

APPENDIX

U.S. NUCLEAR REGULATORY COMMISSION
REGION IV

NRC Inspection Report: 50-188/91-01 Operating License: R-88

Docket: 50-188

Licensee: Kansas State University (KSU)
Department of Nuclear Engineering
Manhattan, Kansas 66506

Facility Name: Nuclear Reactor Facility - (NRF), (Class II, TRIGA Mark II)

Inspection At: NRF (Ward Hall), KSU

Inspection Conducted: March 5-8, 1991

Inspectors:

J. Blais Nicholas

J. B. Nicholas, Senior Radiation Specialist
Radiological Protection and Emergency
Preparedness Section

4/9/91
Date

for J. Blais Nicholas

R. E. Baer, Senior Reactor Health Physicist
Radiological Protection and Emergency
Preparedness Section

4/9/91
Date

Approved:

Blaine Murray

Blaine Murray, Chief, Radiological Protection
and Emergency Preparedness Section

4/9/91
Date

Inspection Summary

Inspection Conducted March 5-8, 1991 (Report 50-188/91-01)

Areas Inspected: Routine, announced inspection of the licensee's management organization, training and qualifications, reactor operations and maintenance, procedures, experiments, surveillances, internal audit and review program, radiation protection program, emergency preparedness, radioactive material transportation, special nuclear material accountability, and physical security and safeguards.

Results: Within the areas inspected, one noncited violation was identified and no deviations were identified. The KSU TRIGA reactor facility appeared to be

well managed and adequately staffed to handle the present experiment irradiation workload. The NRF had demonstrated satisfactory reactor operations and maintenance since the previous NRC inspection in February 1989. The cleanliness and order of the NRF was exceptional. Licensed reactor operators were qualified and training requirements had been met. Reactor operations were being performed in accordance with Technical Specification (TS) requirements. Audits and inspections were performed by the reactor safeguards committee (RSC) and included the areas to ensure TS compliance. Surveillance and reporting requirements had been met.

The radiation protection program at the NRF was considered adequate. The licensee had performed adequate radiological surveys and radiation instrument calibrations. Independent measurements performed by the inspectors did not identify any significant contamination or radiation levels. Personnel radiation exposures were minimal and were not in excess of 10 millirems per quarter. Radioactive effluent releases were minimal and were below unrestricted maximum permissible concentrations (MPCs) prior to release to the unrestricted environment.

The licensee had implemented the physical security program and emergency response activities concerning emergency training, drills, and exercises in accordance with the licensee's approved physical security plan (PSP) and emergency plan (EP).

DETAILS

1. Persons Contacted

KSU

- *N. D. Eckhoff, Chairman, RSC
- *R. E. Faw, Director, NRF
- M. I. Barnett, Chief Executive Officer, St. Mary Hospital
- C. A. Beckom, Chief, KSU Police Department
- *R. L. Bridges, Assistant Radiation Safety Officer
- L. Couchman, Director, Ambulance Service of Riley County
- *J. P. Lambert, Director, Public Safety and Radiation Safety Officer
- E. M. Nunamaker, Administrator, Memorial Hospital
- L. D. Reese, Deputy Chief, Manhattan Fire Department
- W. D. Smith, Chief, Manhattan Fire Department
- *D. J. Whitfill, Jr., Reactor Supervisor

NRC

- *B. Murray, Chief, Radiological Protection and Emergency Preparedness Section

*Indicates those present at the exit meeting on March 8, 1991.

2. Follow-up on Previous Inspection Findings (92701)

(Closed) Violation (188/8801-01): Licensed Operator Requalification - This violation was discussed in NRC Inspection Report 50-188/88-01 and involved the failure of a licensed senior reactor operator (SRO) to perform a minimum of 4 hours of licensed operator activities during the third calendar quarter of 1987 to maintain operator qualification. Furthermore, during the fourth calendar quarter of 1987 the SRO performed license functions without being requalified or being under the direct supervision of another licensed individual. The inspectors examined the licensee's actions committed to in their May 11, 1988, response to the violation. The inspectors reviewed the SRO's and reactor operator's (RO's) requalification training program and requalification training records for the SROs and ROs for 1989 and 1990 and found the requalification training completed and documented in accordance with requirements and the licensee in full compliance with the regulations. The licensee's corrective actions were adequate to close this violation.

(Closed) Violation (188/8901-01): Physical Security Key Control - This violation was discussed in NRC Inspection Report 50-188/89-01 and involved the failure of the KSU director of physical plant to establish an adequate control of the keys issued for access to the NRF. The inspectors examined the licensee's actions committed to in their March 29, 1989, response to the violation. The licensee had changed the locks to the NRF on March 15, 1989, and issued new keys to authorized personnel in accordance with the

NRF and KSU facility key control and distribution office procedures. The licensee revised the NRF procedure, "Entrance to the Reactor Bay," to include new provisions for NRF key control and accountability. The revised procedure was approved by the RSC and implemented by the NRF staff on April 15, 1989. The inspectors reviewed the current NRF key control log and determined that all keys to the NRF were issued to only authorized personnel and were being adequately controlled in accordance with approved NRF and KSU procedures. The licensee's corrective actions were adequate to close this violation.

(Closed) Open Item (188/8801-03): Reactor Test Procedures Manual Table of Contents - This item was discussed in NRC Inspection Report 50-188/88-01 and involved the lack of a current and correct table of contents for the reactor test procedures manual. The licensee had revised the reactor test procedures manual table of contents to indicate the most current procedure revision dates of all the procedures contained in the manual. As NRF test procedures are revised, the table of contents is updated. The inspectors reviewed the table of contents as revised in October 1990 and noted that the dates of issuance or revision of procedures corresponded to the dates indicated on the individual procedures. The inspectors had no further questions in this area.

(Closed) Open Item (188/8801-04): SRO and RO Requalification Training Attendance Record - This item was discussed in NRC Inspection Report 50-188/88-01 and involved the lack of attendance records for SRO and RO requalification training. The licensee had implemented an attendance record for SRO and RO requalification training which required each attendee to sign the attendance record. The inspectors reviewed the SRO and RO requalification training attendance records for 1989, 1990, and 1991 and found them satisfactory. The inspectors had no further questions in this area.

(Closed) Open Item (188/8801-07): Experiment No. 1 Administrative Limits - This item was discussed in NRC Inspection Report 50-188/88-01 and involved the evaluation by the licensee to include additional administrative limits in Procedure Experiment No. 1, "Isotope Production." The licensee had evaluated the administrative limit of not irradiating more than 100 milligrams of an unknown substance and whether it was necessary to also include the criteria of limiting reactor power to 100 watts for an irradiation time of 1 minute or less. After evaluation the licensee decided not to include the additional administrative limits of limiting the reactor power level and irradiation time in Procedure Experiment No. 1, but still control them when authorizing the performance of any irradiations of unknown substances. The inspectors had no further questions in this area.

(Closed) Open Item (188/8901-02): 10 CFR Part 19.12 Training - Personnel Exposure Records - This item was discussed in NRC Inspection Report 50-188/89-01 and involved the lack of radiation protection training and student familiarity with personnel exposure records and where they were available upon request. Initially, the licensee had responded to

this open item by posting the NRF staffs' and experimenters' personal quarterly exposure results in the reactor control room for their information. This posting of an individual's exposure record for all to see was questioned by some individuals as a violation of their privacy and the posting was discontinued. During this inspection, the matter was discussed with the inspectors and the licensee decided to post an information notice on the bulletin board next to the reactor control room door indicating that it was the responsibility of all NRF staff members, students, and experimenters entering the reactor bay, to know their current quarterly and yearly occupational radiation exposures, and that such information was available upon request in the radiation safety officer's (RSO's) office in Room 105 of Ward Hall. The inspectors had no further questions regarding this matter.

(Closed) Open Item (188/8901-03): Neutron Dosimetry - This item was discussed in NRC Inspection Report 50-188/89-01 and involved the licensee's use of Nuclear Track A type film for monitoring reactor fission spectrum neutrons. The reactor supervisor had performed an extensive study of the NRF's neutron dosimetry program showing the differences between the NRF's dosimetry vendor's Types H1 and C neutron dosimeters. The results of the study indicated that the Type C dosimeter was superior to the Type H1 dosimeter, particularly for neutron dosimetry. The reactor supervisor had recommended to the RSC that the NRF begin using the Type C dosimeter instead of the Type H1 dosimeter currently being used for neutron dosimetry at the NRF. The inspectors determined that the RSC approved the use of the vendor's Type C neutron dosimeter at their February 22, 1991, meeting, and the NRF will start issuing the Type C neutron dosimeters in April 1991. The inspectors had no further questions regarding this matter.

(Closed) Open Item (188/8901-04): Effluent Releases - This item was discussed in NRC Inspection Report 50-188/89-01 and involved the need for the licensee to evaluate their liquid effluent release program. The licensee had evaluated their liquid effluent release program and determined that it was in compliance with the provisions of 10 CFR Part 20.303 for disposal of liquid effluents into the sanitary sewage system. The inspectors reviewed analyses results of liquid effluents released from the NRF during the period April 1987 through March 1991 and noted that the analyses results indicated no gamma emitting radionuclides in concentrations greater than background and that the tritium concentration in the liquid effluent samples was always below the MPC for tritium for an unrestricted area according to 10 CFR Part 20, Appendix B, Table II, prior to dilution with water in the sewage system. The inspectors had no further questions regarding this matter.

(Closed) Open Item (188/8901-05): Response to NRC Bulletin 79-19 - This item was discussed in NRC Inspection Report 50-188/89-01 and involved a request for resubmittal of the licensee's response to NRC Bulletin 79-19 indicating KSU's generating and disposal methods for NRF generated radioactive waste. The licensee restated their commitments with respect to NRC Bulletin 79-19 in a letter to the NRC Region IV office dated

May 17, 1989. The inspectors reviewed the licensee's commitments in response to NRC Bulletin 79-19 and found the response satisfactory. The inspectors had no further questions regarding this matter.

3. Open Item Identified During This Inspection

An open item is a matter that requires further review and evaluation by the inspectors. Open items are used to document, track, and ensure adequate followup on matters of concern to the inspectors. The following open item was identified:

<u>Open Item</u>	<u>Title</u>	<u>Paragraph</u>
188/9101-01	Transfer of Byproduct Material	14

4. Organization and Management Controls (40750)

The inspectors reviewed the licensee's organization and staffing to determine compliance with TS H.2 and H.5. The inspectors verified that the NRF organizational structure was as defined in the TS. The NRF staff assignments of responsibilities were described in the NRF administrative plan. All organizational positions were filled with qualified personnel. There had been one NRF staff change in August 1989 since the previous NRC inspection of the KSU NRF. In this change, an SRO had been promoted to the position of reactor supervisor. The inspectors determined that the NRF director devoted approximately 20 percent of his time to reactor activities and the reactor supervisor devoted about 80 percent of his time to directly overseeing reactor activities. The reactor supervisor was supported by two SROs (faculty in the KSU Nuclear Engineering Department) and two ROs (graduate students in the KSU Nuclear Engineering Department) in conducting the reactor program. The inspectors verified that the supervisory control and reactor program implementing responsibilities specified in the TS were being implemented.

The RSC membership was reviewed and found to be in accordance with TS requirements. The inspectors reviewed RSC meeting agendas and minutes and determined that the RSC meetings were being conducted semiannually during the period January 1989 through December 1990 in accordance with TS requirements. The RSC meeting agendas and minutes indicated that the RSC had performed the required reviews, inspections, and audits.

No violations or deviations were identified.

5. Qualification and Training (40750)

The inspectors reviewed the licensee's training program for SROs, ROs, and experimenters to determine compliance with the requirements of the SRO and RO requalification program and 10 CFR Parts 19.12 and 55 and agreement with the Industry Standard ANSI/ANS 15.4-1988, Regulatory Guides 8.13 and 8.29, and the KSU Radiation Safety Manual.

The inspectors reviewed the education and experience of the present NRF staff and RSC members and determined that all of the NRF staff and RSC members met the qualifications required in ANSI/ANS 15.4-1988.

The inspectors reviewed the licensee's SRO and RO requalification program dated October 8, 1974. It was noted that the SRO and RO requalification program had been approved by the NRC and it conformed to the requirements of 10 CFR Part 55.59. The TRIGA Operator Training Manual was reviewed and found to be satisfactory to implement the SRO and RO requalification program. The SRO and RO requalification examinations and training records for the licensed operators for 1989 and 1990 were reviewed. The inspectors found that the examinations and reactor operations records had been included in the training records for all of the licensed operators. The requalification training records for the three SROs and two ROs were reviewed and found to contain all the documentation required by the requalification training program.

The inspectors reviewed the NRF training given to nonoperators, experimenters, and students who work in the NRF. The training conducted as described in the NRF training manual appeared to meet the requirements of 10 CFR Part 19.12 and included the material in Regulatory Guides 8.13 and 8.29. The inspectors reviewed the key exam/radiation safety exam given to persons upon completing the training. All personnel working in the NRF as experimenters or students must complete the key control training and radiation safety training with an examination score of 70 percent or higher. The examination included the essential material necessary to demonstrate the effectiveness of the training. The trainees were also required to sign a review form which documented that the trainee had read and had been given an opportunity to ask questions concerning 10 CFR Part 19, 10 CFR Part 20, Regulatory Guides 8.13 and 8.29, NRC Form 3, and the Kansas State Radiological Health Form equivalent to the NRC Form 3.

No violations or deviations were identified.

6. License Conditions and Special Nuclear Material (SNM) Control and Accountability (85102)

The licensee's SNM control and accountability program was reviewed to determine compliance with 10 CFR Part 70 and License R-88.

The inspectors reviewed SNM storage and inventory requirements for agreement with License R-88, Amendment 7, dated September 11, 1981. License Conditions 2.B and 2.C authorize the possession of up to 3.8 kilograms of uranium-235 and a 2-curie sealed americium-beryllium neutron startup source. The inspectors determined that the licensee possessed a 2-curie americium-beryllium neutron startup source and verified that it was stored in the reactor tank for use in starting up the reactor. The inspectors performed an inventory of the TRIGA fuel the licensee had on site. The inspectors verified that the licensee had 2 TRIGA fuel elements in the 2 fuel storage pits (one in each), 25 fuel

elements in the fuel storage racks in the reactor tank, and 80 fuel elements in the reactor core. These values agreed with the licensee's inventory of 107 TRIGA fuel elements. Based on approximately 34 grams of U-235 per fuel element, the licensee's TRIGA fuel contained approximately 3.64 kilograms of U-235 which was less than the 3.8 kilograms of U-235 allowed by License R-88. The inspectors reviewed the licensee's SNM Forms 742, 742C, and 741 submitted to Oak Ridge for the periods April 1 through September 30, 1989; October 1, 1989, through March 31, 1990; and April 1 through September 30, 1990; and found them in order and correct as verified by the inspectors' inventory of the TRIGA fuel elements possessed by the licensee.

No violations or deviations were identified.

7. Reviews and Audits

The inspectors reviewed the licensee's review and audit programs conducted by the RSC to determine compliance with the requirements in TS H.2.c and agreement with the review and audit process described in Paragraphs 5.0 and 7.0 of the KSU TRIGA NRF Operations Manual.

The inspectors determined that the RCS reviews, inspections, and audits of reactor operations and maintenance activities were being performed semiannually as required. RSC audit reports and NRF inspection reports generated during the period February 1989 through February 1991 were reviewed for scope to ensure thoroughness of program evaluation. The RCS semiannual audits of reactor operations, reactor maintenance, and TS surveillance requirements were found to be of satisfactory depth and quality to adequately verify all operating parameters of the license and TS.

The inspectors noted that the licensee utilized detailed checklists to conduct the semiannual audits and inspections of the NRF. The inspectors reviewed the 1989 and 1990 annual reports submitted pursuant to 10 CFR Part 50.59(b) requirements involving the RSC review of changes to the KSU reactor facility, procedures, and tests and experiments. No changes in facility design or operations were noted. Only minor changes to three operating procedures were reviewed and approved that would involve an unreviewed safety question. Minutes of the semiannual RSC meetings for the period February 1989 through February 1991 were reviewed. The RSC meeting minutes indicated that the required RSC reviews and activities listed in TS H.2.c were being completed.

No violations or deviations were identified.

8. Logs and Records (40750)

The inspectors reviewed the licensee's program for documentation of the reactor operations and maintenance activities to determine compliance with the requirements in License Condition 3.C and TS H.1 and agreement with

the conditions described in Paragraph 6.f of the KSU TRIGA NRF Operations Manual.

The inspectors reviewed the documentation of reactor operations and maintenance for the period January 1989 through December 1990. The logs and records documenting reactor routine operation, maintenance, fuel inspection, fuel inventory and storage, experiments, reactor startup checklist, instrument checks and calibrations, radiation surveys, and personnel exposure were reviewed. The inspectors determined that the NRF annual reports and operations and maintenance history logs adequately documented reactor operations and maintenance activities. The monthly NRF maintenance and surveillance reports for 1989 and 1990 (including daily, weekly, monthly, quarterly, semiannual, annual, and biennial checklists) were reviewed. The licensee's logs and records were clear, concise, and legible, and the reactor operations, inspections, maintenance, and testing were satisfactorily documented in accordance with the facility license.

The inspectors reviewed the reactor operations log for entries documenting unplanned reactor scrams. The licensee had documented unplanned reactor scrams in red in the reactor operations log. The inspectors reviewed selected entries of unplanned scrams and determined that the root causes of the unplanned reactor scrams were sufficiently documented. The most significant unplanned reactor scrams since the previous NRC inspection conducted in February 1989 were related to the malfunctions of the electromagnetic assemblies on the regulating control rod and the shim control rod drive mechanisms.

The inspectors reviewed the NRF maintenance activities. Major reactor maintenance which was reviewed included the replacement and testing of the control rod electromagnet assemblies on the regulating rod and shim rod drive mechanisms. The licensee had thoroughly documented the maintenance and testing of the electromagnet replacement in accordance with the facility license.

No violations or deviations were identified.

10. Procedures (40750)

The inspectors reviewed the KSU NRF Operations Manual; KSU TRIGA Operation, Test, and Maintenance Procedures; and KSU TRIGA Experiments to determine compliance with the requirements in TS H.1.

The licensee had written and approved procedures, checklists, and data forms for safety-related and operational activities that included reactor startup, operation, and shutdown; maintenance; and calibration of reactor equipment and instrumentation. A review of selected procedures including those revised and approved since the last NRC inspection conducted in February 1989, indicated that the licensee had sufficient and satisfactory programmatic procedures to meet the requirements of the TS. The licensee's procedures and experiments had been reviewed by the RSC and their reviews were documented in the semiannual RSC meeting minutes. It was noted that

no changes had been made to the reactor experiment procedures since the previous NRC inspection.

No violations or deviations were identified.

11. Reactor Operations (40750)

The inspectors observed reactor operations to determine compliance with the requirements in License Conditions 3.A and 3.B and TS B, C, D, E, F, and G.

The inspectors inspected the licensee's facilities and observed the licensee startup and operation of the reactor at low power levels to verify reactor protection systems operation. The licensee indicated that the reactor was routinely operated approximately 12-15 hours per week for the purpose of laboratory teaching, reactor system tests, reactor surveillances, and sample irradiations. The licensee initiated startup of the reactor on March 6, 1991, and operated the reactor for approximately 35 minutes at 100 watts steady-state power to demonstrate to the inspectors the operation of the reactor protective systems.

The inspectors reviewed reactor operations logs and records to determine compliance with the license conditions and TS requirements. The licensee had not operated the reactor at thermal power levels in excess of 250 kilowatts in accordance with License Condition 3.A. The reactor safety limit for fuel temperature was verified to be in compliance with TS D.3. The TS limiting conditions for reactor operation were reviewed. The reactor shutdown margin was verified to be \$1.57 on March 15, 1990, during the annual control rod worth determination. This value was greater than \$1.10 required by TS E.5. The excess reactivity in the reactor was also determined during the latest annual control rod worth determination to be \$1.98 which was less than \$2.50 as required by TS D.2. All other reactor reactivity limitations were verified to be in compliance with TS D and E. The maximum rates of reactivity insertion for the standard control rods were determined to be in the range of \$0.029 - \$0.062 per second which were less than \$0.087 per second as required by TS E.6. The inspectors verified that all the required reactor control system instrument channels, safety circuits, and safety interlocks required by TS E.7, E.8, E.9, and E.13 were tested and operable and included on the reactor startup check sheet, Form KSUTMII-3, which had been completed prior to each startup of the reactor in accordance with NRF Operation Procedure No. 15, "Reactor Startup." The area radiation monitors were checked and verified to be operational in the reactor bay and above the reactor pool. The area radiation monitor near the reactor bridge above the reactor pool was tested to verify that it provided a signal which activated an audible alarm and warning light prior to reactor startup in compliance with TS F.1. The continuous air monitor in the reactor bay was verified to be operating and would provide an audible alarm during reactor operation in accordance with TS F.2. The primary coolant chemistry conditions had been maintained in accordance with TS C.1 and C.2.

The TRIGA design features for reactor fuel, reactor core, control elements, fuel storage, reactor pool water systems, and reactor building specified in TS B, C, D, E, and G were inspected and verified. The reactor fuel was verified to be of the type and enrichment described in TS D.1. The inspectors reviewed the current reactor core configuration map and verified that the fuel elements were positioned in the reactor grid plate in accordance with the core map and in compliance with TS D.1. The three reactor control elements were verified to have the required scram capability and contained the materials specified for standard TRIGA control elements in compliance with TS E.1, E.5, and E.6. All fuel elements not positioned in the reactor core were stored in the reactor pool in storage racks or in the NRF fuel storage pits. The fuel elements were stored in storage racks at the bottom of the reactor pool in an arrangement where the Keff had been calculated to be less than 0.8 as per TS 3.1. The minimum free volume of the reactor room was verified to be acceptable by the inspectors and satisfied the TS B requirement. A reactor pool level alarm was provided to indicate a loss of reactor coolant if the reactor pool level should drop more than 2 feet below the normal level and if the reactor building sump level should rise above normal level.

A hole had been drilled in the circulating water piping approximately 3 feet below the normal level of the reactor pool to prevent inadvertent siphoning of the reactor pool to a level less than 18 feet of water above the top of the reactor core.

No violations or deviations were identified.

12. Surveillances (40750)

The inspectors reviewed surveillance results to determine compliance with TS C, D, E, F, and I.

The inspectors verified that the reactor pool area radiation monitor located above the reactor pool was operational and would alarm at a setpoint of 100 millirem per hour per TS C.1. The radiation monitor had been calibrated semiannually and the setpoint and alarm checked quarterly. The reactor primary water temperature was monitored during reactor operation and recorded in the reactor operations log and on the reactor startup check sheet, Form KSUTMII-3. The reactor pool water was tested for conductivity at least weekly and the results were documented in the reactor operations log and on Form KSUTMII-3 prior to each reactor startup. The inspectors verified that the reactor pool water conductivity had not exceeded 2 micromhos per centimeter averaged over a month for the period 1989 through 1990 as per TS C.2.

The inspectors verified that the reactor shutdown margin had been determined in conjunction with the annual control rod worth determinations and documented in the reactor operations log. The results of these determinations were reviewed to determine compliance with TS D.2. Surveillance records indicated that the reactor operation of 100 pulses of

magnitude greater than \$1.00 had not been achieved to require fuel element physical measurement inspection in accordance with TS D.6. At the time of the inspection, the number of pulses remaining before the fuel element physical measurement inspection would be required was 53. The reactor operating records indicated that the reactor had been pulsed with an insertion of a \$1.00 or greater of reactivity semiannually during 1989 and 1990 to compare fuel temperature measurements and peak power levels with those of previous pulses of the same reactivity value per TS D.5.

The inspectors verified that the control rods had been visually inspected at least once every 2 years for indication of significant distortion or deterioration per TS E.2. The last visual fuel element inspection of the control rods was performed in December 1989 on the pulse rod and in January 1990 on the regulating and shim rods.

Channel checks of each of the reactor instrument channels and safety circuits were performed before each day's operation per TS E.9 and documented on the reactor startup check sheet, Form KSUTMII-3. The inspectors verified that the reactor controls and safety interlocks were tested operable, that the regulating rod and shim drop times were less than 1 second, and that the reactor power level safety circuits were tested operable at least semiannually per TS E.11 and documented in the reactor operations log and on the monthly maintenance and surveillance report. The reactor scram times for the scramble control rods were determined to be in the range of 0.42-0.44 seconds which were less than 1 second required by TS E.11.b. Channel calibration of the power level monitoring channel was performed annually in accordance with NRF Test Procedure No. 2 and in compliance with TS E.12. The inspectors reviewed the results of the reactor power level instrument calibrations for 1989 and 1990 and found them satisfactory. The reactor startup channel was verified operational prior to each reactor startup per TS E.13 and documented on the reactor startup check sheet, Form KSUTMII-3. Prior to each pulse mode operation, a functional performance check of the transient (pulse) rod system was performed in accordance with NRF Test Procedure No. 12 and in compliance with TS E.14 and documented in the reactor operations log. The inspectors verified the documented performance of the pulse rod functional performance check in the reactor operations log for selected reactor pulses during 1989 and 1990.

The inspectors verified that the required radiation monitoring systems were installed and operational. The licensee's records indicated that the radiation monitoring systems were checked, maintained, and calibrated in compliance with TS F.1, F.2, and F.3.

No violations or deviations were identified.

13. Experiments (40750)

The inspectors reviewed the licensee's program for control and conduct of reactor experiments including evaluations, conduct, and documentation of experiments to determine compliance with TS I.

The inspectors reviewed several of the licensee's completed reactor experiment authorization forms and determined that an analysis of the irradiation experiments had been performed by the reactor supervisor and approved by the RSC in compliance with TS I. The reactor had been primarily used for the irradiation of geology samples and isotope production.

No violations or deviations were identified.

14. Transportation of Radioactive Materials (86740)

The inspectors reviewed the licensee's program for the transportation of radioactive materials to determine compliance with the KSU NRF license requirements.

The inspectors determined that the licensee had not made any shipments of SNM or reactor components offsite since the last NRC inspection in February 1989. The inspectors determined that the KSU NRF does generate small quantities of radioactive waste as a result of reactor operations and experiments. This radioactive waste is transferred on campus (within Ward Hall) to KSU's Kansas State Byproduct License where it is stored by the university's RSO and is subsequently disposed by a licensed hazardous waste broker.

The licensee had transferred byproduct material produced during the irradiation of samples in conducting experiments to other licensed personnel authorized to receive such byproduct material. The inspectors reviewed selected reactor irradiation authorization and performance data forms and byproduct logs which had been completed for each irradiation experiment. The inspectors observed that for the irradiation of KSU geology department samples, no isotope production inventory was being calculated and recorded on the reactor's byproduct log, Form KSUTMII-4, as part of the isotope production process and prior to the transfer of the irradiated samples to the KSU geology department licensed users in accordance with the conditions of the KSU Geology Department Sublicense of the KSU Kansas State Byproduct License. The KSU Geology Department Sublicense had been issued by the KSU RSO. This KSU Geology Department Sublicense allowed the KSU geology department staff to receive and possess any byproduct material with an atomic number of 3-83, inclusive, as long as the byproduct material contact dose rate did not exceed 2 Roentgens per hour (R/hr). The inspectors verified that the reactor staff had not transferred any irradiated geology samples to the KSU geology department staff that had exceeded the contact dose rate of 2 R/hr.

The inspectors expressed concern that 10 CFR Part 30.41(c) requires, in part, that "Before transferring byproduct material to a specific licensee of the Commission or an Agreement State . . . , the licensee transferring the material shall verify that the transferee's license authorizes the receipt of the type, form, and quantity of byproduct material to be transferred." 10 CFR Part 20.5 requires, in part, that the quantity of

radioactivity for purposes of the regulations shall be measured in terms of disintegrations per unit time or in curies. The inspectors determined on March 6, 1991, that the licensee was not determining the quantity of the byproduct material being transferred to another licensee and documenting the isotopic quantities on the byproduct log, Form KSUTMII-4; therefore, indicating that the licensee had not verified the quantity of byproduct material generated by the experiment and being transferred. The failure to determine the quantity of byproduct material being transferred and verify that the transferee's license was authorized to receive that quantity of byproduct material is considered an apparent violation of 10 CFR Part 30.41(c). However, it was determined that the licensee had verified the transferee's license requirements and had complied with the KSU Geology Department Sublicense requirements (e.g., the sample of byproduct material prior to receipt by the KSU geology department staff must not exceed a contact dose rate of 2 R/hr). After discussing this matter with the licensee during the exit meeting on March 8, 1991, and during a telephone conversation on April 2, 1991, the licensee agreed to develop a completed byproduct log, Form KSUTMII-4, for a typical geology sample based on historical data which would provide a best estimate of the byproduct material quantities in a typical irradiated geology sample. This typical geology sample data would be used to support and document the quantity of byproduct material generated during a typical irradiation of geology samples. Therefore, in accordance with 10 CFR Part 2, Appendix C, Section V.A. of the NRC's Enforcement Policy, no Notice of Violation is being issued for this violation.

The licensee also indicated that they were in the process of developing a sample transfer form to provide documentation of the contents, decay time, and contact dose rate of the geology samples at the time of the sample transfer from the reactor staff to the geology department experimenter receiving the irradiated sample. This matter is considered to be an open item pending further review of the licensee's proposed actions by the inspectors (188/9101-01).

No deviations were identified.

16. Radiation Protection (40750)

The inspectors reviewed the licensee's radiation protection program to determine compliance with the requirements in 10 CFR Part 20 and agreement with the recommendations of Industry Standards ANSI/ANS-15.11-1977 and ANSI N323-1978, Regulatory Guides 8.4 and 8.21, and the KSU Radiation Safety Manual.

The inspectors reviewed selected records and logs, interviewed personnel, made observations, and performed independent radiological surveys in the reactor facility.

Radiation exposure records for NRF personnel were reviewed. It was noted that everyone who worked in the reactor facility had been issued personal dosimetry. The review of the radiation survey data indicated that personnel working in the reactor bay area did not exceed 10 CFR Part 20.101 limits.

The inspectors reviewed the licensee's program for issuance of self-reading pocket dosimeters (SRDs) to visitors or occasional students working in the reactor bay area. The issuance of SRDs to visitors was performed in accordance with Procedure 9 approved April 18, 1989. The licensee had several 0-200 millirem SRDs available in the reactor control room. These SRDs had been calibrated and drift checked semiannually. The licensee had a calibration and quality control program established for SRDs as recommended by Regulatory Guide 8.4.

The inspectors determined that radiation surveys were being performed routinely by the reactor supervisor on a monthly basis and by KSU radiation safety office personnel on an annual basis. The inspectors reviewed selected monthly radiation and contamination survey records for 1989 and 1990. The radiation surveys appeared thorough and indicated very little contamination. The licensee had posted the most recent radiation survey maps near the entrances to the reactor bay. The inspectors performed independent radiation surveys throughout the NRF on March 6, 1991, and found very little indication of radiation or contamination greater than background levels.

The inspectors noted that the licensee had routinely performed neutron surveys of the reactor bay area during reactor operation. Neutron surveys were performed using neutron survey instruments equipped with Donner Sphere detectors calibrated with a moderated californium-252 neutron source traceable to the National Institute of Standards and Technology.

The licensee indicated plans to open one reactor beam port for future irradiation experiments. The inspectors discussed with the licensee the importance of performing detailed surveys for both neutron and gamma radiation at the beam port and to accurately define the beam boundaries. After the beam boundaries have been defined, all personnel entering the reactor bay must be informed of the radiological conditions during the use of the beam port and restricted from unnecessary entry into high radiation areas.

The inspectors reviewed the licensee's inventory of portable radiation protection instruments. The licensee's stock of portable survey instruments appeared adequate. The licensee's portable radiation monitoring instrumentation calibration and quality control programs appeared to satisfy the recommendations of Regulatory Guide 8.21 and Industry Standard ANSI N323-1978. Calibration records were found to be up to date and accurate.

The licensee's high range gamma monitor located above the reactor pool (22-foot level) and the continuous air monitor (CAM) located on the 12-foot level appeared to be sufficient to provide radiation detection capability as low as reasonably achievable. The high range gamma monitor alarm setpoint was verified to be set at 5 R/hr and the CAM alarm setpoint was established at a value less than 1000 net counts per minute so as to provide an alarm prior to exceeding the beta-gamma isotopic MPC limits listed in 10 CFR Part 20, Appendix B, Table 1, Column 1.

The inspectors noted that the licensee had established a personnel frisking station to identify possible contamination on individuals leaving the top of the reactor pool area or exiting the reactor bay area.

No violations or deviations were identified.

16. Radiological Environmental and Effluent Monitoring (40750)

The inspectors reviewed the licensee's radiological liquid and gaseous effluent monitoring program to determine compliance with the requirements in 10 CFR Part 20.106.

The licensee does not maintain a detailed environmental surveillance program (e.g., collection and analysis of water, air, soil, or vegetation samples). There is no specific license requirement that such a program be maintained.

The inspectors reviewed analyses results of liquid effluents released during the period April 1987 through March 1991 and noted that the analyses results indicated no gamma emitting radionuclides in concentrations greater than background, and the tritium concentration in the liquid effluent samples was below the MPC for tritium for an unrestricted area according to 10 CFR Part 20, Appendix B, Table II, prior to dilution with the water in the sewage system. The licensee's operation records indicated that the gaseous releases were within 10 CFR Part 20 limits. The licensee has no license condition or TS requirement to monitor the reactor bay environment or gaseous effluents specifically for argon-41 activity generated as a result of reactor operation.

No violations or deviations were identified.

17. Emergency Preparedness (40750)

The inspectors reviewed the licensee's emergency preparedness program to determine compliance with the requirements in the NRF EP dated October 3, 1990, 10 CFR Parts 50.54(q) and (r), and agreement with the recommendations of Regulatory Guide 2.6 - 1983 and Industry Standard ANSI/ANS-15.16-1982.

The inspectors reviewed the letters of agreement established with the City of Manhattan, Kansas, for fire department services; Riley County for police department and ambulance services; Memorial Hospital and Saint Mary's Hospital for medical services; and the KSU Campus Police Department. All letters of agreement were signed and dated during the time period June 21-29, 1990. The licensee had routinely updated these letters of agreement on a biennial frequency.

The inspectors visited the agencies listed above and discussed the training and coordination provided by the NRF staff. A good relationship existed between KSU and the emergency support agencies.

The inspectors reviewed the results of the annual emergency drills conducted on January 6, 1989; December 19, 1989; and January 10, 1991; and the results of the biennial emergency exercises conducted on August 12, 1988, and June 26, 1990. The critiques and evaluations of the emergency drills and exercises performed by the licensee were reviewed and found to be satisfactory. The inspectors reviewed the licensee's emergency procedures. The inspectors discussed with the licensee during the inspection the observation that in Emergency Procedure 3, "Personnel Monitoring and Contamination," paragraph 3.4 states that, "TLD badges shall be read within 60 minutes" While this may be accomplished using the KSU thermoluminescent dosimeters (TLDs) and processing them in Ward Hall, the licensee also uses a vendor supplied TLD service and the processing of those TLDs could not be accomplished within the 60-minute time period indicated in Emergency Procedure 3. The licensee acknowledged the inspectors' observation.

No violations or deviations were identified.

18. Physical Security (81401, 81810, and 81431)

The inspectors reviewed the licensee's physical security program to determine compliance with the requirements in License Condition 3.E, 10 CFR Part 50.54(p), and the NRF PSP as approved on July 14, 1981.

The inspectors verified that the site and facilities were consistent with the description given in the PSP. The inspectors examined the use and storage of SNM within the controlled access areas and verified that the intrusion alarms functioned properly. The inspectors visited the KSU Campus Police Department and discussed campus police response capability with the KSU campus police chief and campus police dispatcher. The KSU Campus Police Department had a copy of the NRF PSP on file and was well versed in responding to alarms at Ward Hall which houses the reactor. It was noted that the campus police had responded to numerous false alarms at Ward Hall during the period July through November 1990 in conjunction with problems due to the age of the present electrical intrusion sensors. The campus police dispatcher showed the inspectors the alarm panel where the reactor building intrusion alarm signals were received. The campus police

dispatcher and the reactor supervisor indicated that the response time of the campus police to an intrusion alarm at the NRF was approximately 2-4 minutes. The licensee was evaluating the installation of a modern intrusion alarm system for the NRF to replace the current system. The proposed intrusion alarm system was discussed with the licensee. At the exit meeting the licensee was cautioned by the inspectors that the proposed changes to the PSP should be discussed with the NRC Office of Nuclear Reactor Regulation prior to installation and use.

The inspectors verified that the PSP was being maintained under the appropriate level of protection and had been reviewed biennially per Section II.E of the PSP.

The inspectors reviewed the security key control program and determined it to be adequate.

No violations or deviations were identified.

19. Reports and Notifications (40750 and 81402)

The inspectors reviewed the licensee's submittal of reports and notifications to the NRC to determine compliance with the requirements of License Condition D.

The inspectors reviewed the NRF annual reports for the period October 1, 1988, through September 30, 1990. It was determined that the annual reports met the facility license requirements. No special reports had been issued to the NRC since the previous inspection of the KSJ NRF conducted in February 1989.

No violations or deviations were identified.

20. Independent Inspection Effort (40750)

The inspectors observed a reactor startup, steady-state operation, and shutdown. The inspectors also performed independent radiation surveys and collected smear samples for the purpose of comparing analyses results with the licensee. The results of the reactor bay area radiation surveys performed by the inspectors showed comparable results to those of the licensee. The results of the smear surveys taken by the inspectors showed no detectable alpha and beta-gamma removable contamination.

No violations or deviations were identified.

21. Exit Meeting (30703)

The inspectors met with the licensee's representatives identified in paragraph 1 of this report at the conclusion of the inspection on March 8, 1991. The inspectors summarized the scope and the results of the inspection. The PSP reviewed by the inspectors was identified as proprietary information.