GE Nuclear Energy

General Electric Company
P.O. Box 780, Wilmington, NC 28402
910-675-5000

February 25, 1997

Director
Office of Enforcement
U.S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, D. C. 20555-0001

Subject: Reply to Notice of Violation

References: 1) NRC License SNM-1097, Docket 70-1113
2) NRC Inspection Report 96-12, 1/28/97

GE's Nuclear Energy Production (NEP) facility, in Wilmington, N.C., hereby responds to the Notice of Violation dated January 28, 1997. These violations resulted from a special NRC team inspection conducted at our licensed fuel fabrication facility by Messrs. E. McAlpine, D Ayres, D. Stout, G. Smith and C. Tripp during December 4-8, 1996.

Our reply to the items of apparent noncompliance with NRC requirements is provided as an attachment to this letter.

The NRC inspection report comments and suggestions are helpful to us in our constant efforts to improve our programs, to ensure continued health and safety of plant personnel, and to ensure our compliance with NRC regulations and licensed conditions.

Neither your inspection report referred to above nor our response contains information which we believe to be proprietary.

Please contact me on (910) 675-5889 if you wish to discuss this matter further.

Sincerely,

GE Nuclear Energy

Ralph J. Reda

R. J. Reda, Manager
Fuels and Facility Licensing

/zb
attachments

IE01

cc: RJR-97-016
Region II Administrator
GL Troup, NRC-Atlanta
MA Lamastra, NRC-Washington

The information given below refers to the Notice of Violation dated January 28, 1997, relative to NRC Inspection Report 70-1113/96-12.

Violation (70-1113/9612-01)

License Condition Number (No.) S-1 of Special Nuclear Materials (SNM) License No. SNM-1097 requires that licensed materials be used in accordance with statements, representations, and conditions of Part I of the application dated October 23, 1987, and supplements thereto.

Part I, Chapter 4, Section 4.2, subsection 4.2.11 of License SNM-1097 requires that, "Engineered controls detect an undesired situation and implement corrective action without requiring human intervention. Engineered controls must be...capable of performing the criticality safety purpose for which they are specified."

Contrary to the above, on November 30, 1996, the engineered control associated with the Line 3 calciner tube failure did not detect the undesired situation and was not capable of performing the criticality safety purpose specified (i.e., preventing an accumulation of greater than 25 kilograms of uranium). The Active Engineered Control (AEC) in place relied upon the total breakage of the tube and the stoppage of tube rotation at the discharge end. As a result, material accumulation within the annulus of the calciner of 38.77 kilograms exceeded the analyzed safety basis.

This is a severity level IV violation (Supplement VI).

GE Response to Violation

GE concurs that the active engineered control (AEC) relied upon to detect a calciner tube rotation failure did not function as required.

At approximately 0900 a.m., on December 3,1996, 38.77 kgs of 4.9% enriched material was observed between the Line 3 calciner tube and the outer heat shield. The material was promptly placed into safe geometry 3-gallon containers. The AEC interlock on the tube rotation timer failed to minimize the accumulation.

The remaining conversion lines were shutdown on the afternoon of December 3, 1996, and separate root cause investigation and corrective action teams were immediately chartered. A timeline of event sequence, results of these investigation root causes, and short-term and long-term corrective actions matrix was sent to the NRC on December 11, 1996 (See Note 1. below). An extensive 24-point startup checklist was completed for each conversion line prior to startup; this list was reviewed by the NRC special inspection team for Line 3 startup (See Note 1. below).

Actions taken to correct the violation are as follows:

1. The tube rotation timer AEC set point was tightened from a value of approximately 40-second to a new setpoint value of 19-seconds (or 17 second tube rotation time + 2 seconds). This AEC was functionally tested and witnessed by members of the NRC special inspection team. GE is confident the new timer value will detect the 'erratic and delayed' rotation observed by operations on the broken end. This corrective action has been completed on all calciners.

2. The tube rotation timer AEC interlock was modified to not only isolate steam and dissociated ammonia (as before) but will now also automatically stop wet ADU feed by placing the dewatering centrifuge hopper three-way valve into recirculation mode. This will prevent any additional ADU from entering the feed end of the defluorinator tube. Likewise, when in dry recycle mode, the rotary airlock valve is automatically stopped, thereby preventing additional U3O8 from entering the feed end of the calciner tube. These corrective actions have been completed on all calciners, with the exception of Line 6, which only operates in a dry recycle mode.

3. Other 'indirect' indicators of a tube failure were administratively enhanced. These actions include changes made to the calciner stack monitoring program. The stack reporting software was modified to automatically alert the user should a value exceed internal action levels. In addition, the ADU Provox distributive control system was modified such that the weekly stack result MUST be entered as an Operator Action Request for each calciner. Failure to input will stop HUF flow to the conversion lines 1-4, and will stop UNH feed flow to conversion line 5.

Based on the corrective actions above, full compliance has been achieved.

Note:

1. Letter, CP Kipp to BS Mallett, Titled "Summary of Actions for Line 3 Tube Reportable Event", Dated 12/11/96

Violation (70-1113/9612-02)

License Condition No. S-1 of SNM License No. SNM-1097 requires that licensed materials be used in accordance with statements, representations, and conditions of Part I of the application dated October 23, 1987, and supplements thereto.

Part I, Chapter 4, Section 4.2, subsection 4.2.4, Paragraph 4.2.4.3 of License SNM-1097 requires that, "Whenever criticality control is directly dependent on the integrity of a structure used to retain the geometric form of a fissile material accumulation...the structure shall be designed with an adequate strength factor to assure against failure under foreseeable loads or accident conditions."

Contrary to the above, on November 30, 1996, criticality safety in the calciner operations was directly dependent on the integrity of the calciner tubes and the calciner tubes in all units were not designed with an adequate strength factor to assure against failure under a foreseeable load. A contributor to this was that there were no formal provisions (e.g., preventive maintenance) in place to adequately assure against such failures.

This is a Severity Level IV violation (Supplement VI).

GE Response to Violation

GE concurs that assurance against geometry failure under foreseeable loads or accident conditions was not adequate.

A formal preventative maintenance program had been established for old 'cast' alloy calciner tubes. Design operating history, the old 'cast' design was replaced with a new inconel-600 rolled alloy calciner tube design. The originally designed inconel-600 rolled alloy tube was annealed after the flat stock was rolled into the final cylindrical tube product. Subsequent deliveries of calciner tubes showed that the tubes were only annealed as flat stock, but not after the inconel-600 stock was rolled and welded into the final shape.

1. GE has revised the preventative maintenance program for calciner tubes. The inconel-600 rolled alloy calciner tubes are now explicitly addressed in the MPAC software preventative maintenance program. For the cast and single-annealed tubes, these selected action levels represent a minimum of 30% margin reduction from actual throughput data at the time of tube failure. For the double-annealed tubes, these selected action levels represent greater than 50% margin reduction from known throughput data.

   - '**Cast**' alloy tubes will be 'flipped' end for end when the total throughput is less that or equal to 340,000 kgs UO2. These tubes will be replaced when the total throughput is less than or equal to 680,000 kgs UO2.

   - Inconel-600 tubes that have been **single-annealed** (as flat stock, but not after final roll), the tubes will be 'flipped' end for end when the total throughput is less that or equal to 400,000 kgs UO2. These tubes will be replaced when the total throughput is less than or equal to 800,000 kgs UO2.

   - For inconel-600 tubes that have been **double-annealed** (as flat stock and again after final roll) the tubes will be 'flipped' end for end when the total throughput is less that or equal to 400,000 kgs UO2. These tubes will be replaced when the total throughput is less than or equal to 800,000 kgs UO2*.

It should also be noted that the cast and single annealed tubes are no longer planned replacement options for GE calciner (defluorinator) tubes. Only the double-annealed tubes will be used in the future.

2. GE has revised its vendor specifications for inconel-600 (wrought) rolled alloy calciner tubes, and included emphasis of annealing of the final rolled product. GE has also ensured the vendor quality assurance certification meets new the new design specification.

3. GE has revised its change control process by including emphasis on the impacts of material property changes of equipment or processes. GE has sensitized all fuel manufacturing process engineers on this change.

Based on the corrective actions above, full compliance has been achieved.

**Presently line 4 is the only double-annealed tube installed at GE. The 400,000 kgs throughput 'after flip' criteria remains valid; but because over 900,000 kgs have already been processed through this line before the initial tube flip, the total throughput of 1.3 MM kgs will in this case exceed the MPAC limit of 800,000 kgs.*

Violation (70-1113/9612-03)

License Condition No. S-1 of SNM License No. SNM-1097 requires that licensed materials be used in accordance with statements, representations, and conditions of Part I of the application dated October 23, 1987, and supplements thereto.

Part I, Chapter 4, Section 4.2, subsection 4.2.5, Paragraph 4.2.5.1 of License SNM-1097 requires that, "Where control of mass is used to provide criticality safety, the mass of uranium (or U^{235} or U^{238}) is administratively controlled based on measurement by one or more of the following techniques:

- **The mass of uranium (or U^{235} or U^{238}) is determined as the product of the volume and the uranium (or U^{235} or U^{238}) concentration as measured by qualified counting methods.**

- **The mass of uranium (or U^{235} or U^{238}) is determined by qualified counting methods.**

- **The total mass or change in mass of a system is measured assuming the most reactive credible composition.**

Contrary to the above, on November 30, 1996, mass was being administratively controlled to limit input to the calciners upon tube failure and measurements were not being performed as required. The amount of material present in the calciner during a tube breakage was being limited by an administrative control which involved an operator removing the ADU feed tube from the calciner.

This is a Severity Level IV violation (Supplement VI).

GE Response to Violation

GE concurred above that active engineered control (AEC) relied upon to detect a calciner tube rotation failure did not function as required, and as a result, operations were not immediately aware of the loss of tube geometry. Since the AEC failed, operations did not take the immediate administrative actions necessary to minimize the uranium mass accumulation within the refractory annulus.

At approximately 0900 a.m., on December 3,1996, 38.77 kgs of 4.9% enriched material was observed between the Line 3 calciner tube and the outer heat shield. The material was promptly placed into safe geometry 3-gallon containers. The AEC interlock on tube rotation failed to minimize the accumulation.

The ragged circumferential break of the inconel-600 rolled alloy tube was not a clean break as in our past 'cast' tube failure operating experience. The inconel-600 tube failure mode resulted in a continued rotation of the broken discharge end of tube (albeit erratic). This broken tube rotation was observed by operations not to be synchronized with the opposite drive motor end, at which time they took proper corrective action steps.

Actions taken to correct the violation are as follows:

1. The tube rotation timer AEC set point was tightened from a value of approximately 40-second to a new setpoint value of 19-seconds (or 17 second tube rotation time + 2 seconds). This AEC was functionally tested and witnessed by members of the NRC special inspection team. GE is confident the new timer value will detect the 'erratic and delayed' rotation observed by operations on the broken end. This corrective action has been completed on all calciners.

2. The tube rotation timer AEC interlock was modified to not only isolate steam and dissociated ammonia (as before) but will now also 'automatically' stop wet ADU feed by placing the dewatering centrifuge hopper three-way valve into recirculation mode. This will prevent any additional ADU from entering the feed end of the defluorinator tube. Likewise, when in dry recycle mode, the rotary airlock valve is automatically stopped, thereby preventing additional U3O8 from entering the feed end of the calciner tube. These corrective actions have been completed on all calciners, with the exception of Line 6, which only operates in dry recycle mode.

These above corrective actions replace the previous administrative control to stop feed (manually removing the squirt tube) with an 'automated action' which does not require operator intervention.

3. Other 'indirect' indicators of a tube failure were administratively enhanced. These actions include changes made to the calciner stack monitoring program. The stack reporting software was modified to automatically alert the user should a value exceed internal action levels. In addition, the ADU Provox distributive control system was modified such that the weekly stack result must be entered as an Operator Action Request for each calciner. Failure to input will stop HUF flow to the conversion lines 1-4, and will stop UNH feed flow to conversion line 5.

Based on the corrective actions above, full compliance has been achieved.

Finally, it should be stated that a criticality safety analysis revision is presently underway to improve the current neutronics model of the postulated 'tube break' condition. This analysis will improve on the 25 kg mass limit by explicitly modeling the geometry of the material accumulation within the refractory annulus, and possibly taking credit for moderation (due to the high temperature profile of the operating furnace). These calculations will be completed by GE no later than 3/31/97.