

U.S. NUCLEAR REGULATORY COMMISSION

REGION III

Docket No: 070-00036  
License No: SNM-33  
Report No: C70-00036/96004 (DNMS)  
Licensee: ABB Combustion Engineering  
Facility: Hematite Nuclear Fuel Manufacturing Facility  
Location: Combustion Engineering, Inc.  
Hematite, MO 63047  
Dates: September 23 through 27, 1996  
Inspectors: T. Reidinger, Senior Fuel Cycle Inspector  
R. Krsek, Fuel Cycle Inspector  
Approved by: G. Shear, Chief, Fuel Cycle Branch  
Division of Nuclear Materials Safety

## EXECUTIVE SUMMARY

ABB Combustion Engineering  
Nuclear Fuel Manufacturing Facility  
Hematite, Missouri  
NRC Inspection Report 070-00036/96004(DNMS)

The inspection involved the review and observation of selected aspects of licensee management organization and controls, operations, radwaste management, operator training, emergency preparedness, and the assessment of data collected during the recent AIT inspection.

### Management Organization and Controls (IP 88005)

- Staffing appeared adequate to support plant operations (Section 1.0)
- Management planned to hire a criticality analyst and five new draftpersons to assist in upgrading specific areas identified for improvement (Section 1.0).

### RadWaste Management (IP 84850)

- The licensee was effectively implementing its waste liability reduction program (Section 2.0).

### Operator Training (IP 88010)

- An apparent operator understanding weakness relative to "Large Bottle Stacking" criticality safety limits was identified for inspector followup (Section 3.0).

### Criticality Safety (IP 88015)

- The licensee was effectively implementing its criticality safety alarm testing program (Section 4.0).

### Operations (IP 88020)

- Two violations were identified regarding the failure to ensure that procedural criticality limits were implemented during the processing of filters and filter media waste disposal drums. These errors exemplified a lack of attention to detail and self-checking (Section 5.0).
- Operators in the Erbia plant, Oxide Conversion and UF<sub>6</sub> unloading dock and the recycle recovery (Red Room) areas appeared to be properly trained on and knowledgeable of applicable processes and procedures (Section 5.0).

• Augmented Inspection Team Findings Assessment

(1) Emergency Preparedness (IP 88050)

- The overall event response was good. Actions taken to minimize potential radiological exposures to onsite emergency workers and nonessential staff were good (Section 6.0).
- Timely and detailed notifications of the emergency declaration were provided to the applicable State and local Emergency Management Agencies and to the NRC's Operations Center (Section 6.0).

(2) Procedures

- Three Non-Cited violations were identified involving the failure to fully implement several procedures on multiple occasions during the processing of filtrates or scrubber solutions (Section 6.0).

## REPORT DETAILS

### 1.0 Management Organization and Controls (IP 88005)

#### a. Inspection Scope

The inspectors reviewed and discussed licensee personnel changes.

#### b. Observations and Findings

The licensee informed the inspectors of their commitment to hire five new draftpersons to aid plant staff in the conduct of Integrated Safety Analyses (ISAs) for all plant process systems. All process system piping and instrumentation diagrams will be updated, if applicable, as a result of the ISA reviews. The licensee anticipated that component identification and piping and valve labels also would be upgraded during the review process.

In addition, the licensee indicated their intent to hire a second criticality safety specialist to facilitate upgrade of the criticality safety program. In light of these changes, the inspectors discussed the potential need for updates to the Safety Demonstration Volume, "Part 2," Chapter 11, "Organization and Personnel," of the license application. The licensee indicated that they would review and submit any applicable changes to NRC.

#### c. Conclusions

The inspectors determined that the planned licensee personnel changes did not negatively impact the safety of licensed activities and were consistent with license requirements.

### 2.0 Radioactive Waste Management (IP 84850)

#### a. Inspection Scope

The inspectors reviewed the effectiveness of the licensee's waste liability reduction program. The review included observations during facility tours and discussions with licensee personnel.

#### b. Observations and Findings

The inspectors noted that the licensee maintained a computerized accountability system data base for each trailer and container of radioactive waste located in the trailer storage yard. The containers were arranged for further processing and ultimate disposal. Each storage row of trailers and containers was numbered and each container was identified by an easily

identifiable serial number. Although the licensee's waste was stored outside, the inspectors did not observe any safety significant container deterioration. The licensee routinely inspected the containers.

Based on observations during facility tours and discussions with waste handling personnel, the inspectors determined that waste handling operations were consistent with licensee procedures and regulatory requirements. The inspectors noted that the individuals performing these tasks were properly trained and qualified for the work. The inspectors also observed that the licensee waste management engineering staff were actively involved in evaluating engineering controls for waste minimization.

c. Conclusions

The licensee's waste liability reduction program was effectively implemented.

3.0 Operator Training (IP 88010)

a. Inspection Scope

The inspectors interviewed selected operators to assess their training on and knowledge of various plant process systems.

b. Observations and Findings

The inspectors noted that employee training included: 1) radiation protection fundamentals; 2) criticality safety; 3) hazardous chemical safety; 4) fire protection requirements; 5) emergency response requirements, and; 6) security requirements. Refresher training, on fundamentals of criticality and radiation safety, was provided on a biennial basis. In addition to training and qualification on operating procedures, the plant held scheduled safety/training meetings. These meetings covered various aspects of radiological safety, criticality safety, non-radioactive hazardous materials safety, radioactive waste and transportation requirements, emergency response, and industrial safety.

In an effort to assess the training's effectiveness, the inspectors held discussions with eight plant operators or supervisors on the "Safe Individual Unit (SIU) in Transit" concept and several criticality limits. One such limit was the "Do not double stack large bottles (containing fissile material)" requirement. The inspectors determined that plant operators and supervisors had a good understanding of the "SIU in transit" concept. However, most plant operators and supervisors did not appear to understand the "double stacking" criticality limit.

Specifically, during discussions most operators could not explain the "double stacking" concept in a manner similar to that present in the training lesson plans. The plant staff frequently responded that the criticality limit was to ensure that the bottles were not stacked on top of each other. However, the lesson plans stated that the criticality limit was to prevent bottles from being stacked in front of each other. The limit was instituted to prevent operators from hanging bottles in plastic bags in front of each other. This type of arrangement could compromise the intended vertical safe slab geometry configuration limit of one bottle.

The inspectors determined that the apparent incorrect staff understanding of the criticality limit did not pose an immediate safety issue. This assessment was based upon direct observations that no bottles were hanging or attached to plastic bags. However, the ongoing adequacy of plant staff criticality training will be tracked as an Inspection Followup Item (IFI 070-00036/96004-03).

c. Conclusions

The licensee's training program was consistent with the requirements of the license and licensee procedures. Plant staff appeared knowledgeable and adequately qualified to perform their assigned tasks. However, some weaknesses were observed with the staff's understanding of the "large bottle double stacking" criticality limit.

4.0 Criticality Alarm Systems (IP 88015)

a. Inspection Scope

The inspectors observed the monthly criticality alarm system surveillance test and the radiation safety staff's use of procedures.

b. Observations and Findings

The inspectors observed a Criticality Alarm System test conducted on September 27, 1996. During the observations, the inspectors determined that the "Monthly Nuclear Alarm Checklist," used to record the surveillance testing requirements, was adequate. Plant staff also informed the inspectors that actions were recently completed to incorporate the criticality alarm system calibration and testing checklist into a new procedure. Management took this action to better formalize and capture all criticality alarm system licensee requirements.

During the test, the criticality alarm panel configuration was reviewed and no anomalous alarms were observed. Following a 1995 test, the licensee determined that some criticality alarm system



"audibly challenged areas" existed in the plant. In response to this finding, four additional criticality alarm horns were installed at the designated "challenged" locations to ensure that adequate audibility coverage. In response to this alarm test, plant staff did not report any areas with inadequate alarm audibility coverage.

c. Conclusions

The criticality alarm system was functional and satisfied license conditions.

5.0 Conduct of Operations (IP 88020)

a. Inspection Scope

The inspector's toured plant areas and interviewed employees on one night shift and several day shifts. Areas toured included the Recycle Recovery, Incineration, HEPA Filter, Filter and Residue Holding, Pellet Processing,  $UO_2$  powder storage, Erbia Plant,  $UF_6$  Unloading, and the Oxide Conversion. In addition, the inspectors reviewed selected aspects of the operator qualification system, including the computer procedure verification system.

b. Observations and Findings

1. Facility Tours and Discussions

The inspectors' observation and interview of Oxide Conversion and  $UF_6$  Unloading Dock staff indicated that the operators were generally trained and very knowledgeable of the area processes and procedures, with one exception. The operators appeared somewhat confused as to the control room readout location for the fourth floor (oxide) hydrogen fluoride (HF) alarm. This apparent informational shortcoming was compensated for by a process engineer present during the discussions.

During a general walkdown of the plant ventilation system, the inspectors observed that 2 ventilation enclosure HEPA filters were about to reach their differential pressure (D/P) limit of six inches of water. The licensee was informed. All other filters D/Ps were within limits.

The inspectors observations in the Erbia plant revealed that both the operators and supervisors were knowledgeable with work requirements in their respective areas. During one (night) shift, the operators and supervisors correctly answered the inspectors' questions concerning criticality postings, which included the 1% moisture control limit. During tours, the inspectors observed that material cans,

located on the conveyors, had appropriate documentation which indicated within specification "moisture limits." However, some non-conveyor cans had no documentation which identified their specific moisture content.

During followup discussions, the licensee explained that a select number of cans were maintained under a separate and more rigid "moisture control process." This process was based on the lot numbers and did not utilize the documentation observed on the other cans. Plant staff typically verified moisture content cans by accessing a data base and referencing the can's specific lot number. The inspectors did not identify any immediate problems with use of this dual control system. However, the inspectors noted that the system could, with staff knowledge, allow a "non-moisture" controlled can to be stored in violation of the criticality limits. The licensee agreed to review this area.

Inspector interviews with the Pellet Re-processing and Recycle Recovery Area (Red Room) staff revealed that both the operators and supervisors were knowledgeable of area work activity procedures. Operators stated that the plant computer system was used to identify revised work related procedures which required reading prior to beginning a work activity. Operator completion of required reading was also acknowledged on the computer. In addition, the process engineer conducted daily operator briefings to ensure that significant procedure changes were understood. The inspectors noted during conversations, some plant staff did not appear to clearly understand some criticality posting requirements (Section 3.0).

The inspectors toured the Incineration Area (Green Room) and interviewed some employees working in the area. The inspectors observed an operator conduct several grinding operations in a glove box. The operator was very knowledgeable about this process including the associated procedures, criticality limits, and personnel safety issues. The procedure in use was current.

The inspectors observed decontamination room activities. Workers were knowledgeable of safety issues associated with the room. All Radiation Work Permit (RWP) requirements were followed, including proper protective personal equipment and respiratory protection. The inspectors determined that materials stored in the area were in accordance with criticality safety limits and appropriate procedures.

During facility tours, the inspectors noted that criticality control limits were appropriately posted in special nuclear material areas. Air sampling devices, ventilation system



magnahelec and area radiation monitoring equipment appeared fully operational. The inspector noted that fire extinguishers and other fire safety equipment appeared operational and in good condition.

Finally, the inspectors observed that housekeeping was maintained at a good to excellent level throughout the areas toured.

## 2. Violation of Criticality Controls

On September 24, 1996, the inspectors reviewed the continuous U-235 inventory logs and the weight and content tags attached to selected filters stacked by the UO<sub>2</sub> Powder Storage Area. The inspectors determined that on September 18, 1996, two filters, with greater than 2 kgs net weight, and having 77.5 gm and 81.5 gm of U-235 per gamma count, were placed in the area. This discrepancy was brought to the attention of the Criticality Controls Manager and the filters were immediately removed from the pallet and given the proper criticality control spacing of one foot.

Safety Condition S-1 of Special Nuclear Material License SNM-33 requires that licensed material be used in accordance with the statements, representations, and conditions in Chapters 1 through 8 of the application dated October 29, 1993, with supplements. Chapter 4, Section 4.1.4, requires, in part, that all operations involving the handling and storage of special nuclear material be performed according to written procedures.

Operating System (OS) Procedure 801.10, "Filter Processing," Section 5.1.2, requires that 24" by 24" filters, stacked on pallets by the UO<sub>2</sub> Powder Storage Area, may not have more than 2 kilograms (kgs) net weight or more than 75 grams (gm) of U-235 per gamma count.

The failure to maintain the allowable filter U-235 limits was a violation (Violation 070-00036/96004-01).

On September 25, 1996, during a tour of the filter disposal process area, the inspectors observed three (55 gallon) drums of packaged filter media waste (Safe Individual Unit (SIU)) in temporary "transit" prior to disposition to an approved storage area. In addition, the inspectors noted that one of the packaged drums (SIU) of U<sup>235</sup> was separated from another drum (SIU) by only nine inches.

Nuclear Inspection System (NIS) Procedure 201, Nuclear Safety Parameters," requires in Section 1.6., "Containers In Transit," that no more than two Safe Individual Units (SIUs) may be "in transit" at one time in the immediate work area. Furthermore, Section 1.6 requires that an SIU be placed at least one foot from other SIU units.

The failure to limit the number of SIUs "in transit" to two or less in the immediate work area and the failure to maintain proper SIU separation was a violation (Violation 070-00036/96004-02).

The inspectors also reviewed the continuous U-235 inventory logs for the three "in transit" drums. The logs indicated that one of the drums contained 350 gms of U-235. This observation appeared to be in conflict with the requirements of OS 801.10. OS 810.10, Section 2.2, required that each 55 gallon drum (fiberglass prefilter media waste) shall contain no more than 300 gm of U<sup>235</sup>. During subsequent conversations with the licensee, the Criticality Control Manager indicated that the procedural 300 gm limit was a typographical error. This position was supported by calculations and an NIS procedure directive which limited 55 gallon drums to less than 350 total gms of U<sup>235</sup>. In response to these findings, the licensee immediately quarantined the filter work area, stopped any further processing, and cancelled the OS 801.10 procedure. Management plans to conduct a review of other procedures prior to resuming activities.

c. Conclusions

Supervisors and operators were observed to be trained and knowledgeable of operations, procedures, and safety hazards in their respective areas. Criticality safety activities were generally conducted in accordance with prescribed controls, limits, and in appropriately posted areas. However, two examples of inadequate implementation of proceduralized criticality controls were identified. Good to excellent housekeeping was maintained in the areas toured.

6.0 Augmented Inspection Team Followup (IP 92701)

a. Inspection Scope

The inspectors reviewed the unanticipated, exothermic chemical reaction which occurred in the large evaporation and mop water boildown tanks. These tanks were located outside the maintenance and recovery building. This activity included a review of all process procedures, piping and instrumentation diagrams, and associated process equipment. The inspectors also conducted interviews with process operators from two shifts.

b. Observation and Findings

1.a. Emergency Preparedness (EP) Program (IP 88050)

The inspectors reviewed the licensee's actions during and following the event. The actions were appropriate and in accordance with the Emergency Plan Implementing Procedures (EPIPs). Decisions by the Emergency Director (ED) were

conservative and offsite emergency responder and agency interfaces were well handled. The licensee's response was coordinated, orderly, and timely.

The inspectors determined that the event demonstrated that the licensee's EP program and associated procedures were adequate. The licensee actions demonstrated that they were capable of implementing these plans and procedures in an effective manner. However, the inspectors identified some weaknesses with the facility sampling program used to identify potential offsite consequences during the event. The weaknesses included: 1) a lack of procedural guidance for performing activities, and; 2) a lack of equipment necessary to perform some radiological and chemical sample assessments.

As a result of the event and an initial internal self assessment, the plant ordered battery powered, high volume air samplers and Drager tubes to address some of the equipment weaknesses. The plant staff also planned to review the EIPs for applicable revisions.

#### 1.b Closed Inspector Followup Item (IFI) 070-00036/96002-03:

An IFI was opened as the result of a weakness noted during the 1996 emergency preparedness exercise. The IFI dealt with the licensee's provision of delayed and incomplete event classification to State Emergency Management Agencies and NRC's Operations Center during the exercise.

The inspectors review of actions and communications conducted in response to this event indicated that the issue has been resolved. This item is closed.

#### 2. Operating procedures

The inspectors reviewed the procedures used to reduce the volume of Recycle/Recovery Area liquid process wastes. The procedures governed operations involving potassium hydroxide (KOH) scrubber solutions, the "wet side" filtrate (nitrate solutions), and mop water (contaminated cleaning solutions). The inspectors determined that procedures were adequate; however, examples of inadequate procedural adherence were identified as follows.

- Operating System (OS) Procedure, OS 806, "Recycle/Recovery Area Wet Scrubber," Section 2.0, "Nuclear Safety," required weekly measurement of (KOH) scrubber solutions uranium content. The procedure required the maximum uranium concentration to be less than 1.0 gm U/l.

Through a review of the logs and discussions with plant personnel, the inspectors determined that weekly sampling was inconsistent. In particular, plant logs indicated that

sampling was not conducted during the last three weeks in May 1996, the last two weeks in June 1996, and the first two weeks in July 1996. In addition, actual plant practice for sampling the scrubbers varied between the operating shifts. However, results for samples that were taken indicated KOH solution uranium concentrations varied, but were less than the 1 gU/l limit. The licensee informed the inspectors that records for the past 10 years indicated that scrubber solution concentrations were less than the 1.0 gm U/L limit.

- Operating System (OS) Procedure, OS 806, "Recycle/Recovery Area Wet Scrubber," Section 2.0, "Nuclear Safety," step 5.9.2, required that the KOH tank solutions be analyzed prior to pumping the liquids to the evaporation tank.

Through discussions with operators, the inspectors noted that the staff often added KOH solution to the tank after it was mixed and sampled. This activity also occurred concurrent with the transfer of solutions to the evaporation tank. The inspectors determined that the current plant practices were inconsistent with the procedural requirements.

- OS 850 Section 7.0, "Filtrate Hold Tanks," described vessel level control through the use of two level alarms, a solution overflow level alarm and a high level alarm, for each of the two filtrate tanks.

During discussions, the licensee informed the inspectors that the two level alarms were out of service for three years. In their place, the licensee relied upon two other safety features to ensure level control: overflow holes in the side of the tanks and operator monitoring of the tank sight glasses. The inspectors determined that the inoperable alarm status did not constitute a criticality safety concern. This assessment was based upon the presence of raschig poison rings in the tank and the overflow holes. Both of these measures provided a passive means to ensure safe controls.

Safety Condition S-1 of Special Nuclear Material License SNM-33 requires that licensed material be used in accordance with the statements, representations, and conditions in Chapters 1 through 8 of the application, dated October 29, 1993, with supplements. Section 2.6 of Chapter 2 of the application, dated October 29, 1993, states that operations which affect licensed materials shall be conducted in accordance with approved written procedures. These procedures provide detailed instructions for equipment operation, material handling, and the limits and controls required by the license.

The inspectors concluded that these examples of inadequate procedural adherence constituted violations of minor significance. As a result, the individual violations were categorized as Non-Cited, consistent with NRC Enforcement Policy, Section IV. However, collectively, the violations were of concern and indicated weaknesses in the licensee's uranium recovery process operation. The weaknesses included inadequate: 1) management oversight; 2) maintenance and surveillance testing of the filtrate level alarm system, and; 3) staff adherence to procedural requirements.

c. Conclusions

The licensee's response to the event was appropriate, timely, and consistent with their facility emergency program. Some weaknesses were identified with current sampling capabilities.

Three non-cited procedural adherence violations were identified. Collectively, the violations were of concern and indicated weaknesses in the licensee's uranium recovery process operation. The weaknesses included inadequate: 1) management oversight; 2) maintenance and surveillance testing of the filtrate level alarm system, and; 3) staff adherence to procedural requirements.

6.0 Management Meeting

The inspectors met with the Vice-President and others throughout the inspection period and on September 27, 1996. The inspectors summarized the scope and findings of the inspections, including the violations.

The licensee did not identify any information provided and maintained by the NRC during the inspection as proprietary.



## PARTIAL LIST OF PERSONS CONTACTED

### Licensee Personnel Contacted

M. Eastburn, Nuclear Criticality Specialist  
K. Hayes, Industrial Safety Engineer  
R. Land, Director of Infrastructure  
G. Page, Director of Ceramic Operations  
R. Sharkey, Director of Regulatory Affairs  
E. Saito, Health Physicist  
R. Tollen, Director of Assembly Operations

### Inspection Procedures Used

IP 88005: Management Organization and Controls  
IP 88010: Operator Training/Retraining  
IP 88015: Criticality Safety  
IP 88020: Operations Review  
IP 88050: Emergency Preparedness  
IP 84850: Radwaste management

### Items Opened, Closed, And Discussed

#### Closed

070-00036/96002-03	IFI	Failure to provide timely and detailed notifications of the emergency declaration to the State and local Emergency Management Agencies and NRC's Operations Center.
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#### Opened

070-00036/96004-01	VIO	The failure to maintain the allowable U-235 limits on filters.
070-00036/96004-02	VIO	The failure to maintain the proper separation between the SIUs and the failure to maintain the specified quantity of SIUs in the immediate work area.
070-00036/96004-03	IFI	Adequacy of criticality training for the plant operators.