02". At approximately 12:05 a.m., an ADU

Conversion Line steam chest was being heated for start-up. The operator noticed UF₆ leaking from the UF₆ adaptor and pigtail. A maintenance Mechanic reported to the ADU Control Room that there was a suspected UF₆ gas release. The Emergency Coordinator investigated the reported release and confirmed the fact. At the same time, an ADU Pellet Area employee was in the area designated by the licensee as the UF-6 Bay, at the bottom of the stairs. Direction was given to an operator to warn the employee to leave the area and to call the Ladies Change Room to warn them not to enter the UF-6 Bay. One additional female employee, who was about to leave the ladies change room, was instructed to go back into the change room. She followed those direction and went back into the change room. The event was terminated within about 45 seconds by operator actions.

b. Health Physics Actions

The area was surveyed and released by Health Physics at about 12:30 a.m. A total of four individuals were determined to have been potentially exposed to HF vapors from the UF₆ gas release. These employees were placed on restriction as a precaution. Urine samples submitted immediately following the incident were screened by licensee medical staff for the presence of albumin. All results were negative or trace, and within normal parameters. Urine samples were sent off site for radiometric analysis. Estimates of worker exposure (intake, uptake and dose) were performed. Results of all tests performed and subsequent exposure estimates indicate that all individuals involved received exposures that were small fractions of nephrotoxic limiting values and the annual dose limits. Dose estimates were based on ICRP 30 methodology and the use of retention fractions as described in Regulatory Guide 8.9, "Acceptable Concepts, Models, Equations, and Assumptions for a Bioassay Program", and NUREG/CR-4884, "Interpretation of Bioassay Measurements". The estimates were based on the ALI and DAC values for Class D, U₂₃₄ particles of 1.0 micrometer AMAD. The enrichment by weight was determined to be 0.7% (Natural Uranium). Reference man physiology was also assumed.

c. Employee Interviews

The inspectors interviewed the four individuals placed on restriction due to this event, as well as the individual who functioned as the emergency coordinator during this event. The inspectors determined that the actions taken by the licensee appeared appropriate and that the follow-up activities appeared reasonable. Through the interviews and discussions with Emergency Coordinators concerning the January 17, 1994 small UF₆ release and the January 26, 1994 UF₆ release that resulted in an ALERT declaration and implementation of the Emergency Plan, the inspector noted that there was an issue regarding the need for

better guidance (less subjective in nature) for the Emergency Coordinators for determining the significance of a UF_6 release for Emergency Plan Classification. This issue was discussed with the licensee. A licensee representative stated that the licensee would review the issue to determine if changes in guidance were appropriate. The inspector informed licensee management that their actions in response to providing better guidance to the Emergency Coordinators would be tracked by the NRC as an Inspector Follow-up Item (IFI) and would be reviewed during a subsequent inspection.

IFI 70/1151/94-01-02: Provide improved guidance to Emergency Coordinators in the area of UF_6 release Emergency Plan Classification.

4. Exit Interview

The scope and results of this followup inspection were summarized on February 4, 1994, with those persons indicated in Paragraph 1 above. The inspector described the issues reviewed and discussed in detail the inspection results and observations. No dissenting comments were received from the licensee. Although proprietary material was reviewed and discussed during this inspection, proprietary information is not contained in this report.

<u>Item Number</u>	<u>Description and Reference</u>
70-1151/94-01-01	NCV - Failure to provide annual Emergency Director training for the initial responder who assumed the position of Emergency Director during the release on January 26, 1994 (Paragraph 3.c).
70-1151/94-01-02	IFI - Provide improved guidance to Emergency Coordinators in the area of UF_6 release Emergency Plan Classification (Paragraph 4.c).