U. S. NUCLEAR REGULATORY COMMISSION
OFFICE OF INSPECTION AND ENFORCEMENT

REGION V

Report No. 70-754/31-02

Docket No. 70-754 License No. SNM-960 Safeguards Group 1

Licensee: General Electric Company

Vallecitos Nuclear Center
P. O. Box 460
Pleasanton, California 94566

Facility Name: Vallecitos Nuclear Center

Inspection at: Pleasanton, California

Inspection conducted: September 15-18, 1981

Inspectors: William J. Cooley — 10/14/81
W. J. Cooley, Fuel Facilities Inspector — Date Signed

P R Zurakowski — 10/16/81
P. R. Zurakowski, Radiation Specialist — Date Signed

R D Thomas — 10/22/81
Approved by: R. D. Thomas, Chief, Materials Radiological Protection Section — Date Signed

Approved By: for F. A. Wenslawski — 10/29/81
H. E. Book, Chief, Radiological Safety Branch — Date Signed

Summary:

Inspection on September 15-18, 1981 (Report No. 70-754/81-02)

Areas Inspected: Organization; modifications and changes to facilities and systems; internal audit and review; safety committee activities; employee training; operations review; criticality studies; radiation protection and confirmatory measurements.

The inspection involved 52 inspector-hours on site by two NRC inspectors.

Results: One item of noncompliance was identified within the subject areas inspected. That item involved failure to follow internal procedures in loading a special nuclear material vault. Details in Section 8 of the report.

A citation was not issued for the noncompliance item.

RV Form 219 (2)

DETAILS

1. Persons Contacted

*J. H. Cherb, Acting Manager, Nuclear Safety and Quality Assurance
*G. E. Cunningham, Senior Licensing Engineer
W. R. Lloyd, Senior Engineer, Nuclear Safety Technology
D. C. Bowden, Nuclear Safety Corpliance Engineer, Nuclear Safety Technology
P. S. Webb, Training Officer, Radiological and Environmental Protection
C. A. Hooker, Specialist, Radiological and Environmental Protection
R. E. Gest, Environmental Specialist, Radiological and Environmental Protection
W. W. Sabol, Manager, Centralized Counting Laboratory
R. B. Adamson, Manager, Core Material Testing
R. H. Cummings, Specialist, Safeguards and Accounting
M. L. Thompson, Manager, Advanced Fuels Laboratory
J. I. Tenorio, Manager, Remote Handling Operations
T. C. Hall, Manager, Equipment Engineering
L. L. Reed, Manager, Advanced Nuclear Applications
R. N. Robinson, Chemical Testing, Building 400
G. E. Petersen, Chemical Testing, Building 400

*Denotes those attending the exit interview.

2. Organization

R. A. Moschner, formerly Manager, Nuclear Safety and Quality Assurance has terminated employment at the Vallecitos Nuclear Center. W. H. King, formerly Manager, Nuclear Safety Technology has replaced Mr. Moschner. At the time of this inspection Mr. King was on an extended leave of absence and Mr. J. H. Cherb was Acting Manager, Nuclear Safety and Quality Assurance in place of Mr. King. Mr. P. S. Webb, formerly Manager, Radiological and Environmental Protection has transferred to the position of Training Officer within the Radiological and Environmental Protection Group. Mr. C. A. Hooker, Specialist, Radiological and Environmental Protection has assumed many of Mr. Webb's former responsibilities, Mr. Webb remaining immediately available as an aid to Mr. Hooker. In addition to his position as Manager, Nuclear Safety and Quality Assurance, Mr. King remains as Manager, Nuclear Safety Technology.

The net effect of the changes listed above is the elimination of two management level positions in Nuclear Safety and Quality Assurance.

3. Modifications and Changes to Facilities and Systems

The only modifications to facilities and systems other then the modification to the Buildings 103 vault discussed below in Section 4, have been those efforts in the decontamination and removal of glove boxes and equipment from the Advanced Fuel Laboratory. All glove boxes except two have been removed from the laboratory and loaded into special fiberglassed plywood containers. These containers have received NRC approval for shipment to the DOE Hanford Reservation. However, DOT concurrence had not been received as of the last day of this inspection.

One problem has surfaced during the fiberglassing operation. Because of the large size of the boxes and the numerous pieces of equipment within, it has not yet been possible to fiberglass the bottom. A method to tip the boxes gently by 90° is now being researched.

The decontamination effort in the mixed oxide coprecipitation box and the mixed oxide scrap recovery box is nearing completion. Work on their disassembly and transfer to the shipping boxes will start soon. The licensee is hopeful that shipment of the boxes will commence prior to the end of 1981. Realization of this schedule depends on a timely DOT concurrence.

4. Internal Review and Audit

This inspection included a review of radiation safety audits conducted from the date of the last NRC inspection to the present.

In the latter part of May, 1981, a review was made of all required posting throughout the Vallecitos Nuclear Site. In early June visual examination was made of 32 HEPA filters which had been delivered to the Vallecitos Nuclear Center. Fifteen of those were found to be damaged. The licensee believes the damage was due to the fact that the filters were not fastened on the pallets for delivery because the damage appeared to be deformed filter corners.

A three man audit of the Counting Laboratory in Building 103 was conducted during the latter part of June, 1981. Recommendations for improvement resulting from that audit included an improved numbering system for procedures to prevent the use of old procedures which had been superseded; copies of two applicable standard procedures were not available at the laboratory; and no guidance has been given on the required retention time for counting records.

In July a three man vendor inspection by Vallecitos Nuclear Center personnel was made of Radiation Detection Company which furnishes the Vallecitos Nuclear Center with certain analytical results including bioassays and dosimeters.

An additional 18 HEPA filters were visually inspected in July, 1981 and only one found damaged. A reduction in damaged HEPA filters in this latter case appeared due to the proper shipping precautions by the vendor.

In August, 1981 an inventory was made of State of California licensed material along with the status of user authorizations issued for that material. The licensee plans to audit the Change Authorization Program and the status of all Change Authorizations within the year 1981.

The present frequency of radiation safety audits by the licensee is two or more per quarter. This inspection included a review of Change Authorizations issued since the last inspection. A Change Authorization issued June 26, 1981 evaluated the safety of moving glove boxes and other equipment from the Advanced Fuels Laboratory by elevator to the loading area at the rear Building 102. This was necessary because the special shipping container GE Model 9136 was too large to bring to the Advanced Fuels Laboratory for loading. Procedures for the move were prepared. All required approvals had been obtained.

A Change Authorization issued August 31, 1981 studied the safety of indefinite storage of loaded shipping containers Model 9136 in the event they could be not shipped from the site at the time of loading. The Change Authorization specified the permitted storage locations onsite, the requirement of covering the storage shipping containers with a tarpaulin, the requirement that the storage facility be inspected monthly, and that all labeling and identification of the containers be completed at the time of storage. That Change Authorization has not been used as yet.

A Change Authorization had been prepared to evaluate the fiberglass spraying of GE Model 9136 shipping container because that spraying involved the use of acetone, a flamable solution. The Change Authorization considers that flamability. Not all the approvals had been obtained at the time of this inspection and the Change Authorization had not been issued.

In addition to internal audits in the areas of x-ray machines, employee training and retraining, respiratory training, isotope authorization reviews, change authorizations, radiation work permits, radioactive waste handling and radiation detection instrumentation, the licensee also conducts safety investigations of incidents that have the potential to cause or did cause a safety problem. These investigations which are conducted in a formal manner require a formal report and action by the management involved.

Three such investigations involving licensed material were conducted in 1981 to the date of the inspection. Investigation 81-1 involved facial contamination received by an employee because he went into a contaminated area without proper respiratory and anti-C protection. The employee moved a cart from between hot cells 4 and 5 by holding his breath and quickly removing the cart. Because he did not have anti-C clothing on, contamination was inadvertently transferred from his hands to his face. After the employee was decontaminated, lung and whole body counts disclosed no significant internal activity. The Investigation Committee determined that the incident was not reportable to NRC. However, retraining of the people involved was required.

Investigation 81-2 involved a nonreportable GETR incident that did not occur under the jurisdiction of the subject license.

Investigation 81-3 involved a hand injury received by an employee working in a contaminated area. The employee was assisting in the movement of a chemical hood when it started to tip over. He put out his hand to stop the fall and had a finger cut severely in the effort. The employee was given first aid and sent to the hospital. The wound was not contaminated. It was determined that the incident was not reportable to NRC.

Investigation 81-4 involved a radioactive waste spill incurred when liquid waste was being transferred to a portable tank. It was determined that the overflow incident was caused by the failure of the operator to attach an automatic shutoff cable and his leaving the area in order to make a telephone call. It was determined that no contamination entered the public domain offsite.

A review of the documentation disclosed that:

a. The Investigation Committee uses a formal written procedure in conducting its review.

b. At the conclusion of the investigation the committee always writes a formal report.

c. The committee normally requires a response from the management involved.

d. The committee conducts an implementation audit to ensure that its recommendations were followed.

The committee appeared to function in a professional and effective manner.

A periodic "Health Physics Monitor Criticality Inspection" is conducted by the Health Physics Monitors. The purpose of the inspection is to ensure that use and storage of SNM in a Criticality Limit Area is in strict accordance with the applicable criticality analysis. The interval between inspections is determined by the quantity of material and the potential hazard. The AFL and Hot Cells are inspected once a month, the NTR once a quarter and Chemical Labs in Building 103 are looked at once every six months.

The Monitor fills out a "check list" report and is given the opportunity to make comments at the bottom of the report. While reviewing these reports an NRC Inspector noted that a June 11, 1981 inspection by a Health Physics Monitor disclosed that the Building 103 vault had been incorrectly loaded. It further disclosed that this loading was done without the necessary authorization of a specific criticality analysis. Details are included under "Criticality Studies", Section 8.

5. Safety Committee Activities

This inspection included a review of the minutes of meetings of Vallecitos Technical Safety Council which were conducted since the date of the last inspection. On April 21, 1981 the council considered a reduction of radioactive waste material onsite. That waste material contained no special nuclear material. On June 2, 1981 the council recommended processing radioactive liquids stored in tanks onsite. Also discussed was an available substitute for DOP testing of absolute filters and the possibility of adding a section to the Vallecitos site standards devoted to non-nuclear hazardous waste disposal. On August 5, 1981 the council again recommended processing liquid waste on site. It also recommended that an exemption be secured for criticality alarms in areas where material limits were low enough to prevent criticality, and recommended the elimination of the potential for exceeding criticality analysis limits caused by the receipt of certified shipping containers.

6. Employee Training

This inspection included review of tests which had been prepared by the licensee to determine the effectiveness of his various training sessions for employees. The subject of employee training available at the Vallecitos Nuclear Center along with the tests given to evaluate the effectiveness of the training was addressed in NRC Inspection Report 70-754/80-04, Section 6. Since that time revisions and improvements of the number of those tests have been made including several versions of the tests for a given training session. The new employee Radiological Orientation Session Test has been expanded from 6 to 27 multiple choice questions. A test following the Radiation Monitoring Technicians Certification session consists of closed book and open book sections. The closed book part of the quiz includes seventeen questions of multiple choice, true/false, or fill in the blank types of questions. The open book portion of the quiz consists of seven questions all of which require calculations. The Reactor Operators Health Physics Training Course Test consists of 31 of the multiple choice or fill in the blank types of questions. Revisions of existing tests and introduction of new tests along with multiple versions of those tests occurred between June and August, 1981.

7. Operations Review

This inspection included visits to the Advanced Fuels Laboratory, the Building 103 Chemistry and Metellurgy Laboratories, the Building 103 Vault, Remote Handling Operation in Building 102, the Advanced Nuclear Applications Laboratory in Building 105 and the Chemical Testing Facility in Building 400. Particular emphasis during the tour was placed on criticality, NRC-3 and Part 19 posting requirements. No violation of NRC requirements or good health physics practices were noted during the tour.

8. Criticality Studies

The licensee's efforts in validating of computer codes used in criticality analytical work has been addressed in NRC Inspection Report 70-754/81-01, Section 7. That validation effort is continuing. The licensee plans to use (in addition to the Cross Section Evaluation Working Group (BNL) compiled data) the documents Y1858, Validation Checks Using the ANISIN and KENO Codes by Correlation with Experiment Data for high enriched material and the document Y1948 Validation of KENO Code for Nuclear Criticality Safety Calculations of Moderated Low Enriched Systems. Both of those documents were produced by G. R. Handly and C. M. Hopper. Additionally, the computer code SCALE, being developed by Computer Sciences Division, ONRL will be added by the licensee to the codes being validated.

Since the last inspection the licensee has analyzed the use of 4 percent enriched and natural and depleted uranium in the Building 400 Chemical Testing Facility. A criticality mass limit of 300 grams contained U-235 at 4 percent enrichment plus 2,000 grams contained U-235 in natural uranium was established for the Chemical Recovery Studies. The analysis was performed using KENO, a spherical geometry, and a model of 300 grams of U-235 at 4 percent enrichment surrounded by a natural uranium spheroidal distribution of 2,000 grams contained U-235. Accident conditions included double batching both the 4 percent enriched mass limit and the natural uranium mass limit which resulted in a calculated k_{eff} of less than .95 for full water reflection and optimum water moderation. A review of Health Physics Monitor Criticality Inspection records (reported in Section 4, above) revealed that a misloading of Building 103, special nuclear material vault had occurred on approximately June 11, 1981. The so called "seismic" criticality analysis and two models associated with that analysis have been described in NRC Inspection Report Number 70-754/80-04. That analysis assumed a devastating earthquake which resulted in the complete collapse of Building 103 and a resulting destruction of fuel storage racks in the Building 103 vault. A further assumption was made that when the racks were disassembled, the fuel contained therein was not distributed randomly but rather was reassembled in the most reactive configuration calculable. The contingencies placed on the calculation were:

a. All the stored fuel falls from the rack compartments, comes out of its individual containers, and is reassembled along with other available fuel contained in 6M shipping containers stored in the vault.

b. All the fuel reassembles itself in cylindrical geometry at height/diameter ratio of approximately one.

c. All of the fuel reassembles itself in discreet cylindrical layers ranging radially from the highest to the lowest enrichment.

d. The layer of lowest enrichment ($\leq$ 5% enrichment) rearranges itself in a "clumped" arrangement of highest possible reactivity.

e. This reassembly occurs at optimum moderation (an average H/X was used to cover all enrichments).

f. Full water reflection occurred.

A condition of License SNM-960 requires the licensee to adhere to the "double contingency principle" which requires that only two independent and unlikely events must occur before criticality is possible.

The first four of those items were regarded by the analyst as contingencies whereas optimum moderation and full water reflection were disregarded as contingencies. That approach permitted the analyst to envision a fire following the earthquake with the application of water to suppress the fire. Mass limits were placed on individual storage locations and on the vault regarded as a whole. With the prescribed vault loading, taken along with the first four contingencies (each of which appears to be incredible, in itself), the assembly would remain subcritical with optimum moderation and reflection.

A Change Authorization was approved on March 18, 1981 permitting replacement of one fuel storage cubical rack and permitting the fuel available in the vault to be distributed among criticality limit areas in the laboratories of Building 103. The Change Authorization specified that no reloading of the vault was permitted until a new criticality analysis was issued for any rearrangement.

Apparently, in the early part of June 1981, the vault was unloaded in compliance with the Change Authorization and a new fuel rack placed in the vault as permitted. Additionally, a second fuel rack and a fuel rod storage rack (neither permitted in the Change Authorization) were added to the vault. About June 10th, the Building 103 vault was reloaded with its original fuel loading but without benefit of an amended Change Authorization or a new criticality analysis issuance.

As noted in Section 4, above in this report, the reloading of the 103 vault was discovered in a routine internal inspection conducted on July 11, 1981. The matter was reported by the monitor who was unable to correlate the observed vault loading with the vault loading plan in his possession.

The vault was immediately locked and all transfers to and from the vault prohibited. An assessment of the vault loading was made by the vault custodian and the criticality analyst using inventory records. The criticality analyst then recalculated the vault inventory using a "seismic" model similar to the one previously described. The results of that calculation indicated the new vault loading could theoretically be made critical consistant with the four contingencies listed above in this report. The "seismic" model used was a spherical arrangement with discreet layers of enrichments in radial descending order and neglecting the poisoning effect of the 6M container structural material and the contained fuel.

Corrective action taken by the licensee included an appropriate amendment of the Change Authorization accompanied by a new criticality analysis. In that effort, new reduced vault loading limits were prescribed consistant with the new spherical model. The vault was then properly reloaded after all required approvals of the changes had been obtained. The health physics monitor audit sheets were brought up to date to be consistant with the new vault loading. A special training session was given on June 16, 1981 to employees involved in the misloading of the vault. That training session was repeated on September 17, 1981 in a more formal presentation including a written test.

In the matter of the 103 vault misloading, the licensee violated his internal procedures which required reanalysis of the loading. This is regarded by the NRC Inspectors as an item of noncompliance, Severity Level V, Supplement VI (Federal Register, Volume 45 Number 196, dated October 7, 1980).

As reported in Section 8 of this report, the licensee's failure to follow internal procedures with regard to the 103 vault loading is regarded as an item of noncompliance, Severity V. The NRC will not generally issue notices of violation for a violation that meets all of the four following tests:

a. It was identified by the licensee,

b. It fits in Severity Level V or VI,

c. It was reported, if required, and

d. It was or will be corrected in a reasonable time.

In the matter of the 103 vault loading all four of the above test conditions were met by the licensee. Therefore, no notice of violation will be issued in this matter.

9. Radiation Protection

This inspection included a review of the bioassay records for the year 1981 and air sample data for the same period.

a. The bioassay program includes the use of the licensee's "shadow shield" whole body counter. It was disclosed that every employee is given a whole body count at least once a year. Employees who work in restricted areas are checked more often. Visitors who tour potentially contaminated areas are also given a whole body count. Because one of the NRC Inspectors visited the facilities noted in the section entitled "Operations Review", he received a whole body count.

b. Urinalysis for plutonium is performed quarterly by the Radiation Detection Company for those employees who are frequently involved with plutonium. Other persons who are less frequently involved, are bioassayed less often. The limit of detection is 0.02 DPM/L at the 95% confidence level. The licensee's action level is 0.03 DPM/L. Three repeat analyses are performed for analysis showing 0.03 DPM/L or greater. A high reading of 0.11 DPM/L was noted for an employee on 5/14/81. Further investigation disclosed that this employee does not work with Pu and that the reading probably was in error. At the time of the inspection the three repeat analysis reports had not been received by the licensee. The NRC Inspectors were assured that in the event that the repeat analyses reports indicate a real exposure had occurred they would immediately be informed and a thorough investigation would be conducted.

c. Uranium urinalysis is conducted by Eberline. The licensee's action level is 5 µg/L natural uranium and 7 DPM/L enriched uranium. High readings of 1.2 and .71 µg/L were noted in the records. Most results were zero. In the event of a significant exposure, a lung count can be obtained at the Lawrence Livermore National Laboratory which has the sensitive equipment available for such an analysis. No such analysis has been necessary during the past year.

d. Because of the great deal of effort that the licensee is expending in the decontamination of the AFL, the examination of air sampling data from this area was emphasized during this inspection. It was found that smear samples were taken at fixed locations once a week and on the floors every day. Fixed air samplers were noted throughout the laboratory and the records indicated that the filter paper was changed twice a week. Portable air samplers, used extensively during the decontamination operation, were set at between 4-8 MPC-Hrs for plutonium. The licensee's action level was set at $1X10^{-12}$ µCi/cc. Samples found at that level mandated a recount. Most recounts disclosed that the activity was probably due to radon-thoron. One count of $2X10^{-12}$ µCi/cc was investigated further and it was found that this activity was caused by a spill during a glove change. Proper respiratory protection was used during this operation. A recount for one sample reading $1X10^{-12}$ µCi/cc could not be located by the inspector. The Supervisor of Health Physics commented that recounts are always taken of samples at that level. The absence of the record could not be explained. However, the time, date and place of the sample indicated that it probably was due to radon-thoron.

Most air sample readings ranged between 10^{-13} and 10^{-15} µCi/cc.

10. Confirmatory Measurements

An attempt was made to sample water from the 102 shop well, the 102 A and K wells, the 102 waste tank well and RHO pool well. It was found that all of the wells were dry except the 102 K well. These results were not entirely unexpected because the sampling was attempted near the end of the normal California dry spell.

The sample from the 102 K well was sent to DOE's Radiological and Environmental Sciences Laboratory for analysis. The licensee obtained a duplicate sample which they will send to their normal commercial laboratory. The results were not available to be included in this (81-02-01) report. However, they should be included in the next report. Sampling of the other wells will be attempted during the coming wet season.

11. Management Interview

The results of the inspection where discussed with licensee representatives at the conclusion of the inspection on September 24, 1981.

The item of noncompliance listed in Section 8 of this report was included in the discussion.