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

Report No.: 70-1113/94-04

Licensee: General Electric Company
Nuclear Energy Production
P. O. Box 780
Wilmington, NC 28402

Docket No.: 70-1113 License No.: SNM-1097

Facility Name: Nuclear Fuel and Components Manufacturing Plant

Inspection Conducted: March 7-11, 1994

Inspectors: Eldan D. Testa 04/01/94
E. D. Testa, Senior Project Engineer Date Signed

E. M^c Alpine for 4/1/94
E. B. Pharr, Radiation Specialist Date Signed

Approved by: E. M^c Alpine 4/1/94
E. J. McAlpine, Chief Date Signed
Radiation Safety Projects Section
Nuclear Materials Safety and Safeguards Branch
Division of Radiation Safety and Safeguards

SUMMARY

Scope:

This routine, unannounced inspection of the licensee's radiation protection (RP) program involved review of health physics (HP) activities including radiation protection procedures; instruments and equipment; exposure control including external/internal; posting labeling and control; surveys and monitoring; and radioactive material control. In addition, follow-up actions related to previously identified inspection findings were reviewed.

Results:

The licensee's radiological protection program activities appeared adequate to protect the health and safety of plant workers. Routine internal and external exposure programs were implemented with all personnel exposures less than 10 CFR Part 20 limits. An issue for follow-up was identified during a previous inspection regarding continued air sampler plugging in certain areas of the Uranium Recycle Unit (URU). This item will remain open until area modifications are completed and effectiveness of the modifications are assessed (Paragraph 7). During facility tours, the inspector identified potential industrial safety problems associated with material selection of various process flange bolts, lengths of closure bolts, direction of bolts and number of captured threads of closure bolts. The licensee was made aware of the industrial safety concern and was evaluating the item (Paragraph 6).

9404120187 940401
PDR ADOCK 07001113
C PDR

REPORT DETAILS

1. Persons Contacted

*D. Barbour, Radiation Protection Coordinator
*S. Babb, Team Leader, Uranium Recovery Process-Chemical Product Line
*J. Bradbury, Regulatory Team
*D. Brown, Team Leader, Environmental Processes, Chemical Product Line
*M. Chilton, Manager, Chemical Product Line
*D. Dowker, Senior Program Manager, Procedures and Training
T. Hauser, Manager, Environmental, Health and Safety and Nuclear Quality Assurance
*B. Kaiser, Manager, Fuel Fabrication Product Line
*R. Keenan, Program Manager, Compliance Auditing
A. Mabry, Nuclear Safety Engineer
*S. Murray, Manager, Radiation Safety
*R. Patterson, Team Leader, Fuel Fabrication Production
*B. Robinson, Principle Nuclear Safety Engineer
*S. Selby, Team Leader, UO_2 Production Team
B. Torres, Manager, Radiation Protection
*C. Vaughan, Manager, Regulatory & Environmental, Health & Safety
*F. Welfare, Manager, Criticality Safety Engineering
*T. Winslow, Manager, Emergency Preparedness, Security, Material Control and Accountability

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

Nuclear Regulatory Commission

*D. Collins, Chief, Nuclear Materials Safety and Safeguards Branch

*Denotes those present at the exit interview conducted March 11, 1994.

2. Procedure Review (83822)

The inspector reviewed selected procedures which were revised as part of the licensee's implementation of revised 10 CFR Part 20 on January 1, 1994. No problems were identified from the review of procedures. Reviewed procedures appeared to meet the revised 10 CFR Part 20 requirements.

No violations or deviations were identified.

3. Training and Qualifications (83822)

10 CFR 19.12 requires, in part, that the licensee instruct all individuals working in or frequenting any portion of a restricted area in the health protection aspects associated with exposure to radioactive material or radiation; in precautions or procedures to minimize exposure; in the purpose and function of protection devices employed; in

the applicable provisions of the Commission regulations; in the individuals' responsibilities; and in the availability of radiation exposure data.

At the time of the onsite inspection the licensee was conducting their annual Nuclear Safety Refresher training. The inspector noted that the licensee had originally planned to conduct this training, to include revisions to 10 CFR Part 20 requirements, during December 1993. However, primarily due to increased production during the period, the licensee had determined to conduct the required training during March 1994.

The inspector attended one of the licensee's scheduled training sessions and noted that the training included an overview of radiation safety and criticality safety at the licensee's facility. The inspector noted that in the area of radiation protection the training material included the revised regulatory exposure limits, an overview of the revised terminology and definitions, as well as background information detailing the logic for determination of the revised exposure limits. The training material also presented the methodology for determining workers' total occupational exposures, emphasized that all workers monitored for occupational exposure at the facility would receive an annual dose report, and included a review of 10 CFR Part 19 requirements, including a worker's rights and responsibilities. Additionally, the presented training material informed employees of the specific effects of the revised regulations at the facility, to include changes in the thermoluminsescent dosimetry (TLD) issuance and wear policy, the urinalysis program, the lung count program, and the respiratory protection program. Female employees were also provided a handout which was intended to inform them of the risks of radiation exposure to the embryo/fetus, a worker's right to declare pregnancy, applicable exposure limits following declaration, and a copy of Regulatory Guide 8.13, Instruction Concerning Prenatal Radiation Exposure.

The inspector noted that the information presented during Nuclear Safety Refresher training was adequate to inform personnel working within the facility's controlled areas and/or assigned a TLD of the health protection aspects of radiation exposure. The inspector also reviewed the short quiz presented to course attendees and noted that it too was adequate to ensure the workers knowledge of key training objectives.

The inspector was also informed that the Nuclear Safety training was provided in addition to facility access training, Blue Dot Training. The inspector reviewed the course outlines for this access training, and also received Blue Dot site specific training as provided to NRC inspectors. The inspector noted that the training content included a review of access controls, criticality and other facility alarms, proper response to alarms, and a practical factors session which focused on how to enter and exit radiologically controlled areas (RCAs) and how to perform personal monitoring.

The inspector informed licensee representatives that the Nuclear Safety and Blue Dot training programs appeared to adequately provide training to facility workers, and was appropriate for the level of work performed by the workers.

No violations or deviations were identified.

4. External Exposure Controls (83822)

10 CFR 20.1201(a) requires each licensee to control the occupational dose to individual adults, except for planned special exposures under 10 CFR 20.1206, to the following dose limits:

a. An annual limit, which is more limiting of: (i) the total effective dose equivalent (TEDE) being equal to 5 rems: or (ii) the sum of the deep-dose equivalent and the committed dose equivalent to any organ or tissue other than the lens of the eye being equal to 50 rems.

b. The annual limits to the lens of the eye, to the skin, and to the extremities, which are: (i) an eye dose equivalent of 15 rems; and (ii) a shallow-dose equivalent of 50 rems to the skin or to any extremity.

10 CFR 20.1502(a) requires each licensee to monitor occupational exposure to radiation and to supply and require the use of individual monitoring devices for adults likely to receive an annual dose in excess of 10 percent of the limits in 20.1201(a).

The inspector reviewed selected licensee procedures which established responsibilities and methods used to monitor and control external occupational radiation exposure. The inspector verified that the procedures had been appropriately updated to include revised 10 CFR Part 20 terminology and dose limits.

The inspector noted that the licensee provided beta/gamma monitoring TLDs, which were read on a quarterly basis, to the majority of workers exposed to radiation at the facility. Personnel working around neutron sources were provided TLDs also capable of measuring neutron exposure. The neutron TLDs were read each month. During discussions with licensee representatives the inspector was informed that during 1994, no TLD results were yet available. Quarterly TLDs were not to be collected until April, and although monthly neutron TLDs for January had been collected the results had not been supplied by the vendor as of the time of the onsite inspection. The inspector reviewed the licensee's ALARA Report for 1993, dated December 8, 1993, which, in part, summarized the personnel dose for the year. The average worker's external dose for 1993 was approximately 30 millirem (mrem) to the whole body and 40 mrem to the skin of the whole body. The highest individual dose for the year was approximately 560 mrem to both the whole body and skin.

The inspector also noted that the 1993 ALARA report included the results and conclusions from the annual extremity dose study. The study involved monitoring the extremity doses of approximately 80 workers most likely to receive measurable dose to the skin of their fingers. Past studies verified that extremity monitoring was not necessary based on the relatively low doses received by the workers during the studies. This most recent study again verified that no worker monitored exceeded 25 percent of the extremity exposure limit. The inspector noted that the extremity doses of the monitored workers were appropriately measured and reported at a tissue depth of seven milligrams per square centimeter (mg/cm^2). Based on the results during the three week monitoring period, the licensee projected an average quarterly dose of approximately 450 mrem and a maximum quarterly dose of 1335 mrem. The inspector noted that if the maximum quarterly dose was projected to a maximum annual dose of 5340 mrem, then for 1994 the licensee would exceed 10 percent of the revised extremity limit and therefore need to provide extremity monitoring to the applicable individuals. During discussions with licensee representatives the inspector noted that the licensee was aware of the one individual during the 1993 study which would exceed the 1994 extremity monitoring criteria, but had determined that extremity exposure monitoring during 1994 was not necessary. The licensee had based their decision on a License Amendment approved by the NRC during April 1992 which allowed evaluation of extremity exposures at a tissue equivalent skin thickness of 38 mg/cm^2 instead of 7 mg/cm^2. The inspector was further informed that the licensee planned to perform an extremity monitoring study again in 1994 and would most likely use their exemption for evaluating exposures at a tissue depth of 38 mg/cm^2 when determining the need for extremity monitoring in accordance with 10 CFR 20.1502(a). The inspector informed licensee representatives that this evaluation would be evaluated during subsequent inspections.

The inspector verified that the licensee had appropriately updated their external exposure control and monitoring procedures to be consistent with new 10 CFR Part 20 requirements. The inspector also noted that the licensee appeared to be appropriately providing monitoring equipment and controlling exposure to plant personnel.

No violations or deviations were identified.

5. Internal Exposure Control (83822)

10 CFR 20.1204 states that for purposes of assessing dose used to determine compliance with occupational dose equivalent limits, the licensee, when required to monitor internal exposure, shall take suitable and timely measurements of concentrations of radioactive materials in air, quantities of radionuclides in the body, quantities of radionuclides excreted from the body, or combinations of these measurements. When specific information on the behavior of the material in an individual is known that information may be used to calculate the Committed Effective Dose Equivalent (CEDE).

10 CFR 20.1502(b) requires each licensee to monitor the occupational intake of radioactive material by and assess the committed effective dose equivalent to:

a. Adults likely to receive, in one year, an intake in excess of 10 percent of the applicable ALI in Table 1, Columns 1 and 2 of Appendix B to 10 CFR 20.1001-20.2401; and

b. Minors and declared pregnant women likely to receive, in one year, a committed effective dose equivalent in excess of 0.05 rem.

The inspector reviewed selected licensee procedures which established responsibilities and methods used to control, monitor, and evaluate internal occupational radiation exposure. The inspector verified that the procedures had been appropriately updated to include revised 10 CFR Part 20 terminology and dose limits. The inspector also reviewed the licensee's programs for evaluating and controlling internal exposures to include air sampling, lung counting, and urinalysis to review and verify implementation of the revised procedural requirements in accordance with new 10 CFR Part 20.

a. Air Sampling Program

Chapter 3, Section 3.2.4.2.1 of the License Application requires that the radiation safety function annually evaluate fixed air sampling points for representativeness of personnel exposures.

The inspector reviewed and discussed with licensee representatives the most recent air sampler representativeness study, conducted over four weeks during the last quarter of 1993. The inspector noted that the 1993 representativeness study consisted of air flow studies, comparison of personnel breathing zone sampler with stationary air sampler (SAS) results, comparison of measured lung burden with assigned airborne results, and review of urinalysis data. Based on the air flow studies the licensee determined the need to relocate some of the SASs and had recently submitted a Facility Change Request (FCR) to ensure the changes were implemented. The inspector noted that calculated personnel intakes based on results from the use of breathing zone samplers worn by workers during routine insoluble uranium operations were comparable with those based on fixed sampler results at the applicable work station. The inspector also noted that the bioassay program further supported the licensee's efforts in determining the effectiveness and representativeness of their air samplers, in that exposures based on air sampling results were generally higher than measured lung burden exposures, thus more conservative, and urinalysis results typically were much less than the licensee's action limits. In fact, during 1993 less than 0.3 percent of all urinalysis sample results exceeded the licensee's action limits. The inspector noted that the licensee's 1993 study was adequate to demonstrate representativeness of their SASs, in accordance with license and procedural requirements.

During discussions with licensee representatives the inspector was informed that during April 1993 the licensee contracted with a national laboratory to determine particle size and material solubility classification for airborne particulates throughout the facility's process areas. The inspector noted that the results of the study indicated that all process areas had a soluble uranium component and that in five process areas, subjected primarily to insoluble uranium, the airborne particulate particle size was greater than the activity median aerodynamic diameter (AMAD) of one micrometer (μm) that the regulatory limits for the annual limit on intake (ALI) and the derived air concentration (DAC) were based upon. The inspector also noted that based on the conclusion that in certain process areas the particle size exceeded the 1 μm AMAD, a License Amendment was approved in December 1993 which allowed the licensee to adjust the ALI or DAC limits for the applicable process areas, beginning January 1, 1994. However, at the time of the onsite inspection, the inspector noted the licensee had not taken any ALI or DAC adjustments for determining internal exposures. The licensee, instead was conservatively controlling all airborne uranium throughout the process areas with the insoluble uranium, Class Y, limits for the ALI and DAC.

The inspector reviewed and discussed with licensee representatives 1994 airborne concentration levels and personal internal exposures. The inspector was informed that in anticipation of revised and reduced 10 CFR Part 20 airborne concentration and internal exposure limits, the licensee had been making improvements over recent years to introduce laminar flow at numerous work stations with historically high airborne levels, to obtain a License Amendment to reduce the number of required air changes in the process areas during a shift and thereby increase the effectiveness of laminar flow, and to better control contamination at the source with upgraded containments and enclosures. Due to these improvements, the inspector noted that the licensee's airborne concentration levels throughout the facility had continued to trend downward. The inspector reviewed 1994 airborne concentration trendings based on shiftly SAS results and noted that the soluble uranium areas averaged approximately 25 to 100 percent of the DAC, and averaged approximately 25 to 50 percent of the DAC in the insoluble uranium process areas. During review of personnel internal exposures the inspector noted that, to date, the individuals assigned with the maximum exposures, routinely ranging from 150 to 200 DAC-hrs, were regularly associated with activities in the chemical process area, and subjected primarily to soluble uranium. At the time of the onsite inspection, the inspector determined that the maximum assigned internal exposure was approximately 375 DAC-hrs, of which approximately 250 DAC-hrs were assigned due to an incident. The inspector noted that during the year the licensee had been manually reviewing workers' weekly and accumulated quarterly exposures to verify and initiate actions for personnel exceeding

established administrative limits of 40 DAC-hrs or 500 DAC-hrs during a period of a week or a quarter, respectively.

b. In-Vivo Analysis Program

The inspector discussed with licensee representatives changes made in their lung counting program as a result of revised and reduced limits on internal exposures, in accordance with 10 CFR Part 20. At the time of the inspection the minimum detectable limit (MDL) for the lung counter was approximately 55 micrograms of uranium-235 (μg U-235) for an average chest wall thickness of 23 millimeters (mm), and for the licensee's maximum chest wall thickness, 39 mm, the MDL increased to approximately 75 μg U-235. Based on the revised ALIs, approximately 100 μg U-235 equated to 100 percent of the ALI. Although, as stated above, the licensee had gained approval for adjustment of the ALI or DAC based on particle size, only in situations where a confirmed acute intake had occurred would the licensee consider adjusting the ALI, as applicable, for determining internal exposure based on lung count results. The licensee also stated that since the beginning of the year the count time for routine lung counts had been increased from 20 to 30 minutes. Following their upcoming annual calibration of the counter, the MDL was expected to drop to approximately 40 μg U-235, for an average chest wall thickness.

The inspector verified that the licensee had revised their guidelines and action limits for frequency of lung counts to incorporate the revised annual internal exposure limits. During review of selected 1993 and 1994 lung count records the inspector verified that the licensee was appropriately performing routine lung counts, as well as followup counts due to action limits being exceeded, in accordance with their procedural requirements. In particular, the inspector noted that since January 1, 1994 when the licensee's lung count action levels were significantly reduced in accordance with the revised ALIs, personnel were restricted and/or recounted appropriately. The inspector noted that the recounts routinely indicated that the elevated results were due to external contamination. The inspector verified that for those initial results which exceeded licensee action levels the licensee confirmed, based on followup counts, that no personnel exposures were in excess of the ALI.

c. Urinalysis Program

During discussions with licensee representatives the inspector noted that the licensee had not revised implementation of their urinalysis program with the advent of the revised 10 CFR Part 20 requirements since the regulatory limit for soluble uranium intake had remained at 10 milligrams (mg) in a week. The inspector reviewed the licensee's procedure Nuclear Safety Instruction (NSI) O-2.0, Bioassay Program, Revision (Rev.) 26, dated February 7, 1994, which provided details for implementation of the licensee's

bioassay program. The procedure required operators assigned to work in vaporization and hydrolysis, where the potential exposure was uranium hexafluoride, to submit urine samples on the first and seventh, or last, day of their work week. Maintenance personnel working on an as needed basis in these areas were required to submit samples daily. Operators routinely working in areas where the potential exposure was uranium nitrate were required to submit a urine sample on the last or seventh day of the work week. The procedure also defined action limits of 15 micrograms per liter (µg/l) and 2[illegible] g/l for urinalysis results for uranium hexafluoride and uranium [illegible]rate, respectively. If the action limits were exceeded, the time of intake was determined in order to calculate the actual intake. For calculated intakes equal to or exceeding the administrative limit of 7.5 mg the individual was restricted from airborne controlled areas until released by Radiation Protection.

The inspector reviewed selected 1994 sample submittal records and urinalysis results to verify that workers were submitting samples as required and that appropriate actions were taken based on sample results. The inspector reviewed selected records for workers routinely assigned to vaporization, hydrolysis, URU, and workers on a decontamination Radiation Work Permit (RWP) which required end of work shift sample submittals. For those records reviewed the inspector verified that samples were being submitted appropriately. For those records reviewed the maximum urinalysis result was 45 µg/l for an individual assigned to the hydrolysis area. Based on an exposure to uranium hexafluoride an intake of 0.10 mg was calculated for the individual. The maximum calculated weekly intake during 1994 was 0.32 mg due to uranium hexafluoride exposure.

The inspector verified that the licensee had appropriately updated their internal exposure control and monitoring procedures to be consistent with new 10 CFR Part 20 requirements. The inspector also noted that the licensee appeared to be appropriately monitoring and controlling exposure to plant personnel. Specifically, the inspector noted that for workers routinely assigned to the pellet production areas, where concerns were raised during a February, 1994 inspection regarding adequacy of the licensee's contamination control program, their assigned intakes were minimal based on air sample, lung count, and urinalysis results.

No violations or deviations were identified.

6. Surveys and Monitoring (83822)

10 CFR 20.1501(a), in part, states that each licensee shall make or cause to be made, surveys that -

(1) May be necessary for the licensee to comply with the regulations in this part; and,

(2) Are reasonable under the circumstances to evaluate -

- The extent of radiation levels;
- Concentrations or quantities of radioactive material; and
- The potential radiological hazards that could be present.

NSI O-6.0, Contamination Measurement and Control, Rev. 26, dated December 7, 1993, lists the guidelines for conducting the contamination measurement program, evaluation and documentation of the results, and required action based upon the contamination survey findings. The procedure specifies the frequency of surveys in controlled areas to be conducted weekly and in uncontrolled areas monthly. Action levels are specified in the procedure for disposition of contaminated areas once they are identified.

The inspector toured the controlled areas of the plant several times during the inspection. The portion of the product line toured included the fuel pellet press area, the green pellet storage area, the sintering furnace area, the sintered pellet storage area, the pellet grinders area, and the rod loading area. During the tours the inspector did not note any weaknesses in the licensee's program to control contamination at various locations. No excessive loose contamination and no loose pellets were observed during the tours. The inspector also reviewed actual weekly contamination surveys conducted from January 31, 1994 through March 7, 1994, for both the Furnace Room and Rod Load/Grinder Areas and no adverse trends were identified.

The inspector requested that selected smear surveys from an "in use" respirator mask storage area and from selected face pieces of masks stored in this area. The smears were counted and all smears were found to be less than administrative limits. Several additional smears were taken in storage trailers outside the process facility, with all smears found to be below administrative action limits.

During these facility tours, the inspector also observed the use of carbon steel flanges and bolts in the uranium recovery area and corrosion on those bolts and flanges. Also, several flanges were observed to be bolted with nuts which were only partially threaded through the nut. Several flanges had bolts running in opposite directions and one bolt was found loose enough to move in the channel. Bolts of differing length were observed in other process areas and differing numbers of washers were used to adjust bolt lengths. The licensee immediately corrected the loose bolt in the flange and was evaluating the other items.

No violations or deviations were observed.

7. Previously Identified Inspector Follow-up Items (92701)

a. (Open) Inspector Follow-up Item (IFI) 70-1113/92-02-01: During a previous inspection the inspector noted numerous documented cases of air sampler plugging problems in URU, particularly the Cross

Flow Filter Room. Discussions with licensee representatives indicated that the plugging was attributed to the interaction of chemical fumes in the area resulting in the deposition of ammonium nitrate on the filters. During the current inspection, the inspector was informed that the licensee's continued actions in response to the plugging included: tracking of sampler clogging; increased filter surveillance; and application of a correction factor to sampler results to account for the reduced flow when samplers were found clogged. The inspector informed licensee representatives that the effectiveness of t[illegible] actions to correct the plugging problems would continue to be t[illegible]ed as an IFI (IFI 70-1113/92-02-01) pending final resolu[illegible]on of the problem.

b. (Closed) IFI 70-1113/93-09-02: The inspector reviewed the procedural improvements in the Contamination Measurements and Control procedure associated with the conduct of the routine survey program during plant shutdown periods and found the improvements to satisfactorily address the concern.

8. Exit Meeting (83822, 92701)

The inspector met with licensee representatives indicated in Paragraph 1 at the conclusion of the inspection on March 11, 1994. The inspector summarized the scope and findings of the inspection. Although proprietary documents and processes were reviewed during the inspection, the proprietary nature of these documents is not reflected in this report. Dissenting comments were not received from the licensee.

Type	Item Number	Status	Description and Reference
IFI	70-1113/92-02-01	Open	Update to air sampler plugging problems (Paragraph 7).
IFI	70-1113/93-09-02	Closed	Procedural improvements associated with conduct of routine surveys during plant shutdown periods (Paragraph 7).