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

REGION V

Report No. 81-01

Docket No. 50-228 License No. R-98 Safeguards Group

Licensee: Aerotest Operations

3455 Fostoria Way

San Ramon, California 94583

Facility Name: Aerotest Research Reactor Facility

Inspection at: San Ramon, California

Inspection conducted: February 11, 12, 17, 24, 25 and March 24, 1981

Inspectors: J. R. Curtis — April 1, 1981
J. R. Curtis, Radiation Specialist — Date Signed

F. A. Wenslawski — 4/1/81
F. M. Cillis, Radiation Specialist — Date Signed

Approved By: F. A. Wenslawski — 4/1/81
F. A. Wenslawski, Chief
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Approved By: H. E. Book — 4/2/81
H. E. Book, Chief, Radiological Safety Branch — Date Signed

Summary:

Inspection on February 11, 12, 17, 24, 25 and March 24, 1981 (Report No. 50-228/81-01)

Areas Inspected: Routine unannounced inspection of the radiation protection, environmental protection and emergency response planning programs at the facility; including follow-up on licensee action in response to an item of noncompliance identified in Inspection Report 79-02, and licensee response to IE Bulletin 79-19 and IE Circular 80-14. The inspection involved 30 inspection-hours onsite by two inspectors. On March 24, 1981 a management meeting was held with the licensee to discuss neutron dose assessment at the facility.

Results: Of the areas inspected, one item of noncompliance was identified pursuant to 10 CFR 20.401(a) as described in paragraph 8.

DETAILS

1. Persons Contacted

*R. Newacheck, President Aerotest Corporation
*R. Tsukimura, Radiation Safety Officer, Aerotest
J. Haskins, Reactor Supervisor, Aerotest

Other members of the Aerotest staff.

*Indicates presence at the exit interview held February 17 & 25, 1981.

2. General Operations - Tour

The Aerotest Research Reactor is a TRIGA pool type reactor with a fixed core and special facilities for routine neutron radiographic operations. The reactor normally operates at 200 to 250 KW power, averaging four to five hours of operation per day, five days per week. The inspector toured the facility and observed typical neutron radiography operations.

There have been no major changes in the building housing the reactor but considerable expansion is underway in the form of additions to the north and eastern portions of the existing facility. The expansion of space for set-up and handling of materials for routine neutron radiography operations is a result of part of the licensees efforts to reduce personnel exposure in its ALARA program. Other activity includes management's establishment of a program to train all of the staff in the various tasks associated with the radiography operation so that assignments may be rotated to minimize individual exposure.

No items of noncompliance or deviations were identified.

3. Radiation Control

a. Posting

The posting practices at the facility were noted during the tour. Posting and labeling was consistent with the requirements of 10 CFR 19.11 and 10 CFR 20.203.

b. Radiation Surveys

Routine meter surveys of gamma and neutron radiation levels are performed monthly. Contamination levels are checked by swipe surveys performed on a regular schedule. Film badge monitors are placed at ten locations in and around the facility. Integrated doses reported in 1980 range from 50 to 150 $\frac{\text{millirem}}{\text{year}}$ at the fence line to 2.40 to 2.74 $\frac{\text{rem}}{\text{year}}$ in the neutron radiography area of the reactor room. Radiation levels associated with irradiated materials are monitored at various stages during handling. Air samples are taken at selected locations in the facility and the filters are changed and counted daily.

Samples of the results of surveys for the period for January 1979 to January 1981 were examined. Radiation levels throughout the facility vary greatly dependent upon the location and the shielding conditions provided by shutters and various sized aperture plates inserted in the neutron radiography beam. Results of surveys were consistent with those previously reported. Some decrease in the general radiation level around the radiography sample insertion tunnel was achieved by the placement of baffle plates in the tunnel.

A survey was performed during the inspection using the NRC's Health Physics Instruments Model 1070, Tissue Equivalent Ion Chamber Meter, Serial #004670, calibrated January 7, 1981. General radiation levels measured three feet above the floor were in the range of 0.2 to 0.5 mrad/hr at a location remote from the reactor to 30 mrad/hr in front of the radiography sample tunnel. Levels in locations on top of shields or otherwise not normally accessible were higher, in the 50 to 150 mrad/hr range.

Records of radiation levels measured during sample handling ranged from 0.5 mr/hr to 7 r/hr. The high radiation levels are associated with measurements made at the surface of aluminum sample holders. The measurements were made upon removal from the irradiation facility and the samples are remotely placed in a shielded storage container immediately where they are stored until the short half-lived activity associated with the aluminum decays. Records of radiation measurements made on samples prepared for transport were examined and results appeared to meet the requirements of 49 CFR 173.393. Records of swipe survey and air filter analysis indicated that levels were routinely in the background range. Occasional swipe results that were greater than 2 times background levels were investigated by the Radiation Safety Officer for followup action where necessary.

c. Instrumentation

The licensee maintains a supply of survey instruments for monitoring neutron and beta-gamma radiation levels. The instruments available for use and in use were checked for adequate calibration frequency. All instruments checked were in current calibration. Calibrations had been done in accordance with Technical Specifications and/or operational procedures. The next calibration due date for survey instruments was May 18, 1981.

Fixed area, air and water monitoring instruments are response checked by the reactor operator according to daily and monthly reactor operation check lists. The power supply and readout portions of the fixed air and water monitoring instrumentation had recently been upgraded by replacements and the detector locations were changed to increase shielding and to improve sensitivity.

d. Radiation Safety Procedures

The licensee's operations are conducted according to Standard Operating Procedures (SOPs) that are approved by management and are periodically reviewed and audited by the Reactor Safety Committee. The radiation safety procedures are presently undergoing complete revision and review by the Radiation Safety Officer. The last formal review and update was in 1975, however individual portions had been updated and improved whenever changes were implemented.

e. Personnel Monitoring

The licensee uses the personnel dosimetry services of The U. S. Testing Company of Richland, Washington. NTA film badges for monitoring beta-gamma and neutron dose are issued to ten to twelve staff members and self reading, gamma sensitive pocket dosimeters (PIC) are issued to visitors whose visit might involve entry into radiation areas. Thermoluminescent extremity dosimeters (TLD) are available and issued to persons who, in the process of handling neutron radiographic cassettes or other irradiated materials might be exposed to significant radiation levels. Periodic bioassay evaluations have been conducted using urine analysis and whole body counting methods, both performed by outside contractors.

Personnel dosimetry records for calendar years 1979 and 1980 were examined. Recorded doses ranged from minimum detectable for the company secretary to 3.76 rem/year beta-gamma (2.50 rem/year penetrating) in 1980 for one of the staff members whose principal duties have been in the neutron radiographic area. The reactor supervisor whose principal duty has been reactor operation at the console had recorded whole body penetrating doses of .96 and 1.01 rem for 1979 and 1980 respectively. The staff member whose principal duties have been evaluation of neutron radiographs in the quality assurance area of the facility had recorded whole body penetrating doses of 1.22 and 1.21 rem for 1979 and 1980 respectively.

The 8% neutron dose contribution discussed in RV Inspection Report 50-228/79-02 had not been incorporated into the dosimetry records for the radiographers. The licensee indicated that he had requested that the calculated value of 8% of the gamma dose be added to doses recorded by their dosimetry service supplier although this is not required by NRC Regulations or Regulatory Guide 8.14. No evidence existed that this had been done up to the period through December 31, 1980. The neutron dose component for the Quality Control area and Control Console area is discussed in paragraph 8.

No items of noncompliance or deviations were identified.

4. Emergency Response Planning

The licensee has an emergency response plan that classifies emergencies, provides for alarms, and provides evacuation instructions for individual action to mitigate the effect of accidents, fires, natural disasters and to notify and summon off-site support organizations. The reactor supervisor is presently reviewing the plan to make the appropriate revisions to meet pending regulatory requirements.

The licensee has installed an improved telephone dialing system to provide for rapid contacts with off-site emergency response groups and the various regulatory agencies requiring rapid notification. A second system for establishment of a duty officer and to provide for effective communication with key emergency response staff members has been initiated. Radiation monitoring instruments, self reading dosimeters and respiratory protective equipment designated for emergency response use is located at personal residences, in the counting laboratory located away from the reactor facilty, and at the San Ramon Fire District's Fire Station.

No items of noncompliance or deviations were identified.

5. Transportation Activities

The licensee's operations involve some sample irradiations which result in the return of materials made radioactive. The shipment of these constitutes transport activities involving radioactive material covered under DOT and NRC regulatory requirements. The Radiation Safety Officer (RSO) and the Reactor Supervisor are the persons in the Aerotest organization who handle outgoing shipments and ascertain that regulatory requirements are met. The licensee subscribes to two services that provide updated information on NRC and DOT regulations. The RSO had generated a section in the S.O.P. manual for internal guidance on the requirements.

Records of shipments were examined for the period January 1978 to December 1980. There were 80 shipments in 1978, 73 in 1979, and 81 in 1980. Radiation levels reported as surface dose rates were in the range of "less than one" to 150 mr/hr and levels at one meter distance were in the "less than one" to 2 mr/hr range.

No items of noncompliance or deviations were identified.

6. Environmental Protection-Effluents

Radioactive materials generated at the facility are mainly short-lived products of neutron activation and releases into the environment are minimal. Argon-41 releases are estimated from a tabulation of reactor operations in which air or gas volumes might be activated. The licensee indicated that irradiation facilities which present a gas filled void during irradiation are purged with carbon dioxide prior to irradiation to minimize Argon-41 production, and estimated releases are considered as maximum possible releases. Records of Argon-41 releases indicated 360 microcuries for 1978, 280 microcuries for 1979, and 304 microcuries for 1980.

Liquid wastes that have been generated during filter or ion exchange resin changes or on occasions when the reactor pool water level was temporarily lowered, have been collected in hold-up tanks, and sampled prior to release to the sanitary sewer. There have been three releases of 1500 gallons in the period January 1979 to January 1981. No activity above background level was detected using gamma spectroscopic analysis of a sample of the water.

Solid waste generation is minimal; on May 18, 1980 three 55 gallon drums of low level waste were transferred to a disposal contractor for disposal. No solid waste shipments had been made since 1973 prior to the 1980 shipment which contained a less than 100 microcurie Cobalt-60 source and an accumulation of possibly contaminated miscellaneous materials. The Cobalt-60 source had been carried on a state license and was a possibly leaking sealed source.

No items of noncompliance or deviations were identified.

7. Licensee Response to IE Bulletins and Circulars

The licensee received and responded to IE Bulletin 79-19 "Packaging of Low-Level Waste for Transport and Burial", in a timely manner. The licensee's operations do not result in the generation of significant quantities of low-level waste, (see paragraph 6 Effluents). The licensee's program appeared to be adequate to meet the needs of the low volume, low activity generator which they are. Three 55 gallon drums of solid waste and approximately 5500 gallons of very low-level liquid wastes have been generated and disposed of since April 1978.

The licensee received IE Circular 80-14 and evaluated their facility's deionized water system. No sources of cross contamination or siphon action were identified.

No items of noncompliance or deviations were identified.

8. Action on Previous Inspection Findings

The corrective actions taken by the licensee in response to a Region V Notice of Violation in IE Inspection Report No. 50-228/79-02, concerning the need for establishing neutron dose component was examined. The licensee's timely response to that notice, dated December 3, 1981 and corrective action was acceptable. This matter is considered closed (79-02-01).

The licensee's followup action to the previous item of noncompliance was examined. Survey records, personnel dosimetry records and the licensee's evaluation report concerning neutron dose assessment for personnel occupying the control console and quality control (Q.C.) areas were examined.

The licensee committed that an appropriate evaluation of the neutron component would be accomplished pursuant to 10 CFR 20.201(b) to ensure compliance with 10 CFR 20.101 by January 15, 1980. Additionally, the licensee stated that the neutron dose component would be documented in the appropriate dosimetry records.

The inspector's examination of the evaluation report revealed that the licensee had determined the neutron dose component in accordance with the guidelines of paragraphs C.1.b and C.1.c of Regulatory Guide (R.G.) 8.14 and C.3 of R.G. 8.4. A neutron to gamma ratio of approximately 70% had been determined for the "Control Console" area and a ratio of 100% for the Q.C. area. The evaluation appeared to adequately assess the neutron component based on measurements with portable monitoring instruments and known personnel occupancy times. The assessment appeared to adequately determine the "worse case" condition. The evaluation was completed by January 15, 1980; however, the neutron components established were not documented in the appropriate personnel dosimetry records pursuant to 10 CFR 20.401(a) which requires documentation of personnel exposures be entered on a form NRC-5 or equivalent, for periods of time not exceeding one calendar quarter. The licensee felt that the neutron dose components established on January 15, 1980 were high by a factor of 2 to 3 and was therefore reluctant to use the data for updating personnel dosimeter records.

After completing the initial evaluation on January 15, 1980 the licensee decided on a course of action to collect more date before documenting the neutron component in personnel dosimetry exposure records. The licensee had ascertained that the exposures of involved individuals were well within the limits of 10 CFR 20.101 and 10 CFR 20.202 using the neutron component data determined from the initial evaluation, although the exposure records of the involved individuals were not updated.

The licensee decided to continue their evaluation of establishing a more accurate assessment of the neutron component in accordance with guidelines of R.G. 8.14 using a thermal-neutron dosimeter, model 609. The thermal-neutron dosimeter was received from Dosimeter Corporation of America in July 1980. The dosimeter is a direct reading dosimeter with first collision thermal-neutron dose measured in millirems. Its range is 0-120 mrem and its reported calibration accuracy is $\pm$ 20% (neutron).

The Radiation Safety Officer stated that an analysis of the thermal neutron dosimeter was performed between the period July 1980 and mid November 1980. The analysis primarily consisted of evaluating: (1) the response of the dosimeter to direct readings obtained with portable monitoring equipment in the "Q.C." and "Control Console" areas and (2) comparing the response of thermal neutron dosimeter and direct reading pocket dosimeters (PIC) used for measuring x and gamma radiation doses. Subsequently, the thermal neutron dosimeter was assigned

to the reactor operator for a two month period ending in January 1981. A neutron component of 23% was established for the control console area by comparing the thermal neutron dosimeter to the PIC results. The thermal neutron dosimeter was then assigned to the licensee's Quality Assurance inspector in February 17, 1981 to determine the neutron component in the Q.C. area. The neutron component for the week and one half data collected for the Q.C. area at the time of the inspection ranged from 22 to 33%. At no time during the evaluation of the thermal neutron dosimeter were quarterly and/or bi-annual calibrations of the dosimeter performed as recommended by R.G. 8.4.

The licensee could not determine if the neutron spectra used for calibration of the thermal neutron dosimeter simulated the spectra in the area where the neutron dosimeters would be required as recommended by paragraph 6 of ANSI-N319-1976. Neither were additional calibrations made in areas of the licensee's facilities were personnel neutron dosimeters would be required as recommended by the ANSI standard. The licensee did not have a copy of the dosimeters energy response data available.

The inspector discussed previous inspection findings identified in Region V Inspection Reports 50-228/77-01 and 50-228/78-01 with the licensee. These inspection reports discuss concerns with the licensee's personnel neutron dosimetry program and need for documenting the neutron dose components in appropriate personnel exposure records. The need for resolving their neutron dosimetry program was re-emphasized during the discussions. The licensee agreed stating that an appropriate evaluation using the most accurate results would probably be completed by the end of March 1981. The licensee stated they were looking into the availability of an Albedo neutron-dosimetry service as a possible resolution to their personnel neutron dosimetry program.

The need to document the neutron component into personnel exposure records was discussed in great detail with the licensee. It was emphasized to use the data currently available and to revise the records as refined data becomes available. The licensee proposed that the neutron component would be documented in the appropriate personnel exposure records by March 6, 1981.

In conclusion the licensee was informed that failure to document the neutron dose component in personnel dosimetry records was considered to be in noncompliance with 10 CFR 20.401(a). Additionally the licensee was invited to attend a Management Meeting in Region V on March 24, 1981 to discuss the neutron dose assessment at the Aerotest Facility (see paragraph 10). An Aerotest letter to Region V, dated March 4, 1981, confirmed that the licensee had documented the neutron components into the appropriate personnel exposure records. This item is considered closed.

9. Exit Interview

An exit interview was held for the portion of the inspection concluded on February 17 and again for the portion of the inspection concluded on February 25, 1981. The inspectors met with Messrs. Newacheck and Tsukimura (denoted in paragraph 1). The inspectors summarized the scope and findings of the inspection and discussed in detail the concerns of paragraph 8.

The items of concern identified in paragraph 8 were brought to the licensee's attention during the exit interview.

10. Management Meeting

A management meeting was held with the licensee at the Region V office on March 24, 1981 to discuss the following Region V concerns:

- Findings identified during the inspection (see paragraph 8) and from previous NRC inspections dating back to 1977.
- The need for the licensee to resolve the neutron dose assessment at the Aerotest Facility.
- The item of noncompliance pursuant to 10 CFR 20.401(a)
- Acceptability of the Model 609, Thermal Neutron Dosimeter
- The need for the licensee to continue with the documentation of the currently established neutron components in appropriate personnel dosimetry records pursuant to 10 CFR 20.401(a) requirements.

The licensee was in agreement with the item of noncompliance stating Aerotest would continue with the documentation of the neutron component into appropriate personnel dosimetry records although it may be conservative by a factor of 2 to 3 times.

Also discussed, was the significance of the neutron exposure controversy resulting from a petition to the National Council of Radiation Protection (NCRP) by Dr. H. H. Rossi in 1976 to increase the quality factor for neutrons by a factor of 10. Dr. Rossi's petition was based on scientific studies which indicated an increase in leukemia induction by neutrons of 4 to 60 times over what was previously estimated.

The need for the licensee to resolve his personnel neutron dosimetry program was re-emphasized.