



UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION II
101 MARIETTA STREET, N.W., SUITE 2900
ATLANTA, GEORGIA 30323-0199

Report No.: 70-1113/94-03

Licensee: General Electric Company
Wilmington, NC 28402

Docket No.: 70-1113

License No.: SNM-1097

Facility Name: General Electric Company

Inspection Conducted: February 14-18, 1994

Inspector: *G. L. Troup*
G. L. Troup, Fuel Facility Project Inspector

3/14/94
Date Signed

Approved by: *E. J. McAlpine*
E. J. McAlpine, Chief
Radiation Safety Projects Section
Nuclear Materials Safety and Safeguards Branch
Division of Radiation Safety and Safeguards

3/18/94
Date Signed

SUMMARY

Scope:

This routine, unannounced inspection was conducted in the areas of management controls, nuclear criticality safety, facility operations and training. In addition, a reportable occurrence and previous inspection findings were reviewed.

Results:

As the result of the licensee's Investigation Team report for the accumulation of uranium-bearing materials under the chemical conversion quarantine tanks, two violations were identified. These violations represent additional examples of the violation cited in Inspection Report 70-1113/93-12. A separate Notice of Violation is not being issued.

A review of two findings in the licensee's audit program showed that the management actions regarding reclassification was in accordance with the program guidance.

Review of the issue concerning the ventilation in the Gadolinia shop showed that the system, as installed, did not represent an immediate safety concern. The delays in initiating corrective action were of concern, at least in documenting the acceptability of the system. Corrective actions are in progress with a scheduled completion time.

The training programs for operators changing product line areas are indicative of positive actions from the Performance Improvement Program.

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REPORT DETAILS

1. Persons Contacted

- *S. Babb, Team Leader, Uranium Recovery
- *D. Barbour, Coordinator, Radiation Protection
- *D. Brown, Team Leader, Environmental Processes
- *M. Chilton, Manager, Chemical Product Line
 - T. Flaherty, Area Manager, URLS Project
- *N. Gutermuth, Specialist, Industrial Safety
 - D. Hassler, Supervisor, Maintenance Support Team
- *T. Hauser, Manager, Environmental, Health & Safety & Nuclear Quality Assurance
- *B. Kaiser, Manager, Fuel Fabrication Product Line
 - A. Lehmann, Principal Engineer, Environmental Processes
- *D. McCaughey, Engineer, Regulatory Team, Fuel Manufacturing Operation
- *S. Murray, Manager, Radiation Safety
- *R. Patterson, Team Leader, Fuel Fabrication Production
- *S. Selby, Team Leader, UO₂ Production Team
- *G. Smith, Team Leader, Fuel Manufacturing Operation Maintenance Support Team
- *J. Taylor, Principal Engineer, Nuclear Safety
- *C. Vaughan, Manager, Regulatory & Environmental, Health & Safety
- *F. Welfare, Manager, Criticality Safety Engineering
- *T. Winslow, Manager, Emergency Preparedness, Security and Material Control & Accountability

Other licensee employees contacted during the inspection included area coordinators, operators, engineers and maintenance personnel.

*Denotes those present at the exit interview on February 18, 1994

2. Event Review (88005, 88015, 88020)

- a. On January 24, 1994, the licensee made a telephone report to the NRC Operations Center under the provisions of NRC Bulletin 91-01. This report (No. 26674) was caused by the discovery of a sludge containing uranium under quarantine tanks ("Q" tanks) in the chemical area. The licensee classified the incident as contrary to the favorable geometry nuclear safety control for the area. The licensee had initiated an inspection of plant areas where uranium may have accumulated as the result of spills, leaks or other causes. These inspections were initiated as a result of the discovery of uranium accumulations in the sumps of three pellet presses, as documented in Inspection Report 93-12 and was part of the corrective actions for the violation cited in that report.
- b. After discovering the accumulation of the uranium-bearing sludge under the Q-tanks, the licensee initiated the cleaning and removal of the sludge, and established an Investigation Team to determine the root cause(s) of the problem. The material was removed, often by chiseling it off the concrete floor under the tanks and placing

it in favorable geometry containers. In addition to the sludge, considerable debris and scrap materials were also removed. A total of approximately 543 kilograms of uranium was removed from the area in a total of 2820 kilograms of sludge. There was also general solid debris which could not have come from the tanks and was not included in the sludge weight total. The total amount of sludge represented approximately 65 cubic feet.

- c. The investigation team determined that the source of the sludge was from spills and overflows in the tank room as well as tank clean-outs (when the tanks were drained and flushed to the floor and then into a sump). Subsequent clean up of the area was hindered by cramped conditions around and under the tanks. The highest build-up was about from 5 feet from the end of the tank (with about a 12 inch floor clearance) going back towards the center of the tank. According to the investigation team, this resulted from two major causes: system design and inadequate corrective actions to clean the area after accumulations were identified. Additional causes identified were in management systems (the area was cramped and poorly lighted) and procedural deficiencies (no requirements were instituted to check periodically for accumulation of material). The team report also contained specific recommendations for both the short term (prior to system restart) and long term.
- d. The major source of material accumulation had been removed by a system design change implemented in 1988, which altered the radwaste tank processing. In addition, a program had been initiated in December, 1993 to eliminate the use of the slab tanks. This project was initiated following the identification of liquids under the tanks and continuing problems in this area as documented in a NSE audit. Technical resources were assigned to a alternate system which could replace the slab tanks in use. Following discussions between the inspector and the cognizant manager, this project was identified by the licensee as one of two high priority tasks for the Chemical Product Line in 1994.
- e. The nuclear criticality safety for the Q-tanks was based on four percent enriched uranium dioxide with optimum moderation (25 weight fraction water) and reflection on all sides. The analysis did not consider accumulations of uranium-bearing materials under the tank(s) or evaluate the safety of the materials as a slab. Values contained in Part I, Chapter 4 of the license application are for either homogeneous or heterogeneous mixtures of uranium dioxide and water and do not consider the presence of other materials. The actual uranium content of the materials removed and the amount of liquid in the initial "grab" samples varied widely with uranium concentrations ranging from less than one percent up to 32 percent and liquid from less than four percent up to 57 percent. The enrichment of the samples were all less than three percent, with the average of 2.7 percent. In evaluating the nuclear criticality safety condition of the accumulations, the

values in the license application could not be used directly due to the variability of uranium and moderator concentrations. For the area with the thickest accumulation, the highest uranium percentage was less than 25 percent. With the low uranium content, the low enrichment and an over-moderated condition, the sludge by itself did not present an immediate nuclear criticality safety hazard.

- f. The licensee's investigation report identified two potential items of non-compliance regarding inadequate procedures (no inspection or clean-out requirements in operating procedures and a failure to include requirements in procedures based on identified deficiencies following a previous incident). Since these items were identified by the licensee as part of an organized effort to take corrective action on previous violation, was in the time that corrective actions were being planned and conducted, and prompt and effective corrective action were taken, the violations meet the criteria specified in the NRC Enforcement Policy, 10 CFR 2, Appendix B, and no violation is being issued.

Within the scope of the inspection, licensee identified violations were noted which are additional examples of the violation previously cited in Inspection Report 93-12 (LIV 70-1113/94-03-01).

3. Ventilation System Design Problems (88005, 88015)

- a. In Inspection Report 70-1113/94-02, an Unresolved Item (URI 94-02-02) was identified concerning the ventilation ducts in the Gadolinia Shop. The issue had been identified in an internal Nuclear Safety Engineering (NSE) audit during the second quarter, 1993. The original finding was that the ducts above the can dump stations "had an unsafe geometry in the ductwork and the basis for safety was unknown." Subsequent to the audit, an additional review of other areas identified a number of locations which also had horizontal runs and unfavorable geometry transitions. A memo dated January 24, 1994 further discussed the situation, and identified the priority for correction based on risk.
- b. The inspector discussed the situation with nuclear criticality safety personnel and expressed concern about the phrase "the basis for safety was unknown." Licensee personnel explained that there was no single document or document package which was readily available which had the calculations and other review documents for this system. The system design was acceptable for the enrichment of the material currently approved for use in the area. This was supported by 1980 and 1981 documents which demonstrated that a cylinder with a radius of 20 centimeters (cm) was safe ($k_{eff} < 0.85$) for four percent enriched uranium dioxide mixed with the equivalent of 50,000 ppm moderating material. Another document demonstrated that a sphere containing 127 liters of four percent enriched uranium dioxide with the equivalent of 50,000 ppm

moderator was also safe (a sphere with a volume of 127 liters has a radius of 31.2 cm.). Licensee representatives stated that these values show the system was safe even without a specific document because the ducts in question were less than the analyzed dimensions.

- c. The equivalent of 50,000 ppm of moderating material is less than optimum moderation for the powder. Optimum moderation is in the range of 20-25 weight percent (w/o) or approximately 200,000 - 250,000 ppm moisture for powder of this enrichment. Moisture at the optimum moderation concentration would result in a wet paste which is not suitable for powder and pelletizing operations. Operations require that powder meet moisture requirements at the calciner discharge of approximately 0.2-0.5 w/o before it can be released to pellet operations. Even after the powder lubricant and/or binder is added, the moderator equivalent is significantly less than 50,000 ppm equivalent. Powder is under moderator control through milling and blending. The dump stations and other process areas are under moderation control as the primary nuclear criticality safety control by limiting the moisture/moderator content of the powder and limiting any sources of water in the process areas. Powder dump stations are located in enclosures that protect against moisture intrusion into the process or into the ventilation systems. The inspector concluded that the nuclear criticality safety analyses using 50,000 ppm equivalent moderator was a very conservative basis for evaluating system safety.
- d. When the maximum enrichment of uranium was raised to five percent in other portions of the facility, the ventilation system was modified to eliminate horizontal runs ahead of filters, replace large filter housings with different designs, mount filter housings vertically and reduce the duct diameter to favorable geometry dimensions. While the Gadolinia Shop is presently limited to four percent enriched uranium, licensee personnel felt that the sections which had the highest potential for accumulating uranium should be eliminated. As the result of the repeat finding in the fourth quarter NSE audit, plans were developed to correct the three most significant areas during the upcoming plant shutdown period.
- e. Licensee personnel stated that there was a routine surveillance program to survey the ducts for the accumulation of uranium. The surveys would detect about 25-30 kilogram quantities which is significantly less than a critical mass. Personnel also noted that the ducts are routinely inspected and cleaned whenever the filters are replaced.
- f. The inspector reviewed Nuclear Safety Instruction (NSI) 0.15.0, HVAC System Audits and Inspections, rev. 16, which requires weekly visual inspections of hoods (which includes the hoods in question), including the position of the roughing filters on the hood vent. On a quarterly basis, radiation surveys are conducted

of the horizontal duct runs. The NSI states "pay particular attention to locations where powder will normally accumulate (bottom of elbows, transition for filters)." The inspector reviewed the last two survey results for the powder dump hood ventilation and noted that the readings were about ten percent of the procedure action limit (which is about 30 kilograms). The duct survey for the pellet grinder in August, 1993 showed higher readings but this was attributed to material being loosened during removal of the duct for cleanout. The inspector also reviewed the results of a special inspection of the ducts conducted in January, 1994. The hood duct and the grinder duct each had a total of about 2 kilograms of material. The individual who conducted the inspection described the situation as a "light coating or film - no big chunks or accumulations." Two kilograms of material in the entire duct system represents less than 0.04 percent of the minimum critical mass for a sphere.

- g. The inspector toured the areas identified by the licensee as "high risk" areas and discussed operations with operators and the HVAC supervisor. On different occasions the inspector observed powder cans being dumped into the system. During dumping, there was no evidence of significant airborne dust or powder which would indicate that significant quantities of material was being released into the ducts. Operators told the inspector that at least each shift, and normally before each can dump, they verify that the roughing filter is in place (these filters reduce the amount of powder which might be drawn into the ventilation system). The inspector also determined by visual observation that the ducts in question were less than the minimum critical diameter previously determined for this material (hood ducts were approximately 6-8½" in diameter - critical values are 15¼" for a cylinder and 24½" for the sphere).
- h. The inspector concluded that possible accumulations of powder and pellet material did not constitute an immediate safety concern. The inspector agreed, however, with the original audit finding that the ventilation systems should be upgraded to comply with the licensee's current approach to ventilation system criteria which is planned for the summer outage.
- i. Based on the review of the systems and the operating conditions, the inspector informed licensee management at the Exit Interview that URI 94-02-02 was closed. Note that the other portion of this items is discussed in paragraph 4.b.

Within the scope of the inspection, no violations or deviations were identified.

4. Audits (88005, 88015)

- a. Inspection Report 70-1113/93-11 noted that the report for the external nuclear criticality safety audit, as required by Part I, Chapter 2, Section 2.8.3 of the license application, had been received but that the licensee had not had sufficient time to review the findings and take corrective actions. The inspector discussed the findings with the cognizant manager and discussed the status of corrective actions. Corrective actions and the target completion dates had been established for the open items. These will be reviewed during future NRC inspections and will be tracked as Inspector Followup item 70-1113/94-03-02. The audit also identified concerns about a process upset which had occurred during the audit period. The inspector discussed this condition with licensee representatives. Corrective actions had been initiated immediately after the condition arose. Changes were made to the Distributed Control System (DCS) logic and the system controls to minimize major swings or surges in the waste systems which had previously caused the process upsets. The inspector discussed these changes with operators who confirmed that the swings or surges had been reduced and control of the systems was easier to maintain.
- b. Part of the scope of URI 94-02-02 dealt with changing of the level or category of NSE audits. Of particular concern was a finding originally classified as a Potential Non-Compliance (PNC) but was reclassified to a Finding following the Area Manager's response. The issue was the storage of two 5-gallon containers of stripper and floor wax in a cabinet in the powder warehouse. The nuclear safety posting (NSR/R) prohibits the "bulk storage" of moderators but permits moderators "of the type and quantities necessary to operate the facility." The Area Manager contended that the two containers were material in use to operate the facility and were not "bulk quantities." After discussions on the issue, it was determined that such storage did not violate the posting and, therefore, was not a PNC. This was reclassified as a "finding" with the notation that some control method was necessary. The storage cabinet was stenciled to state exactly how much material of each type was authorized. This was considered acceptable by the auditing group. After discussing the issue with the production group and the auditor group, the inspector concluded that the initial finding had been evaluated on an adequate technical basis and had been reclassified as allowed by the licensee's internal procedures. This portion of URI 94-02-02 is also closed.

Within the scope of the inspection, no violations or deviations were identified.

5. Organization Changes (88005, 88010)

- a. Several personnel changes have been made at the "team leader" level within the licensee's organization. None of these positions are described in the license application as having specific requirements. The license application states that such selections will be in accordance with normal administrative policies. Additional changes will be made to fill openings created by these changes.
- b. A number of operators have shifted from the fuel fabrication area to the chemical product areas. The inspector discussed the training that would be provided for these operators to assure that they can perform the assigned tasks in a safe manner. Training and qualification journals have been prepared for the various areas. These journals include detailed training lists (including on-the-job training) and qualification cards which require sign-off of the required knowledge and practical factors needed to be approved for each operator station. The URLS training program also had training and qualification requirements for maintenance and laboratory personnel.

Within the scope of the inspection, no violations or deviations were identified.

6. Operations (88015, 88020)

- a. On February 16, a maintenance mechanic was injured while working on piping in the "Q-tank" room. While disconnecting piping to permit removal of a filter, a periodic air pulse in the system blew material in the pipe into the man's face. Emergency personnel responded after notification of the injury by an operator and transported him to the hospital. No personnel contamination occurred and there was no intake of radioactive material. The licensee classified this as Level I Unusual Incident and established an Investigation Team to investigate the occurrence. The results of this investigation will be reviewed during future inspections and will be tracked for followup purposes as an Inspector Followup Item 70-1113/94-03-03.
- b. In Uranium Recovery (URU), the inspector reviewed logs and records and determined that certain periodic inspections had been conducted as required with satisfactory results. Included in this review was the monthly sample of tank V-103 and the weekly tests of the Aqueous Waste monitor tanks for the presence of organics.
- c. During a tour of the facility, the inspector noted an emergency stretcher mounted on the hallway wall was blocked by a tool chest. The tool chest prevented the stretcher cover from being opened until the chest could be moved. The chest had been "parked" in the hallway during relocation work in an adjacent area. Industrial safety personnel moved the chest after the condition

was brought to their attention. Inspection of fire hoses and fire extinguishers did not reveal any that were obstructed or were not functional.

- d. As the result of the issue identified in Inspection Report 70-1113/94-02 concerning pellet accumulations on the floors and in some equipment, the licensee installed flashlights in numerous locations for workers to use. The NSR/Rs were revised for work stations to require that inspections be conducted at the end of each shift for stray pellets.

Within the scope of the inspection, no violations or deviations were identified.

7. Exit Interview (30703)

On February 18, 1994, the scope of the inspection and the findings were discussed with those persons identified in Paragraph 1.

The inspector informed licensee management representatives that Unresolved Item 92-02-02 was closed based on the inspection of the Gadolinia Shop ventilation and the review of audit findings.

The items identified by the licensee concerning the sludge build-up under the Q tanks was identified as a potential violation. It was subsequently determined that they were licensee identified additional examples for a previously cited violation.

Although proprietary documents were reviewed during the inspection, the proprietary nature of the documents has been deleted from this report.