

U. S. NUCLEAR REGULATORY COMMISSION

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Report No: 50 -182/99-201

Licensee: Purdue University

Facility: Purdue University PUR-1 Research Reactor

Location: West Lafayette, Indiana

Dates: April 12-15, 1999

Inspector: Thomas M. Burdick, Non-Power Reactor Inspector

Approved by: Ledyard B. Marsh, Chief  
Events Assessment, Generic Communications and  
Non-Power Reactors Branch  
Division of Regulatory Improvement Programs  
Office of Nuclear Reactor Regulation

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## EXECUTIVE SUMMARY

This routine, announced inspection included onsite review of selected aspects of the: operations program, organizational structure and functions program, design control program, review and audit program, radiation protection program, environmental protection program, operator requalification program, maintenance program, surveillance program, fuel handling program, experimental program, procedural control program, emergency preparedness program, safeguards program, security program, and transportation program since the last NRC inspection of this program.

The licensee's programs were acceptably directed toward the protection of public health and safety, and in compliance with NRC requirements.

### ORGANIZATIONAL STRUCTURE AND FUNCTIONS

The laboratory director obtained an NRC reactor operator license and plans to pursue a senior reactor operator license later this year.

### OPERATIONS

Operations were conducted intermittently at various power levels and in compliance with license requirements.

### DESIGN CONTROL

No design changes were performed since the last inspection.

A new form was implemented to document 50.59 reviews.

The licensee had concluded that the reactor facility will not be impacted by the year 2000 computer problem since no microprocessors or computers were incorporated in the facility systems

### REVIEW AND AUDIT

The licensee committed to using qualified persons who are not responsible for the programs being audited for future required audits.

### RADIATION PROTECTION

Only minor levels of exposure were recorded since the last inspection.

Contamination has not been a problem due to conscientious licensee effort.

ENVIRONMENTAL PROTECTION

No significant release occurred and minimal waste was generated.

OPERATOR REQUALIFICATION

The program was reestablished after many years of exemption.

MAINTENANCE

Facility maintenance was typically preventive and well documented.

Material conditions were significantly improved.

SURVEILLANCE

Surveillance was timely and satisfied operability requirements.

FUEL HANDLING

Fuel handling was routine and well documented.

EXPERIMENTS

No new experiments were conducted.

PROCEDURES

Procedures were acceptable. The licensee developed a new one for determining control rod worth.

EMERGENCY PREPAREDNESS

Licensee drills and training ensured acceptable licensee readiness.

SAFEGUARDS

Safeguards for possession of special nuclear material were acceptable.

SECURITY

Facility security met program requirements.

TRANSPORTATION

The licensee had not conducted any transportation of licensed material since the last inspection.

## Report Details

### Summary of Plant Status

Since the last inspection the reactor had been operated intermittently at various power levels to support experiments, education, operator training, and surveillance. Materiel conditions had improved significantly.

#### 1. ORGANIZATIONAL STRUCTURE AND FUNCTIONS

##### a. Scope (69001)

The inspector reviewed:

- organization and staffing
- qualifications
- management responsibilities
- administrative controls

##### b. Observations and Findings

The organizational structure and staffing had changed since the last inspection. The reactor supervisor and laboratory director were separated into two positions in January 1997. The laboratory director obtained a reactor operator license and plans to obtain a senior reactor operator license later this year. The former reactor supervisor/lab director had been working part time and will fully retire in May 1999. The organizational structure and staffing at the facility and as reported in the Annual Report was as required by Technical Specification.

Two members of the Committee on Oversight of Reactor Operations (CORO) are scheduled for retirement this year. One of the CORO positions was required by technical specifications (TS) to be the Purdue University Director of Safety and Security. Due to reorganizations, title changes, and delegation of responsibilities, the CORO membership had not always been filled by the person holding that title or its equivalent. The licensee has recommended that the Chief/Director of the Purdue University Police Department (the equivalent person) hold that position in the future. The licensee plans to request a TS amendment to change the requirement. All incumbent members and their proposed replacements appeared to be qualified to sit on the CORO.

Review of records verified that management responsibilities were administered as required by TS and applicable procedures.

c. Conclusions

The organizational functions satisfied NRC requirements.

2. OPERATIONS

a. Scope (69001)

The inspector reviewed:

- operational logs and records
- staffing for operations
- selected operational, startup, or shutdown activities

b. Observations and Findings

The operating logs and records were legible and provided an indication of operational activities. This included documentation of events, and resolution or tracking of events. The logs and records indicated that shift staffing including on-call personnel was as required by TS.

The inspector noted that the former reactor supervisor (working part-time until full retirement in May 1999), although holding a current license, had not obtained a physical examination since February 25, 1997. The inspector reminded the licensee that operators must have a physical examination biennially (includes a 30-day period after the anniversary date). The other licensed staff members had current physical examinations. The licensee had the schedule for physical examinations in their surveillance tracking system.

The licensee had noted that the TS staffing requirement for startup following an unscheduled scram was less restrictive than the regulations in 10 CFR 50.54(m). The inspector verified through the licensee records that they had met the requirements of 50.54(m) which requires a senior reactor operator present in the facility during a reactor restart following an unscheduled shutdown. The licensee plans to establish that past practice in their operating procedure.

The inspector noted that the last two TS audits cited the requirement to log channel checks at four hour intervals. A review of the logs indicated that the intervals were stated as hourly. The licensee acknowledged that the logs need to be revised to reflect the current procedure and practice.

Logs and records also showed that operational conditions and parameters were consistent with license and Technical Specification requirements. Discussion with the staff regarding operational activities further confirmed that these conditions and requirements were satisfied. No operations were conducted during the inspection.

c. Conclusions

The operational functions satisfied NRC requirements.

3. DESIGN CONTROL

a. Scope (69001)

The inspector reviewed:

- facility design changes and records
- facility configuration

b. Observations and Findings

Through review of applicable records and observations of the facility, the inspector determined that changes initiated and/or completed at the facility had undergone an acceptable review in accordance with 10 CFR 50.59 and applicable licensee administrative controls. None of the changes constituted an unreviewed safety question or required a change to the TS.

The licensee had implemented a systematic method of documenting changes and their evaluation for unreviewed safety questions required by 10 CFR 50.59.

The licensee had concluded that the reactor facility will not be impacted by the year 2000 computer problem since no microprocessors or computers were incorporated in the facility systems.

c. Conclusions

The design change functions satisfied NRC requirements.

4. REVIEW AND AUDIT

a. Scope (69001)

The inspector reviewed

- Safety review records
- Audit records
- Responses to safety reviews and audits
- Review and audit personnel qualifications

b. Observations and Findings

Records showed that the safety reviews were conducted at the Technical Specification required frequency. Topics of these reviews were also consistent with Technical Specification requirements to provide guidance, direction, and oversight, and to ensure suitable use of the reactor.

The inspector noted that the safety reviews and audits, and the associated findings were acceptably detailed and that the licensee responded and took corrective actions as needed.

The safety review and audit personnel had not always met Technical Specification requirements and licensee administrative controls. Both the Emergency Plan and the Security Plan had been audited by members of the staff who were directly responsible for the program implementation. The audits of these areas appeared acceptable in depth and scope. However, TS 6.2.6 required that the audits be conducted by persons other than those responsible for the program implementation. The number of personnel involved in the safety reviews and audits satisfied Technical Specification and licensee procedural requirements. The licensee committed to ensure that future audits will be conducted by qualified personnel who are not responsible for the program implementation. This failure was a violation of minor significance and, in accordance with NUREG/BR 0195 (Rev 2), NRC Enforcement Manual, Section 3.5.c, is not subject to formal enforcement action. It will be reviewed for corrective action in the future (50-182/99201-01).

c. Conclusions

The review and audit function satisfied NRC requirements with one minor exception.



5. **RADIATION PROTECTION**

a. **Scope (69001)**

The inspector reviewed selected aspects of:

- the Radiation Protection Program
- radiological signs and posting
- routine surveys and monitoring
- dosimetry records
- maintenance and calibration of radiation monitoring equipment
- As Low As Reasonably Achievable (ALARA) reviews

b. **Observations and Findings**

The radiation protection program had not changed since the last inspection. The licensee's review of the radiation protection program at least annually in accordance with 10 CFR 20.1101(c) was not documented. The licensee committed to document its future reviews in the TS audit for the reactor. This will be reviewed in a future inspection (50-182/99201-02).

NRC Form 3, "Notice to Employees," was posted in accordance with 10 CFR 19.11. Caution signs, postings and controls to radiation areas were as required in 10 CFR 20, Subpart J. Licensee personnel observed the indicated precautions for access to the radiation areas.

Use of dosimeters and exit surveying practices were in accordance with radiation protection requirements. The licensee used a National Voluntary Laboratory Accreditation Program (NVLAP)-accredited vendor to process dosimetry. Radiological exposure records showed that occupational doses and doses to the public were within 10 CFR Part 20 limitations. Training records showed that personnel were acceptably trained in radiation protection practices.

Experiments were typically class experiments limited to predominantly solid form samples with short-lived isotopes at minimum exposure and low energy used repeatedly from class to class. This minimized the chances of contamination and exposure.

Radiation monitoring and survey activities were as required. Equipment used for these activities were maintained, calibrated and used acceptably. The inspector conducted an independent random radiation survey that confirmed licensee findings.

ALARA reviews were acceptably performed as required. Documentation for one review of an extremity exposure was not available. The licensee indicated that the 440 millirem extremity exposure was most likely received at the broad-scope instrument calibration lab. The individual works there part-time and uses radioactive sources for calibrations.

The licensee did not require a respiratory protection program or planned special exposure program.

c. Conclusions

The radiation protection program satisfied NRC requirements.

6. ENVIRONMENTAL PROTECTION

a. Scope (69001)

The inspector reviewed selected aspects of:

- the environmental monitoring program
- annual reports
- release records
- counting and analysis program

b. Observations and Findings

Environmental samples were collected, prepared, and analyzed consistently with the Technical Specification requirements. Laboratory equipment was maintained and calibrated acceptably. Data indicated that no measurable dose above background. This was acceptably documented in the Annual Reports. Observation of the facility found no new potential release paths. The licensee showed that the air emissions or radioactive material to the environment met the 10 millirem constraint specified in 10 CFR 20.1101(d).

The facility design minimizes release paths and sources of effluents.

The program for the monitoring and storage of radioactive liquid, gases, and solids was consistent with applicable regulatory requirements. Radioactive material was monitored and released when below acceptable limits or was acceptably transferred to the broad-scope license for disposition. The principles of As Low As Reasonably Achievable were acceptably implemented to minimize radioactive releases. Monitoring equipment was acceptably maintained and calibrated. Records were current and acceptably maintained.

c. Conclusions

The environmental protection program satisfied NRC requirements.

7. OPERATOR REQUALIFICATION

a. Scope (69001)

The inspector reviewed selected aspects of:

- the Requalification Program
- operators licenses
- operator training records
- operator physical examination records
- operator examination records
- operator active duty status

b. Observations and Findings

The Requalification Program was reestablished last summer, after many years of exemptions as allowed in a letter from James R. Miller, dated March 23, 1982. Operators' licenses were current. Records showed that operator training was consistent with the Requalification Program requirements. Physical examinations of the operators were conducted as required. Records showed that written and operating examinations of the operators were acceptably implemented. The inspector noted that the staff misunderstood their program requirements for examinations and discussed clarification of the issue with the staff. Logs showed that operators maintained active duty status as required.

c. Conclusions

Operator requalification was conducted as required by the Requalification Program.

8. MAINTENANCE

a. Scope (69001)

The inspector reviewed selected aspects of:

- maintenance procedures
- equipment maintenance records

b. Observations and Findings

Logs indicated that corrective maintenance activities and problems were addressed as required by procedure. Records showed that routine maintenance activities were conducted at the required frequency and in accordance with the TS, or the applicable procedure or equipment manual. Maintenance activities ensured that equipment remained consistent with the Safety Analysis Report and Technical Specification requirements. Further, maintenance activities were consistent with the requirements of 10CFR50.59.

The licensee had made significant improvement in the materiel condition of the facility by removing an unused machinery pedestal structure and wall insulation materials and recoating all concrete surfaces.

c. Conclusions

The maintenance program satisfied NRC requirements.

9. SURVEILLANCE

a. Scope (69001)

The inspector reviewed selected aspects of:

- surveillance and calibration procedures,
- surveillance, calibration and test data sheets and records

b. Observations and Findings

Surveillance, test, and verifications and calibrations were completed on schedule and in accordance with licensee procedures. All the recorded results were within the TS and procedurally prescribed parameters. The records and logs reviewed were complete and were being maintained as required. Checks, tests, and calibrations were completed as required by TS.

The licensee had meticulously verified the viability of determining control rod worth using subcritical multiplication before implementing a procedure for its use.

c. Conclusions

The surveillance program satisfied Technical Specification requirements.

10. FUEL HANDLING

a. Scope (69001)

The inspector reviewed selected aspects of:

- fuel handling procedures
- fuel handling equipment and instrumentation
- fuel handling and examination records

b. Observations and Findings

Fuel handling procedures provided a prescribed method to move and handle fuel consistent with the provision of the TS and the licensee safety analyses. Fuel movement and fuel examination records showed that the fuel was moved and examined as required. Records also show that fuel handling and monitoring equipment and instrumentation was verified operable prior to use. Personnel were knowledgeable of the procedural and equipment requirements for criticality control and assurance of fuel integrity. Radiological and security precautions were also met in accordance with applicable procedures.

c. Conclusions

The fuel handling program satisfied licensee Technical Specification and procedural requirements

11. EXPERIMENTS

a. Scope (69001)

The inspector reviewed selected aspects of:

- experimental program requirements
- procedures
- logs and records
- experimental administrative controls and precautions

b. Observations and Findings

The experiments at the facility were routine procedures that had been in place for several years. Experiments were typically class experiments that were predominantly solid form samples with short-lived isotopes at minimum exposure and low energy used repeatedly from class to class. No new or unknown-type experiments had been initiated, reviewed, or approved since the last inspection. The experiments were completed with the cognizance of the Reactor Supervisor and a Senior Reactor Operator and in accordance with Technical Specification requirements (e.g., reactivity limitations). The results of the experiments were documented in acceptable experimental logs, data sheets, or records. Engineering and radiation protection controls were implemented as required to limit exposure to radiation.

c. Conclusions

The program for experiments satisfied Technical Specification and procedural requirements.

12. PROCEDURES

a. Scope (69001)

The inspector reviewed selected aspects of:

- administrative controls
- records for changes and temporary changes
- procedural implementation
- logs and records

b. Observations and Findings

Administrative controls of changes and temporary changes to procedures, and associated review and approval processes were as required. Training of personnel on procedures and changes was acceptable. Personnel conducted activities in accordance with applicable procedures. Records showed that procedures for potential malfunctions (e.g., radioactive releases and contaminations, and reactor equipment problems) were implemented as required.

The licensee had produced a new procedure for control rod worth measurement that had been carefully evaluated before implementation.

c. Conclusions

The procedural control and implementation program satisfied Technical Specification requirements.

13. EMERGENCY PREPAREDNESS

a. Scope (69001)

The inspector reviewed selected aspects of:

- the Emergency Plan
- implementing procedures
- emergency response facilities, supplies, equipment and instrumentation
- training records
- offsite support
- emergency drills and exercises

b. Observations and Findings

The Emergency Plan (E-Plan) in use at the reactor and emergency facilities was the same as the version most recently approved by the NRC. The E-Plan was audited and reviewed as required. Implementing procedures were reviewed and revised as needed to employ the E-Plan effectively. Facilities, supplies, instrumentation and equipment were being maintained, controlled and inventoried as required in the E-Plan. Through records review and interviews with licensee personnel, emergency responders were determined to be knowledgeable of the proper actions to take in case of an emergency. Communications capabilities were acceptable with these support groups and had been tested as stipulated in the E-Plan. Emergency drills had been conducted as required by the E-Plan. Off-site support organization participation was also as required by the E-Plan. Critiques were held following the drills to discuss the strengths and weaknesses identified during the exercise and to develop possible solutions to any problems identified. The results of these critiques were documented and filed. Emergency preparedness and response training was being completed as required. Training for off-site and reactor staff personnel was conducted and documented as stipulated by the E-Plan.

c. Conclusions

The emergency preparedness program was conducted in accordance with the Emergency Plan.

14. **SAFEGUARDS**

a. **Scope** (85102)

The inspector reviewed selected aspects of:

- nuclear material inventory and locations
- accountability records

b. **Observations and Findings**

The inventory of material was verified. The material control and accountability program tracked locations and content of fuel and fission detectors under the research reactor license. The possession and use of special nuclear material (SNM) were limited to the locations and purposes authorized under the license. The material control and accountability forms (DOE/NRC Forms 741 and 742) were prepared and transmitted as required.

c. **Conclusions**

Special Nuclear Materials were acceptably controlled and inventoried.

15. **SECURITY**

a. **Scope** (81401/81431)

The inspector reviewed selected aspects of:

- the Physical Protection Plan
- security systems, equipment and instrumentations
- implementation of the Physical Protection Plan

b. **Observations and Findings**

The Physical Protection Plan was the same as the latest revision approved by the NRC. Physical protection systems (barriers and alarms), equipment and instrumentation were as required by the Physical Protection Plan. Access control was as required. Implementing procedures were consistent with the Physical Protection Plan. Acceptable security response and training were demonstrated through alarm response and drill response in accordance with procedures.

c. **Conclusions**

Security activities and systems satisfied Physical Protection Plan requirements.



16. **TRANSPORTATION**

a. **Scope** (86740)

The inspector reviewed selected aspects of:

- radioactive materials shipping procedures
- radioactive materials transportation and transfer records

b. **Observations and Findings**

Records showed that the radioactive material for disposal was transferred to the broad scope license in accordance with licensee requirements. This program for radioactive material transport is consistent with license requirements.

The licensee had not transferred any radioactive material subject to Department of Transportation regulations since the last inspection.

c. **Conclusions**

The program for transportation of radioactive materials satisfied NRC requirements.

17. **Exit Meeting Summary**

The inspector presented the inspection results to members of licensee management at the conclusion of the inspection. The licensee acknowledged the findings presented.

### Licensee Staff Contacted

Edward Merritt	Reactor Supervisor
Robert Bean	Laboratory Director
Jim Schweitzer	Radiation Safety Officer

Other members of the licensee staff and management were also contacted during the inspection.

### Inspection Procedures Used

IP 69001	Class II Non-power Reactors
IP 86740	Inspection of Transportation Activities
IP 81401	Plans, Procedures, and Reviews
IP 81431	Fixed Physical Security Protection
IP 85102	Material Control and Accounting

### Items Opened and Closed

Open

99201-01	IFI	Audits by persons not responsible for program implementation
99201-02	IFI	Annual radiation protection program review documentation

Closed

None

### List of Documents Reviewed

Safety Analysis Report	Emergency procedures
Safety Evaluation Report	Training Program
Reactor Operating License	Security Plan
Technical Specifications	Emergency Plan
Administrative Procedures	Dosimetry Records
Operating Procedures	Training Records
Maintenance Procedures	Various Reports
Surveillance Procedures	
Maintenance and Surveillance Records	

List of Acronyms Used

ALARA	As Low as Reasonably Achievable
CFR	Code of Federal Regulations
CORO	Committee on Reactor Operations
DOT	Department of Transportation
HP	Health Physics
NRC	Nuclear Regulatory Commission
PDR	Public Document Room
RSO	Radiation Safety Officer
SAR	Safety Analysis Report
SNM	Special Nuclear Material
TS	Technical Specifications