

May 9, 2003

Dr. Daniel B. Bullen  
Mechanical Engineering Department  
Iowa State University  
2025 H.M. Black Engineering Building  
Ames, IA 50011-2241

SUBJECT: NRC ROUTINE, ANNOUNCED INSPECTION REPORT NO. 50-116/2000-201

Dear Dr. Bullen:

The inspection effort involved the coordination of the confirmatory radiological survey activities that were performed by our contractor, Oak Ridge Institute for Science and Education, of your research reactor on September 25-27, 2000. In addition, various aspects of your reactor operations, decommissioning, and radiation protection programs were inspected, including selective examinations of procedures and representative records, interviews with personnel, and observations of the facility.

Based on the results of this inspection, it has been determined that; 1) the decommissioning of the 10 kW Universal Training Reactor has been performed in accordance with the approved Decommissioning Plan; 2) the terminal radiation survey and associated documentation from the licensee demonstrated that residual radioactive material at the facility and site is less than the approved Derived Concentration Guideline Limits; and 3) since the licensee has met their Derived Concentration Guideline Limits, the facility and site meet the criteria for decommissioning set forth in 10 CFR Part 20, Subpart E.

No safety concern or noncompliance with Nuclear Regulatory Commission (NRC) requirements was identified. No response to this letter is required.

Dr. D. Bullen

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In accordance with 10 CFR 2.790 of the NRC's "Rules of Practice," a copy of this letter and its enclosure will be available electronically for public inspection in the NRC Public Document Room or from the Publicly Available Records (PARS) component of NRC's document system (ADAMS). ADAMS is accessible from the NRC Web site at (the Public Electronic Reading Room) <http://www.nrc.gov/NRC/ADAMS/index.html>. Should you have any questions concerning this inspection, please contact Mr. Stephen Holmes at 301-415-8583.

Sincerely,

***/RA by Alexander Adams, Jr. Acting For/***

Patrick M. Madden, Section Chief  
Research and Test Reactors Section  
Operating Reactor Improvements Program  
Division of Regulatory Improvement Programs  
Office of Nuclear Reactor Regulation

Docket No. 50-116  
License No. R-59

Enclosures: 1. NRC Inspection Report No. 50-116/2000-201  
2. Confirmatory Survey Plan for Iowa State University UTR-10 facility dated September 21, 2000  
3. Confirmatory Survey of the Iowa State University Training Reactor UTR-10, dated March 7, 2001 (ADAMS Accession Number ML01950026)

cc w/enclosures: Please see next page

Iowa State University

Docket No. 50-116

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Dr. D. Bullen

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U. S. NUCLEAR REGULATORY COMMISSION

Docket No: 50-116

License No: R-59

Report No: 50-116/2000-201

Licensee: Iowa State University

Facility: Universal Training Reactor -10 Research Reactor

Location: Ames, Iowa

Dates: September 25-27, 2000

Inspector: Stephen W. Holmes

Approved by: Patrick M. Madden, Section Chief  
Research and Test Reactors Section  
Operating Reactor Improvements Program  
Division of Regulatory Improvement Programs  
Office of Nuclear Reactor Regulation

## EXECUTIVE SUMMARY

Iowa State University  
UTR-10 Research Reactor  
Report No: 50-116/2000-201

This routine, announced inspection involved the confirmatory radiological survey and the on-site review of selected activities being performed at the Iowa State University Universal Training Reactor. In addition, the activities audited during this inspection included: organization and staffing; review and audit functions; operations; release criteria; disposition of materials; confirmatory final survey; procedures; maintenance and surveillance; and radiation protection program. The inspector was assisted by the NRC's contractor, Oak Ridge Institute for Science and Education (ORISE) Environmental Survey and Site Assessment Program (ESSAP)

### Organizational and Staffing

- The organizational structure and functions were consistent with Technical Specification Section 6.0, Amendment No. 14, dated May 8, 2000, and the Decommissioning Plan for the UTR-10 facility dated January 6, 1999.

### Review and Audit Functions

- Audits conducted by the Reactor Use Committee were found to be in accordance with the requirements specified in Technical Specification Section 6.2, Amendment No. 14, dated May 8, 2000.

### Procedures

- The procedural control and implementation program was acceptably maintained and met Technical Specification and UTR-10 facility Decommissioning Plan requirements.

### Removal of Materials

- Fuel and radioactive and non-radioactive waste was removed from the site in accordance with the UTR-10 facility Decommissioning Plan and Department of Transportation and Nuclear Regulatory Commission requirements.

### Decommissioning Activities

- Decommissioning activities were performed as required by Decommissioning Plan Section 2.3 and licensee procedures.

### Release Criteria

- Duke Engineering and Services, Inc. used the appropriate Derived Concentration Guideline Levels, as required by the Decommissioning Plan, in performing the final survey.

#### Confirmatory Final Survey

- The two elevated floor readings in Room 114 and near the door to Room 101 were not associated with UTR-10 operations.
- Based on the results of the licensee's final status survey and NRC's confirmatory measurements, Iowa State University had adequately demonstrated that the UTR-10 facility satisfies the criteria for release for unrestricted use.

#### Maintenance and Surveillance

- The maintenance program was being implemented as required by Iowa State University procedures.
- The licensee's program for surveillance and limiting conditions for operation confirmations satisfied Technical Specification and Decommission Plan requirements.
- The licensee's design change procedures were in place and were implemented as required by licensee procedures.

#### Radiation Protection Program

- The radiation protection program satisfied the requirements of 10 CFR 19.12 and 10 CFR Part 20.1101.
- Radiological postings satisfied regulatory requirements.
- Surveys were performed and documented as required by 10 CFR 20.1501(a), Technical Specifications, and licensee procedures.
- The personnel dosimetry program was acceptably implemented and doses were in conformance with licensee and 10 CFR 20 limits.
- Portable survey meters, radiation monitoring, and counting lab instruments were being maintained according to Technical Specifications, industry/equipment manufacturer standards, and licensee and contractor procedures.

## **Report Details**

### **Summary of Plant Status**

Iowa State University (ISU), in Ames, Iowa, previously initiated the process for decommissioning its 10 kW Universal Training Reactor (UTR-10) and its associated systems, located in the Nuclear Engineering Laboratory (NEL) on the ISU main campus. The UTR-10's primary purpose was to provide ISU faculty/researchers with the capabilities to enhance teaching, operator training, and experiment outcomes in nuclear science studies. The UTR-10 Argonaut type reactor, was installed in 1959 on the ground floor, central bay area, of the NEL. The reactor was initially fueled with high enriched uranium but, in 1991, the high enriched fuel was replaced with a lower-enriched fuel of 19.75 percent of U-235.

On May 8, 1998, the final reactor criticality was recorded and on May 15, 1998, all operations at the reactor ceased. Iowa State University contracted Duke Engineering and Services, Inc. (DE&S) to undertake ISU's Request for Decommissioning Order from the NRC and to perform the actual decommissioning of the reactor. In 1998, DE&S performed a characterization survey of the UTR-10 reactor, based upon the Multi-Agency Radiation Survey and Site Investigation Manual guidance. Results of the characterization survey were provided in DE&S' "Characterization Report for the UTR-10 Reactor" issued January 6, 1999. Iowa State University requested the NRC, by letters dated January 4 and 6, 1999, to grant them the authorization to decommission the reactor according to their submitted decommissioning plan. On May 8, 2000, the NRC issued Amendment No. 14 to the reactor licence which approved ISU's Decommissioning Plan. DE&S started decommissioning operations June 6, 2000. Final facility decommissioning was completed in August 2000.

The Final Status Survey Report for the UTR-10 facility was completed and issued September 2000. According to the report, all contaminated systems and components had been removed from the site. Potentially contaminated structural surfaces identified during characterization surveys had been removed and/or remediated such that the residual radioactivity above background would not result in a total effective dose equivalent (TEDE), to the average member of the critical group, of greater than 25 mRem (0.25 mSv) per year.

The NRC requested Oak Ridge Institute for Science and Education's (ORISE) Environmental Survey and Site Assessment Program (ESSAP) to perform a confirmatory survey of the UTR-10 facility. On September 25-27, 2000, the ESSAP team, accompanied by an NRC inspector, conducted this survey.

### **1. ORGANIZATIONAL STRUCTURE AND FUNCTIONS**

#### **a. Scope (Inspection Procedure (IP) 69001)**

The inspector reviewed selected aspects of:

- organization and staffing
- Decommissioning Plan (DP) for the UTR-10 facility dated January 6, 1999
- qualifications
- management responsibilities
- administrative controls
- decommissioning activity records



b. Observations and Findings

The general organizational structure and staffing had not changed since the last inspection. The organizational structure and staffing at the facility and as reported in the Annual Report was as required by technical specification (TS) Section 6.1.1. Review of records verified that management responsibilities were administered as required by TS Section 6.1.2 and applicable procedures.

The decommissioning of the reactor has required ISU management to assume additional project management responsibilities. Through record reviews and interviews with the reactor manager, radiation safety officer (RSO), and DE&S project manager, the inspector confirmed that both ISU management and the decommissioning project organization structures were as required by DP Section 2.4.

c. Conclusions

The organizational structure and their corresponding functions were consistent with TS Section 6.0, Amendment No. 14, dated May 8, 2000, and The DP for the UTR-10 facility dated January 6, 1999.

**2. REVIEW AND AUDIT FUNCTIONS**

a. Inspection Scope (IP 69001)

The inspector reviewed selected aspects of:

- Reactor Use Committee (RUC) minutes
- safety review records
- audit records
- responses to safety reviews and audits
- personnel qualifications

b. Observations and Findings

The inspector reviewed the qualifications of the RUC members and confirmed that they met TS Sections 6.2.1 and 6.2.2, and the Committee's charter requirements. The inspector noted that, between August 12, 1999, and September 7, 2000, the RUC met four times. This number of RUC meetings exceeded TS Section's 6.2.2(1) semiannual meeting requirements. The inspector reviewed the minutes of the RUC and determined that they provided guidance, direction, operations oversight and 10 CFR 50.59 request reviews as required.

Committee minutes and audit records showed that safety reviews and audits were conducted as required by TS Section 6.2.4 and the Committee's charter. The content of the safety reviews were found by the inspector to be consistent with the TS. These reviews provided guidance, direction, and oversight to ensure satisfactory decommissioning of the reactor.

By examining the committee's review of the DP and their audits of the operations and training programs, the inspector determined that the safety reviews, audits, and associated findings were satisfactory and that the licensee took the appropriate corrective actions in response to these findings.

The inspector reviewed selected decommissioning and facility change approvals. Specifically, the inspector performed a review of the evaluation and approval of the 10 CFR 50.59 change from wire saw cutting to jack hammering removal of the concrete biological shield. The inspector determined that the RUC review and approval of this change was adequately performed.

c. Conclusions

The audits conducted by the RUC were found to be in accordance with the requirements specified in TS Section 6.2, Amendment No. 14, dated May 8, 2000.

3. **PROCEDURES**

a. Inspection Scope (IP 69001)

The inspector reviewed selected aspects of:

- administrative controls
- records for changes and temporary changes
- DP for the UTR-10 facility dated January 6, 1999.
- decommissioning procedures
- logs and records

b. Observations and Findings

The inspector confirmed that written health physics (HP), decommissioning, and final survey procedures were available for those tasks and items required by TS Section 6.3, the DP, and the Final Survey Plan for ISU UTR-10. The procedures were routinely updated while minor modifications to the procedures were made as temporary changes.

Through review of the 1999 and 2000 training records and interviews with staff, the inspector determined that the training of personnel on procedures was adequate. During the inspector's tours of the facility, it was observed that personnel performing radiation surveys, conducting instrument checks, and issuing dosimetry were doing so in accordance with applicable procedures.

c. Conclusions

Based on the procedures and records reviewed and observations of personnel during the inspection, it was determined that the procedural control and

implementation program was acceptably maintained and met TS and DP requirements.

#### **4. REMOVAL OF MATERIALS**

a. Scope (IPs 69001, 86740, and 85102)

The inspector reviewed selected aspects of:

- transportation records
- disposal records
- NRC Forms 741 and 742

b. Observations and Findings

At the time the reactor ceased operations both high enriched (HEU) and low enriched uranium fuel (LEU) was on-site either in storage or in the reactor core. Prior to starting facility decommissioning this fuel was removed from the site. As noted in the previous NRC Inspection Report No. 50-116/99-201, the HEU fuel was shipped to the Savannah River Site on March 18 and 30, 1998. The University subsequently shipped the LEU fuel to the Savannah River Site on January 7, 2000. The inspector confirmed that, as required by DP Section 3.2.1, all fuel had been removed from ISU prior to decommissioning.

Radioactive waste was to be shipped to U.S. Ecology in Oak Ridge, Tennessee. Shipments were made under Iowa License 0014-2-85-AAB and Tennessee permit T-IA-003-L00 on July 25 and 26, 2000. The inspector confirmed, by reviewing transfer and shipping records and interviewing licensee staff, that radioactive waste was disposed of as required by DP Section 3.2.3 and in accordance with Department of Transportation and NRC regulations.

Non-radioactive waste was to be disposed of at the Ames-Story Environmental Landfill. The inspector's review confirmed that this was done in accordance with DP Section 3.2.2.1 and licensee procedures.

c. Conclusions

As a result of the records review and observations made during facility tours it was confirmed that the fuel and radioactive and non-radioactive waste was removed from the site in accordance with the ISU DP and Department of Transportation and NRC regulations.

## 5. **DECOMMISSIONING ACTIVITIES**

### a. Scope (IP 69001)

The inspector reviewed selected aspects of:

- operational logs and records
- decommissioning procedures
- decommissioning logs and records
- DP for the UTR-10 facility dated January 6, 1999
- toured the facility

### b. Observations and Findings

The licensee permanently shut down the reactor in May 1998. On June 6, 2000, the licensee started its decommissioning of the facility. Decommissioning of the facility was completed in August 2000.

Decommissioning activities focused on the dismantling and removal of the reactor proper, its support structures, auxiliary equipment and components, and the biological shield. The inspector examined the following selected tasks from DP Section 2.3, Decommission Tasks:

2.3.1.3 Demolition and Construction - Removal and relocation of the south double doors, demolition of the cinder-block wall, and removal and sealing of the second floor north -door openings was required.

2.3.1.4 Removal of Stairs - The north stairs and platform to the reactor top were to be removed and disposed of.

2.3.1.5 Plug Removal - The reactor plugs were to be removed and disposed of.

2.3.1.6 Water Tank Demolition - The water tank was to be cut up, removed, and disposed of.

2.3.1.7 Graphite and Core Component Removal - The reactor graphite, core mechanical components, and support structures and internals were to be removed from the core and disposed of.

2.3.1.8 Bio-Shield Removal - The reactor biological shield assembly was to be demolished, removed, and disposed of.

2.3.1.12 Tank and Sump Equipment Removal - The fuel pit, tank and associated reactor water piping was to be removed to the point where it entered the concrete wall and the embedded piping abandoned in place.

2.3.1.13 Miscellaneous Equipment Removal - Attached conduit, miscellaneous equipment and non-operational systems attached to the walls were to be removed and disposed of.

In order to verify that the above tasks had been performed in accordance with the DP, the inspector reviewed the related records and toured the facility. The inspector determined that the above tasks had been completed in accordance with final approved DP.

c. Conclusions

Based on the observations made during the inspection, decommissioning activities had been performed as required by DP Section 2.3 Decommissioning Tasks and licensee procedures.

6. RELEASE CRITERIA

a. Scope (IP 69001)

The inspector reviewed selected aspects of:

- DP for the UTR-10 facility dated January 6, 1999
- Characterization Report for the Iowa State University UTR facility, dated January 6, 1999
- Iowa State University UTR-10 Final Status Survey Report, dated September 2000

b. Observations and Findings

The NRC Final Rule on License Termination, 10 CFR 20.1402, provides radiological criteria for release of a site for unrestricted use. Acceptability criterion for unrestricted use is such that the residual radioactivity above background would not result in a TEDE greater than 25 mRem (0.25 mSv) per year to an average member of the critical group and that the residual radioactivity has been reduced to levels that are as low as reasonably achievable.

Site-specific Derived Concentration Guideline Limits (DCGLs) for ISU were determined based on radionuclide analyses of samples from the reactor facility and calculated using the USNRC Model DandD Version 1.0 program. The DCGLs were modified by adjusting the generic limits to account for hard-to-detect radionuclides. The DCGLs were reviewed and approved by the NRC as part of the review of the licensee's DP. The DCGLs were the contamination limits used in the final surveys to demonstrate that the predicted TEDE to a member of the critical group from any residual activity above background would not exceed 25 mRem (0.25 mSv) per year.

### ISU Site-Specific DCGLs

Material	Total Surface Contamination DCGL (dpm/100 cm <sup>2</sup> )
Structural Surfaces	5.3E03
Reactor Graphite	5.3E03
Reactor Steel	5.3E03
Reactor Aluminum	5.3E03
Reactor Concrete (Activated Portions)	1.1E04

The inspector interviewed DE&S representatives. The inspector determined that DE&S used the appropriate DCGLs as calculated in the Characterization Report and specified in the approved DP.

c. Conclusions

DE&S used the appropriate DCGLs, as required by the DP, in performing the final survey.

## 7. CONFIRMATORY FINAL SURVEY

a. Scope (IP 69001)

The inspector reviewed selected aspects of:

- DP for the UTR-10 facility, dated January 6, 1999
- Characterization Report for the Iowa State UTR Reactor, dated January 6, 1999
- Iowa State University Universal Training Reactor—UTR-10 Final Status Survey Report, dated September 2000

b. Observations and Findings

1. Review

The ESSAP team reviewed the Final Status Survey Plan, Final Status Survey Report, Characterization Report, and DP. Document reviews consisted of comparing the characterization report and final report methodology and survey measurements for consistency. These reviews focused on final status survey procedures, how information was evaluated to assure that areas identified as exceeding the site release criteria had undergone decontamination, and verification that residual radioactivity levels satisfied the established release criteria. As part of the confirmatory process ESSAP reviewed and evaluated the overall final status survey process implemented by DE&S. The review included the following categories: 1) final status survey documentation; 2) application of DCGLs; 3) survey area classification; and 4) instrumentation.

The team's review of DE&S reports determined that overall, the procedures, methods, and data submitted by DE&S were appropriate and adequately reflected the radiological status of the UTR-10. They noted that DE&S was consistent in methodology and instrumentation. DE&S deviated from initial survey planning in that the number of samples obtained was increased to improve overall survey results. They confirmed that the licensee determined appropriate surface activity and soil concentration DCGLs and gross activity DCGLs, for each radionuclide of concern, in addition to modifying the gross activity DCGLs to account for any hard-to-detect radionuclides. This data was reviewed by ESSAP to evaluate its appropriateness of use and determined it to be satisfactory. The team evaluated the nominal measurement detection sensitivities for some of the detector types selected by DE&S for obtaining field and laboratory measurement data and determined that the detection sensitivities, typical for the type of detectors used, were adequate to detect residual contamination at the DCGLs.

2. Surface Scans

Confirmatory alpha, beta, and gamma radiation surface scan coverage was based on the DE&S survey units classifications, outlined in the Multi-Agency Radiation Survey and Site Investigation Manual, as either:

Class 1 - Areas that had known contamination based on the characterization survey in excess of the DCGLs.

Class 2 - Areas that had a potential for radioactive contamination, but not expected to exceed the DCGLs.

Class 3 - Any impacted areas that are not expected to contain any residual radioactivity, or are expected to contain levels at a small fraction of the DCGLs.

Particular attention was given to cracks and joints in the structural surfaces where material may have accumulated. Scans were performed using gas proportional, Geiger Muller, and/or Sodium Iodide scintillation detectors coupled to ratemeters or ratemeter-scalers with audible indicators. Locations of elevated direct radiation detected by surface scans were marked for further investigation which included additional surface scans to delineate contamination boundaries.

The ESSAP team re-established the 1 m × 1 m reference grid system on the floor and lower walls (up to 2 meters) that DE&S used in the high bay area of the reactor room. A similar reference grid was also established in the NEL Room 114, located adjacent to the high bay area. Measurement locations on ungridded surfaces were referenced to prominent building features. Direct measurements for alpha and beta surface activity were performed at the center of the structural surface grid blocks. The alpha measurements were obtained when the historical review of the facility and fuel indicated the potential for residual alpha activity. Additional surface activity measurements were performed at locations of elevated direct radiation identified by surface scans. Direct measurements were performed using gas proportional detectors coupled to ratemeter-scalers. Smear samples, for determining removable gross alpha and gross beta activity levels, were collected from each direct measurement location.

Two of the alpha/beta confirmatory measurements exceed the DCGLs, one on the floor in Room 114 and the other on the floor in the high bay area of the NEL near the door to Room 101. These areas were classified as Class 3 areas and were not associated with the reactor operations.

The inspector performed individual measurements of these two floor areas where confirmatory measurements exceed the DCGLs. *In Situ* gamma spectroscopy of these areas indicated that there was not a prevalent gamma emitter and no alpha decay was identified. The elevated readings also corresponded directly to a part of the floor that was not original concrete, but appeared to be a section of the floor that had been patched with new material.

The ISU HP has subsequently reported that, in attempting to collect a sample from the floor near the door to Room 101 for radiological analysis, the mechanical removal of the top 0.5 cm of the floor area effectively decontaminated that location. The radioactive material in the sample was identified as a natural mix of radiothorium. The Radiation Safety Officer stated that these rooms are controlled by the University's Broadscope Material License No. 0014-2-85-AAB and are actively used for radiation work. The findings of these surveys had been filed with the

individual room records and the sample has subsequently been disposed of under the state license. This survey information will be considered in the future during the termination of the State material license.

All remaining confirmatory direct measurements were within the established DCGLs.

3. Sampling

Two surface (0 to 15 centimeters) soil samples were collected from the trench of the former reactor core and one from the exposed soil near the process pit. Three surface soil samples were also collected from the exterior of the NEL. A concrete sample was collected from the side wall of the trench near the general location of the former reactor core.

Radionuclide concentrations in soil samples were less than the established DCGLs for soil. All confirmatory samples were also below the total activity criteria.

c. Conclusions

Based on the above observations, surveys, evaluations, and analyses, the inspector concluded that; 1) the two elevated floor readings in Room 114 and near the door to Room 101 were not associated with UTR-10 operations; 2) based on the results of the licensee's final status survey and ESSAP's confirmatory measurements, ISU had adequately demonstrated that the UTR-10 facility satisfies the criteria for release for unrestricted use.

8. **MAINTENANCE AND SURVEILLANCE**

a. Inspection Scope (IP 69001)

The inspector reviewed selected aspects of:

- maintenance procedures
- equipment maintenance records
- surveillance and calibration procedures
- surveillance, calibration, and test data sheets and records
- Reactor periodic checks, tests, verification, and decommissioning activities
- facility design and DP changes and records
- facility configuration

b. Observations and Findings

- (1) General Maintenance

During decommissioning general maintenance was focused on the support services and equipment and not on any reactor systems. The inspector reviewed maintenance records, interviewed staff and observed minor maintenance performed on lighting, water service, electrical and other support equipment. Based on the inspector's interviews and observations, general maintenance was acceptable for an industrial site.

(2) Surveillance

The inspector reviewed records of all TS Sections 3 and 4 required limiting conditions for operation and surveillance verifications performed since August 1999. The results of the surveillances were within prescribed TS limits and procedure parameters and in close agreement with the previous surveillance results.

(3) Change Control

Reactor, TS, or DP related 50.59 changes require review by the RUC in accordance with TS Section 6.2.3, "Review Function," and DP Section 2.4.5, "ISU Reactor Use Committee."

The inspector reviewed the RUC approved change package for changing the method of removing the concrete biological shield from cutting with a wire saw to jack hammering. The inspector determined that the change evaluation was technically complete and adequately documented. Additionally, the inspector concluded that the RUC 10 CFR 50.59 review and approval was focused on safety, and met licensee program requirements.

c. Conclusions

The licensee's program for surveillance and limiting conditions for operation verification satisfied TS and DP requirements. The licensee's maintenance and design change programs were in place and were being implemented as required by licensee procedures.

9. **RADIATION PROTECTION**

a. Inspection Scope (IP 69001)

The inspector reviewed selected aspects of the radiation protection program (RPP):

- Radiation Protection Training
- radiological signs and posting
- facility and equipment during tours
- routine surveys and monitoring
- survey and monitoring procedures

- dosimetry records
- maintenance and calibration of radiation monitoring equipment
- periodic checks, quality control, and test source certification records
- ISU Radiation Safety Manual (RSM)
- event/incident records

b. Observations and Findings

(1) Radiation Protection Program

Although individual procedures had been revised and some added, the RPP had not functionally changed since the last inspection. The licensee reviewed the RPP at least annually in accordance with 10 CFR 20.1101(c). This review and oversight was provided by the RUC as required by TS Sections 6.2 and 6.3.

The inspector's review of procedure change records, revisions, and radiation work permits (RWP), confirmed that the RSO, individually and as a RUC member, reviewed and approved RPP changes, and radiation protection related events/conditions as required by TS 6.2, DP Section 3.0, and the RPP.

Through record reviews and interviews with ISU and DE&S staffs, the inspector confirmed that the RPP was applied to all activities during the decommissioning project, as required by DP Section 3.1 and ISU procedures.

(2) Radiation Protection Postings

The inspector observed that caution signs, postings and controls to radiation and contaminated areas at the NEL were acceptable for the hazards involved and were being implemented as required by 10 CFR Part 20, Subpart J. The inspector observed licensee and contractor personnel and verified that they complied with the indicated precautions for access to such areas. The inspector confirmed that current copies of NRC Form-3 and notices to workers were posted in appropriate areas in the facility as required by 10 CFR Part 19.

(3) Radiation Protection Surveys

The inspector audited the NEL's daily, monthly, quarterly, and other periodic contamination and radiation surveys, including airborne activity sampling, performed from August 1999 to August 2000. The surveys were performed and documented as required by RSM, DP Section 3.0, and ISU survey procedures. HP surveys required for special decommissioning activities, such as RWPs, were also performed and documented as required. Results were evaluated and corrective actions taken and documented when readings/results exceeded set action levels.

The inspector's review of the survey records since November 1999 confirmed that contamination, radiation, and airborne surveys were being performed as required by the DP, RSM, and individual procedures. Results were reviewed and corrective action taken when results

exceeded facility action levels. Resurveys were performed to ensure corrective actions were effective.

(4) Dosimetry

The inspector confirmed that dosimetry was being issued to staff, contractors, and visitors as outlined in licensee procedures. The licensee's dosimetry issuing criteria specifies that dosimetry should be issued to individuals who might receive a dose equivalent exceeding 10 percent of the annual limits specified in 10 CFR Part 20.1201(a). This criteria meets the requirements of 10 CFR 20.1502 for individual monitoring. During the inspection the inspector observed that workers and staff wore their dosimetry as required.

The licensee used a National Voluntary Laboratory Accreditation Program-accredited vendor to process personnel thermoluminescent dosimetry. Dosimetry results were reviewed by the RSO and doses above the facility's ALARA limits were investigated or referred to the RUC as required. The inspector's review of the licensee's radiological exposure records from August 1999 to July 2000 verified that occupational doses were within 10 CFR Part 20 limitations.

(5) Radiation Monitoring Equipment

The calibration and periodic checks of the portable survey meters, radiation monitoring, air sampling, and counting lab instruments were performed by facility staff or by certified contractors. The inspector confirmed that the licensee's calibration procedures and annual, quarterly, semiannual and monthly calibration, test, and check frequencies satisfied TS Section 4.3.3, DP Section 3.1, RSM, and 10 CFR 20.1501(b) requirements, and the American National Standards Institute N323 "Radiation Protection Instrumentation Test and Calibration" or the instruments manufacturers' recommendations. The inspector verified that the calibration and check sources used were traceable to the National Institute of Standards and Technology and that the sources' geometry and energies matched those used in actual detection/analyses.

The inspector also reviewed DE&S instrument calibrations. Their calibration and periodic checks of the portable survey meters, radiation monitoring, air sampling, and counting lab instruments were performed by their staffs or by certified contractors. The inspector confirmed that calibration procedures and annual, semiannual, quarterly, monthly, and daily calibrations, tests, and check frequencies satisfied DE&S HPS procedures. Calibrations also met 10 CFR 20.1501(b) requirements, and the American National Standards Institute N323 "Radiation Protection Instrumentation Test and Calibration" or the instrument's manufacturers' recommendations. The inspector verified that the calibration and check sources used were traceable to the National

Institute of Standards and Technology and that the sources' geometry and energies matched those used in actual detection/analyses.

The inspector reviewed the licensee's calibration lists and confirmed that calibrations for the radiation monitoring and counting lab equipment in use had been performed. Review of DE&S instrument calibrations confirmed that all instruments in use were calibrated. The inspector verified the calibration of the lab multichannel analyzer, two count rate meters, one portable ion chamber, and a portable multichannel analyzer.

All instruments checked by the inspector had current calibrations appropriate for the types and energies of radiation they were used to detect and/or measure.

(6) Respiratory Protection

DP Section 3.2.5 describes how the ISU respiratory protection would be established. It would meet 10 CFR Part 20, Subpart H and 29 CFR 1910.134 requirements and use ANSI Z88.2, NRC Regulatory Guide 8.15, and NUREG-0041 for guidance.

During the time covered by this inspection, the licensee had not implemented the respiratory protection program under 10 CFR 20, Subpart H. The licensee determined that, based on calculations and air sampling results, respiratory protection was not required to limit intake of radioactive material. The inspector reviewed the licensee's sampling and calculation results, interviewed staff, and performed independent calculations. The inspector confirmed the licensee's conclusion that respiratory protection was not required to limit intake of radioactive material.

c. Conclusions

Based on the observations made and records audited, it was determined that, because: 1) surveys were being completed and documented as required by 10 CFR 20.1501(a), TS, and licensee procedures, 2) postings met regulatory requirements, 3) the personnel dosimetry program was acceptably implemented and doses were in conformance with licensee and 10 CFR Part 20 limits, 4) Portable survey meters, radiation monitoring, and counting lab instruments were being maintained and calibrated as required, and 5) the evaluation and administration of the respiratory programs were adequately being performed, the RPP being implemented by the licensee satisfied NRC and DP requirements.

**10. EXIT MEETING SUMMARY**

The inspector presented the inspection results to members of licensee management at the conclusion of the inspection on September 27, 2000. The licensee acknowledged

the findings presented and did not identify as proprietary any of the material provided to or reviewed by the inspector during the inspection.

### **PARTIAL LIST OF PERSONS CONTACTED**

T. Brown	Field Staff, ESSAP
*D. Bullen	OSI Facility Director
*M. Granus	Project Manager, DE&S
*E. Heath	DE&S Staff
*K. Kerns	Radiation Safety Officer
J. Payne	Field Staff, ESSAP
*P. Weaver	Project Leader, ESSAP
*S. Wendt	UTR-10 Reactor Director

\* Attended exit meeting.

The inspector also contacted other supervisory, technical and administrative staff personnel as well.

### **INSPECTION PROCEDURE (IP) USED**

IP 69001	Class II Non-Power Reactors
IP 86740	Inspection of Transportation Activities
IP 85102	Material Control and Accounting - Reactors

### **ITEMS OPENED AND CLOSED**

#### **Open**

None

#### **Closed**

None

### **PARTIAL LIST OF ACRONYMS USED**

ANSI	American National Standards Institute
DE&S	Duke Engineering and Services, Inc.
DP	Decommissioning Plan for the UTR-10 facility dated January 6, 1999
HEU	High Enriched Uranium
HP	Health Physics
ISU	Iowa State University
LEU	Low Enriched Uranium
LCO	Limiting Conditions for Operation
NEL	Nuclear Engineering Laboratory
NRC	Nuclear Regulatory Commission
ORISE	Oak Ridge Institute for Science and Education
RWP	Radiation Work Permits
RPP	Radiation Protection Program
RSM	ISU Radiation Safety Manual
RSO	Radiation Safety Officer
RUC	Reactor Use Committee
TEDE	Total Effective Dose Equivalent
TS	Technical Specifications
UTR-10	10 kW Universal Training Reactor

