



UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
WASHINGTON, D.C. 20555-0001

January 25, 2023

EA-22-134

Dr. William Charlton, Director  
Nuclear Engineering Teaching Laboratory  
The University of Texas at Austin  
Pickle Research Campus, Building 159  
10100 Burnet Road  
Austin, TX 78758

SUBJECT: UNIVERSITY OF TEXAS AT AUSTIN – U.S. NUCLEAR REGULATORY  
COMMISSION SPECIAL INSPECTION REPORT NO. 05000602/2022201

Dear Dr. Charlton:

This letter refers to the U.S. Nuclear Regulatory Commission (NRC) special inspection conducted from November 7 – December 8, 2022, at the University of Texas at Austin, Nuclear Engineering Teaching Laboratory. The NRC staff initiated the special inspection in accordance with NRC Management Directive 8.3, “NRC Incident Investigation Program” and “Reactive Inspection Guidance for Non-Power Production and Utilization Facilities,” following event notification 56198 received from your staff on November 2, 2022. The NRC staff discussed preliminary inspection results with you and members of your staff at the conclusion of the onsite portion of the special inspection on November 17, 2022. A final exit briefing was conducted via teleconference with you on December 8, 2022. The enclosed report presents the results of this special inspection.

Based on the results of this special inspection, one Severity Level IV violation and one apparent violation were identified. These violations were evaluated in accordance with the Enforcement Policy which is located on the NRC’s website at <http://www.nrc.gov/about-nrc/regulatory/enforcement/enforce-pol.html>. Both violations are discussed in the “Summary of Findings,” section of the enclosed report. The circumstances surrounding these issues, the significance of the issues, and the need for lasting and effective corrective action were discussed with members of your staff during the exit meeting on December 8, 2022.

The Severity Level IV violation is related to facility changes not being reviewed by the Nuclear Reactor Committee as required by technical specification (TS) 6.2, “Review and Audit.” This violation is cited in the enclosed Notice of Violation (Notice) and the circumstances surrounding it are described in detail in the subject inspection report. You are required to respond and should follow the instructions specified in the enclosed Notice when preparing your response. If you have additional information that you believe the NRC should consider, you may provide it in your response to the Notice. The NRC’s review of your response to the Notice will also determine whether further enforcement action is necessary to ensure compliance with regulatory requirements.

The apparent violation is being considered for escalated enforcement action in accordance with the NRC Enforcement Policy. It is related to the facility operating with fuel that did not meet the requirements of TS 5.3, "Reactor Core and Fuel." Since the NRC has not made a final determination in this matter, no Notice of Violation is being issued for this inspection finding at this time.

Before the NRC makes its enforcement decision concerning the apparent violation, we are providing you an opportunity to: (1) respond to the apparent violation addressed in this inspection report within 30 days of the date of this letter, or (2) request a PEC. If a PEC is held, it will be open for public observation and the NRC will issue a press release to announce the time and date of the conference. If you decide to participate in a PEC, please contact Mr. Travis Tate at (301) 415-3901 within 10 days of the date of this letter. A PEC should be held within 30 days of the date of this letter.

If you choose to provide a written response for the apparent violation, it should be clearly marked as a "Response to Apparent Violations in NRC Special Inspection Report 05000602/2022201; EA-22-134" and should include for each apparent violation: (1) the reason for the apparent violation or, if contested, the basis for disputing the apparent violation; (2) the corrective steps that have been taken and the results achieved; (3) the corrective steps that will be taken; and (4) the date when full compliance will be achieved. Your response may reference or include previously docketed correspondence, if the correspondence adequately addresses the required response. Additionally, your response should be sent to the NRC's Document Control Center, with a copy mailed to Dr. Mohamed Shams, Director, Division of Advanced Reactors and Non-Power Production and Utilization Facilities, Office of Nuclear Reactor Regulation, 11555 Rockville Pike, Rockville, MD 20852-2738 within 30 days of the date of this letter. If an adequate response is not received within the time specified or an extension of time has not been granted by the NRC, the NRC will proceed with its enforcement decision or schedule a PEC.

If you choose to request a PEC, the conference will afford you the opportunity to provide your perspective on these matters and any other information that you believe the NRC should take into consideration before making an enforcement decision. The decision to hold a PEC does not mean that the NRC has determined that a violation has occurred or that enforcement action will be taken. This conference would be conducted to obtain information to assist the NRC in making an enforcement decision. The topics discussed during the conference may include information to determine whether a violation occurred, information to determine the significance of a violation, information related to the identification of a violation, and information related to any corrective actions taken or planned.

In addition, please be advised that the apparent violation described in the enclosed inspection report may change (e.g., number and characterization) as a result of further NRC review. You will be advised by separate correspondence of the results of our deliberations on this matter.

In accordance with Title 10 of the *Code of Federal Regulations* Part 2, "Agency Rules of Practice and Procedure," Section 2.390, "Public inspections, exemptions, requests for withholding," a copy of this letter, its enclosure(s), and your response, if you choose to provide one, will be made available electronically for public inspection in the NRC Public Document Room or from the NRC's Agencywide Documents Access and Management System, accessible from the NRC website at <http://www.nrc.gov/reading-rm/adams.html>. To the extent possible, your response should not include any personal privacy, proprietary, or safeguards information so that it can be made available to the public without redaction.

W. Charlton

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If you have any questions concerning this matter, please contact Mr. Travis Tate, Chief, Non-Power Production and Utilization Facilities Oversight Branch at (301) 415-3901.

Sincerely,



Signed by Shams, Mohamed  
on 01/25/23

Mohamed K. Shams, Director  
Division of Advanced Reactors and Non-Power  
Production and Utilization Facilities  
Office of Nuclear Reactor Regulation

Docket No. 50-602  
License No. R-129

Enclosures:  
As stated

cc w/enclosures: See next page

cc:

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State of Texas  
1100 West 49<sup>th</sup> Street  
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Sharon Wood, Executive Vice President  
and Provost  
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DeAnn Walker, Director  
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Office of Budget and Policy  
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Paul Whaley, Associate Director  
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Jim Terry, Reactor Supervisor  
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Test, Research and Training  
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Attention: Amber Johnson  
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Roger T. Bonnecaze, Dean  
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301 E. Dean Keeton St., ECJ 10th Floor  
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Ashley Forbes, Director  
Radiation Materials Division, MC 233  
Texas Commission on Environmental  
Quality  
P.O. Box 13087  
Austin, TX 78711-3087

SUBJECT: UNIVERSITY OF TEXAS AT AUSTIN – U.S. NUCLEAR REGULATORY  
 COMMISSION SPECIAL INSPECTION REPORT NO. 05000602/2022201 DATED:  
 JANUARY 25, 2023

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**NRC-002**

<b>OFFICE</b>	NRR/DANU/UNPO	NRR/DANU/UNPO	RES/DSA/CRAB I	NRR/DANU/LA
<b>NAME</b>	AWaugh	CBassett	JStaudenmeier	NParker
<b>DATE</b>	12/19/2022	12/19/2022	12/20/2022	12/21/2022
<b>OFFICE</b>	NRR/DANU/BC	OE/EB	NRR/DANU/D	
<b>NAME</b>	TTate	DJones	MShams	
<b>DATE</b>	1/21/2022	1/24/23	1/25/2022	

**OFFICIAL RECORD COPY**

## NOTICE OF VIOLATION

The University of Texas at Austin  
Nuclear Engineering Teaching Laboratory

Docket No. 50-602  
License No. R-129

During a U.S. Nuclear Regulatory Commission (NRC) special inspection conducted during November 7 – December 8, 2022, a violation of NRC requirements was identified. In accordance with the NRC Enforcement Policy, the violation is listed below:

Section 6.2.3, "Review Function," of the licensee's technical specifications (TSs) states, in part, that the Nuclear Reactor Committee shall review "[d]eterminations that proposed changes in equipment, systems, tests, experiments, or procedures do not involve an unreviewed safety question."

Contrary to TS 6.2.3, from 2020-2022, the Nuclear Reactor Committee failed to review determinations for proposed facility changes to equipment, tests, and procedures. Specifically, facility personnel implemented three changes that were not assessed by the Nuclear Reactor Committee, as required, for unreviewed safety questions. These changes included a fire alarm and sprinkler system upgrade completed on March 10, 2020, a security system change completed on May 28, 2020, and a roof and purge pump replacement completed on December 13, 2020.

This is a Severity Level IV violation (Section 6.1).

Pursuant to the provisions of Title 10 of the *Code of Federal Regulations* (10 CFR) Section 2.201, "Notice of violation," the University of Texas at Austin is hereby required to submit a written statement or explanation to the U.S. Nuclear Regulatory Commission, ATTN: Document Control Desk, Washington, DC 20555-0001, within 30 days of the date of the letter transmitting this Notice of Violation (Notice). This reply should be clearly marked as a "Reply to a Notice of Violation," and should include: (1) the reason for the violation, or, if contested, the basis for disputing the violation or severity level, (2) the corrective steps that have been taken and the results achieved, (3) the corrective steps that will be taken, and (4) the date when full compliance will be achieved. Your response may reference or include previous docketed correspondence, if the correspondence adequately addresses the required response. If an adequate reply is not received within the time specified in this Notice, an Order or a Demand for Information may be issued as to why the license should not be modified, suspended, or revoked, or why such other action as may be proper should not be taken. Where good cause is shown, consideration will be given to extending the response time.

If you contest this enforcement action, you should also provide a copy of your response, with the basis for your denial, to the Director, Office of Enforcement, United States Nuclear Regulatory Commission, Washington, DC 20555-0001.

Because your response will be made available electronically for public inspection in the NRC Public Document Room or from the NRC's document system (Agencywide Documents Access and Management System), accessible from the NRC website at <http://www.nrc.gov/reading-rm/adams.html>, to the extent possible, it should not include any personal privacy, proprietary, or safeguards information so that it can be made available to the public without redaction. If personal privacy or proprietary information is necessary to provide an acceptable response,

then please provide a bracketed copy of your response that identifies the information that should be protected and a redacted copy of your response that deletes such information. If you request withholding of such material, you must specifically identify the portions of your response that you seek to have withheld and provide in detail the bases for your claim of withholding (e.g., explain why the disclosure of information will create an unwarranted invasion of personal privacy or provide the information required by 10 CFR 2.390(b) to support a request for withholding confidential commercial or financial information). If safeguards information is necessary to provide an acceptable response, please provide the level of protection described in 10 CFR 73.21, "Protection of Safeguards Information: Performance Requirements."

In accordance with 10 CFR 19.11, "Posting of notices to workers," you may be required to post this Notice within two working days of receipt.

Dated this 25<sup>th</sup> day of January, 2023

**U.S. NUCLEAR REGULATORY COMMISSION**  
**OFFICE OF NUCLEAR REACTOR REGULATION**

Docket No: 50-602

License No: R-129

Report No: 05000602/2022201

Licensee: The University of Texas at Austin

Facility: Nuclear Engineering Teaching Laboratory

Location: Austin, Texas

Dates: November 7 – December 8, 2022

Inspectors: Andrew Waugh  
Craig Bassett  
Joseph Staudenmeier  
Andrew Boulanger (Observer from the Department of Energy)

Approved by: Travis Tate, Chief  
Nonpower Production and Utilization  
Facility Oversight Branch  
Division of Advanced Reactors and Non-Power  
Production and Utilization Facilities  
Office of Nuclear Reactor Regulation



## SUMMARY OF FINDINGS

The University of Texas at Austin  
Nuclear Engineering Teaching Laboratory  
Inspection Report No. 05000602/2022201

The U.S. Nuclear Regulatory Commission's (NRC's) program for overseeing the safe operation of research and test reactors is described in Manual Chapter 2545, "Research and Test Reactor Inspection Program." In response to event notification (EN) 56198 by the University of Texas at Austin (UTA) to the NRC, a special inspection team was established in accordance with NRC Management Directive 8.3, "NRC Incident Investigation Program" and "Reactive Inspection Guidance for Non-Power Production and Utilization Facilities." The special inspection team used inspection procedure 69001, "Class II Research and Test Reactors," inspection procedure 93812, "Special Inspection," and a special inspection charter to conduct this special inspection.

### NRC-Identified and Self-Revealing Findings

1. Apparent Violation: The licensee's technical specifications (TSs) section 5.0 discusses the design features of the facility. TS 5.3.1 states, in part, that fuel element cladding will be "304 stainless steel, nominal 0.020 inches thick." Contrary to TS 5.3.1, between January 6 - October 17, 2022, the licensee operated the reactor with two aluminum clad fuel elements installed in the reactor core.

On January 6, 2022, Nuclear Engineering Teaching Laboratory (NETL, the facility) staff performed a core change. As part of the core change, NETL unknowingly installed two aluminum clad TRIGA [Training, Research, Isotopes, General Atomics] fuel elements in the reactor core. NETL operated the reactor with the two aluminum clad elements in the reactor core until October 17, 2022, when the acting reactor manager identified the issue while reviewing paperwork. Reactor operations were suspended by NETL management at that time pending an assessment of the issue and implementation of corrective actions. NETL notified NRC of the issue on October 17, 2022, and made an official report (EN 56198) to the NRC on November 2, 2022.

This is an apparent violation pending significance determination.

2. Severity Level IV Violation: Section 6.2.3, "Review Function," of the licensee's TSs states, in part, that the Nuclear Reactor Committee shall review "[d]eterminations that proposed changes in equipment, systems, tests, experiments, or procedures do not involve an unreviewed safety question." Contrary to TS 6.2.3, from 2020-2022, the Nuclear Reactor Committee failed to review determinations for proposed facility changes to equipment, tests, and procedures. Specifically, facility personnel implemented three changes that were not assessed by the Nuclear Reactor Committee, as required, for unreviewed safety questions. These changes included a fire alarm and sprinkler system upgrade completed on March 10, 2020, a security system change completed on May 28, 2020, and a roof and purge pump replacement completed on December 13, 2020. This is an inspector identified issue.
3. Minor Violation: Section 6.6.2, "Special Reports," of the licensee's TSs states, in part, that the licensee shall make a telephone notification to the NRC Operations Center

describing the circumstances of any reportable events no later than the following working day. Contrary to TS 6.6.2, the issue requiring a notification was discovered on October 17, 2022, but was not reported to the NRC Operations Center by the licensee until November 2, 2022.

The NRC determined that this event met the reporting criteria defined in section 6.6.2 of the licensee's TS. Since the event met the reporting criteria it should have been reported to the NRC Operations Center within a working day after discovery of the issue which occurred on October 17, 2022. The issue of reporting timeliness to the NRC Operations Center was mitigated by the fact that the licensee informally notified NRC of the issue on October 17, 2022.

## REPORT DETAILS

### 1. Introduction

#### a. Background

The UTA operates a 1.1-megawatt TRIGA Mark II research reactor at the Pickle Research Campus in Austin, Texas. The NETL is used for laboratory exercises; undergraduate and graduate research; development and application of nuclear methods for researchers from other universities, industry, and government organizations; nuclear analytic services; and provides public education through tours and demonstrations.

#### b. Event Description

In EN 56198, UTA reported to the NRC that on October 17, 2022, NETL staff determined that aluminum clad TRIGA fuel elements stored at the facility were inadvertently placed into the reactor core and used for reactor operations from January 2022, through October 2022. In accordance with its TSs, the reactor is only licensed to operate with stainless-steel clad TRIGA fuel elements; aluminum clad TRIGA fuel elements are not authorized in the reactor core. NETL staff determined that as part of a reactor core change on January 6, 2022, two aluminum clad TRIGA fuel elements were installed in the reactor core. The aluminum clad TRIGA fuel elements were in the possession of NETL, because the elements were received along with stainless-steel clad TRIGA elements as part of a 2004 fuel shipment. The fuel loading error was identified by the acting reactor manager while reviewing paperwork following the retirement of the reactor manager. Reactor operations were suspended by NETL management pending an assessment of the issue and implementation of corrective actions.

### 2. Sequence of Events

During the special inspection, NRC inspectors interviewed licensee personnel and reviewed records to develop the sequence of events leading up to and following the events described above.

2004	NETL received a shipment of fuel from the University of Illinois at Urbana-Champaign. This shipment included two aluminum clad fuel elements. The aluminum clad fuel elements were placed in the facility's storage wells at that time.
2018	Most of the irradiated fuel elements (including the aluminum clad fuel elements) in the storage wells were moved to the reactor pool racks in anticipation of a pending shipment to the Department of Energy (DOE).
1/4/2022	Biennial fuel inspections were conducted by the licensee.
1/6/2022	NETL staff changed the configuration of the reactor core to increase reactivity. Fuel elements set to be installed in the reactor core were

inspected. Ten fuel elements were installed in the reactor core, including the two aluminum clad elements.

1/6/2022-10/17/2022 NETL operated the reactor with the two aluminum clad elements in the reactor core.

10/17/2022 While reviewing paperwork, the acting reactor manager identified that the two aluminum clad fuel elements were installed in the reactor core during the core configuration change on January 6, 2022. The aluminum elements were removed from the core and visually inspected. Reactor operations were suspended pending assessment of the issue and in order to implement corrective actions.

The NETL associate director contacted the NRC inspector and project manager.

10/17/2022-11/1/2022 NETL continued communications with the NRC regarding the event and conditions the aluminum clad fuel elements experienced during operations in the reactor core.

10/18/2022 NETL staff informed the Nuclear Reactor Committee regarding the event.

### **3. Licensee's Response to the Event**

While reviewing reactor paperwork on October 17, 2022, the acting reactor manager identified that the reactor was operated between January 6 and October 17, 2022, with two aluminum clad fuel elements installed in the reactor core. Reactor operations were suspended pending an assessment of the issue and implementation of corrective actions. The aluminum clad fuel elements were removed from the reactor core, visually inspected, and placed into a pool storage rack. No damage to the aluminum clad fuel elements was identified during that visual inspection.

Later, on October 17, 2022, NETL's associate director contacted the NRC inspector and project manager to brief them on the event. At that time, NETL staff determined that the event did not meet the reporting requirements defined in the TSs but wanted to keep the NRC informed of the event at the facility. On October 18, 2022, NETL staff informed the Nuclear Reactor Committee of the event and the suspension of operations.

NETL staff continued to keep the NRC staff informed on the event from October 18 to November 1, 2022. During this time, NETL staff gathered operational data and performed calculations to determine the conditions the aluminum clad fuel elements were subjected to during the operational period. NETL also performed visual inspections on all fuel elements in the reactor core at the time of the event, analyzed reactor pool water samples, and evaluated radiation monitoring data to determine if there was damage to any fuel elements from operating in the unanalyzed condition. No fuel element damage was identified by NETL staff.

NETL staff also reviewed procedures and engineering controls concerning fuel movements, measurements, and inspections to determine if any programmatic weakness existed which contributed to the event. The NETL staff identified procedural

and engineering control inadequacies and incorporated them into their planned corrective actions.

On November 2, 2022, NETL determined the event met the reporting requirements defined in the TS and officially reported the event to the NRC Operations Center.

#### NRC inspection assessment

The NRC inspectors requested a visual inspection of the two aluminum clad fuel elements during the on-site inspection. During that visual inspection, bubbles were identified coming from the weld area of one of the elements. The NRC inspectors sought manufacturing and historical data for the two elements from a DOE representative observing the inspection, but the information was not available due to the age of the elements. NETL staff evaluated pool water samples, radiation monitoring data, operational data, and performed calculations to determine the cause of the bubbles. The licensee determined that the cause of the bubbles was due to an issue with a weld and that the bubbles were hydrogen. The NRC inspectors independently evaluated the licensee's determination for the cause of the observed bubbles and found it to be adequate. Therefore, the NRC found that there was no damage to the two aluminum clad fuel elements.

The NRC inspectors found that this event did meet the reporting requirements defined in the TSs. The inspectors found that the event was not reported within the timeliness requirements defined in the TSs.

#### **4. Consequences of the Event**

NETL is only licensed to operate with stainless-steel clad fuel elements in the reactor core and the safety analysis report evaluates the use of stainless-steel clad fuel elements and not aluminum. While aluminum clad fuel elements are licensed for use in some TRIGA reactors, these reactors have more restrictive operational limits and settings than those limits and settings authorized at NETL. Specifically, aluminum clad fuel elements require a more conservative safety limit (peak fuel temperature of 500 degrees Celsius) than that of stainless-steel clad fuel elements (peak fuel temperature around 1,000 degrees Celsius) to ensure the integrity of the cladding is maintained. By installing in the reactor core aluminum clad fuel, NETL operated with a safety limit and limiting safety system settings that were less conservative than what is necessary to ensure the integrity of a fission product barrier.

To determine if the integrity of the aluminum clad fuel elements was maintained NETL did the following:

- 1) Visually inspected the aluminum clad fuel elements and all other fuel elements that were installed in the core during the event,
- 2) Pulled operational data and performed calculations to verify peak fuel temperature did not reach 500 degrees Celsius,
- 3) Performed pool water samples analyzing for the presence of fission products, and
- 4) Evaluated radiation monitoring logs looking for the presence of fission product gasses.

NETL determined that the integrity of the aluminum clad fuel elements was maintained throughout the operational period and that peak fuel temperature did not reach 500 degrees Celsius.

#### NRC inspection assessment

NRC inspectors and technical expert independently verified the licensee's analysis and conducted independent calculations. The NRC's assessment found that it is unlikely the two aluminum clad fuel elements experienced temperatures approaching 500 degrees Celsius during operations. Based upon the NRC's independent assessment and fuel inspections, the NRC inspectors determined that no fuel damage occurred and that there were no actual nuclear safety consequences as a result of this event.

### **5. Safety Significance of the Event**

All reactor licensees are required by 10 CFR 50.36(c) to specify safety limits in their TSs. These safety limits should be placed on important process variables identified in the safety analysis report (SAR) as necessary to reasonably protect the integrity of the primary barrier against the uncontrolled release of radioactivity. For non-power reactors, the radioactivity of concern is generally the fission products in the fuel. Reactor conditions and safety limits should be developed to avoid failure of the fuel and should be supported by SAR analyses.

NETL is not authorized to operate with aluminum clad fuel in the reactor core and did not analyze for operations with aluminum clad fuel in their SAR. The reactor parameters and safety features in place at the facility are for operations with stainless-steel clad fuel. Aluminum clad fuel elements require a more conservative limit with regard to peak fuel temperature than stainless-steel clad fuel elements. The lower peak fuel temperature is to ensure the integrity of the cladding is maintained. By installing aluminum clad fuel in the reactor core, NETL operated with a safety limit and limiting safety system settings that were less conservative than what is necessary to ensure the integrity of a fission product barrier.

#### NRC inspection assessment

Based upon its review of the NETL licensing documents and TSs, the NRC inspectors found that the licensee operated the reactor in an unanalyzed condition that increased the potential for fuel cladding damage and failure of the integrity of the primary fission product barrier from January 6 - November 17, 2022. The inspectors determined the safety significance to be low due to no actual damage occurring to the two aluminum clad fuel elements. Additionally, had cladding damage occurred resulting in the release of fission products, the inspectors determined the fission products released would have been contained within the reactor pool water.

### **6. Adequacy of Refueling Procedures**

The NETL staff identified weaknesses in refueling procedures and process which contributed to the event. The NETL identified root causes and the corrective actions are discussed in sections 8 and 9 of this report. As a corrective action, NETL updated the fuel measurement and inspection procedure to include steps to remove disqualified fuel from service and to update the B159.xls (fuel management) file so that disqualified fuel

is more readily identifiable to staff involved in fuel movements and management activities. NETL updated the fuel movement procedure to include a step to evaluate if the fuel was qualified for use or not. NETL also implemented engineering controls to help ensure that disqualified fuel would not be utilized in the core such as segregating the storage of disqualified fuel and using placards to identify disqualified fuel. Additionally, NETL revised processes and procedures associated with fuel movements to require additional management oversight and removed the previous process that allowed moves to be conducted with one approval that introduced a single point failure.

#### NRC inspection assessment

The inspectors reviewed the updated procedures for fuel movements and fuel measurements and inspections. The inspectors found that the updated procedures and enhanced engineering and management controls met the corrective actions created by the licensee and approved by the Nuclear Reactor Committee and that they were adequate to prevent recurrence of the event.

### **7. Adequacy of the Change Management Process**

NETL identified procedural inadequacies in their change management process and are in the process of revising the applicable procedure.

#### NRC inspection assessment

NRC inspectors reviewed and agreed with the licensee's determination of the procedural inadequacies. Inspectors also identified cases where the licensee's change management process was not implemented in accordance with TS requirements. Specifically, TS 6.2.3, which requires the Nuclear Reactor Committee to review "[d]eterminations that proposed changes in equipment, systems, tests, experiments, or procedures do not involve an unreviewed safety question." NRC inspectors determined that contrary to TS 6.2.3, NETL staff made three changes over the last couple of years that were evaluated by facility management but were not reviewed by the Nuclear Reactor Committee. The inspectors determined this is a Severity Level IV violation in accordance with the NRC's Enforcement Policy.

The NRC inspectors will review the adequacy of procedure revisions during future routine inspections.

### **8. Root Cause Determination and Contributing Causes**

NETL determined the root cause of the event was that procedures were inadequate in identifying disqualified fuel elements and keeping them out of the core. NETL also identified the following contributing causes:

- 1) Lack of attention to detail when selecting the elements to be used in the core,
- 2) Inadequate administrative and engineering controls were in place to ensure disqualified fuel elements were easily identifiable,
- 3) Inadequate safety conscious work environment led to a procedure revision that was improperly implemented, and
- 4) Lack of management oversight led to a single point failure.

## NRC inspection assessment

The NRC inspectors reviewed and agreed with the root causes listed above and identified weaknesses in the licensee's nuclear safety culture. The NRC defines nuclear safety culture as: "the core values and behaviors resulting from a collective commitment by leaders and individuals to emphasize safety over competing goals to ensure protection of people and the environment." Specifically, NRC inspectors identified weaknesses in the following nuclear safety traits:

- 1) Work Processes, defined as "The process of planning and controlling work activities is implemented so that safety is maintained," and
- 2) Questioning Attitude, defined as "Individuals avoid complacency and continually challenge existing conditions and activities in order to identify discrepancies that might result in error or inappropriate action."

## **9. Corrective Actions**

The licensee implemented, or plans to implement, the following corrective actions:

- 1) Remove aluminum fuel elements from the core,
- 2) Revise the surveillance procedure for fuel element inspections and measurements,
- 3) Perform the revised fuel element inspection and measurement surveillance for all fuel elements installed in the core at the time of the event and elements that will be installed for the new core configuration,
- 4) Review other procedures that satisfy TS surveillances, to evaluate if other non-compliances were introduced in performance,
- 5) Conduct control rod worth calibrations,
- 6) Include in the B159.xls (fuel management) file:
  - a. Date of last fuel inspection,
  - b. A 'qualified' or 'disqualified' flag to indicate fuel elements not to be used in the core.
- 7) Review the event with NETL staff, emphasizing the importance of procedural compliance, the change control process for procedures, the application of license and TS as administrative controls, and the incorporation of this into NETL culture,
- 8) Revise the fuel handling procedure to require fuel not in a tested configuration (i.e., not installed at the last control rod worth calibration) to be verified prior to installation:
  - a. Qualified/disqualified for use,
  - b. Inspection completed within prior 2 years,
  - c. Core loading only with qualified fuel verified by NETL management prior to startup.
- 9) Develop a method to designate fuel racks with visible indications that the contents are not allowed to be used in the core.

## NRC inspection assessment

NRC inspectors reviewed the licensee's corrective actions planned and implemented and found that they are adequate to prevent recurrence of the event. NRC inspectors will review planned corrective actions in future routine inspections.



## **10. Adequacy of the New Core Configuration**

After the event, and prior to resuming normal operations, NETL took steps to ensure the adequacy of the new core configuration. NETL management reviewed and approved the new core configuration to be used. NETL staff measured and inspected all the fuel elements used in the new core configuration to ensure that no disqualified fuel elements would be utilized. Surveillances were completed following the change in core configuration to ensure TS requirements were met. Specifically, control rod worth, excess reactivity, shutdown margin, and transient insertion were measured.

### NRC inspection assessment

The NRC inspectors reviewed the new core configuration and calculated reactor parameters required to support startup and found that the new core configuration met TS requirements.

## **11. Exit Interview**

The NRC inspectors conducted an inspection debrief with NETL reactor management at the conclusion of the onsite portion of the special inspection on November 17, 2022. NRC inspectors discussed the inspection results in an inspection exit meeting at the conclusion of the special inspection with Dr. Charlton, NETL Director, and members of his staff on December 8, 2022.

## **PARTIAL LIST OF PERSONS CONTACTED**

### Licensee Personnel

W. Charlton	Director, NETL
P.M. Whaley	Associate Director, NETL
J. Terry	Reactor Supervisor, NETL
T. Tipping	Reactor Health Physicist and Laboratory Manager

## **INSPECTION PROCEDURES USED**

IP 69001	Class 2 Research and Test Reactors
IP 93812	Special Inspection

## **ITEMS OPENED, CLOSED, AND DISCUSSED**

### Opened:

05000602/2022-201-01	AV	Operating with fuel elements that did not meet TS requirements. (TS 5.3.1)
05000602/2022-201-02	VIO	Failure to have the Nuclear Reactor Committee review facility changes as required by TS. (TS 6.2.3)
05000602/2022-201-03	VIO	Failure to report the event within the TS timeliness requirements. (TS 6.6.2)

### Closed:

None

### Discussed:

None

## **Licensee Documents Reviewed**

- "University of Texas at Austin Research Reactor Special Inspection Team Charter," ADAMS Accession No. ML22307A305
- "Annual Water Systems Surveillance Checklists," dated (2020-present)
- Various "Bi-monthly Pool Water Sample," records dated (2021-present)
- Summary of 2022 Aluminum Fuel Event and Follow-up, Updated November 8, 2022
- Administrative procedure (ADMN)-1, "NETL Procedure Control," dated April 8, 2010
- Maintenance procedure (MAIN)-5, "Fuel Inspection and Measurement," dated May 30, 2000
- MAIN-5, "Fuel Inspection and Measurement," dated November 1, 2022
- FUEL-1, "Movement of Fuel," dated February 14, 2005

- Assessment for 2022 Aluminum Fuel Event: Thermal Hydraulic Analysis of Aluminum-Clad Fuels in UT-NETL Core, updated November 4, 2022
- Event Notification #56198
- Various "B159 File" records
- Various "Fuel Move Log" records, dated 2018-present
- Fuel maps, dated 2018-present
- "10 CFR 50.59 Evaluation Forms," dated 2020-present
- Various "Reactor Oversight Committee Meeting Minutes," dated 2020-present
- Reactor Oversight Committee Charter
- University of Texas, Submittal of 14-Day Report for Event Number 56198, ML22333A623
- Various "Console Operation Log" entries, dated 2022-present
- 2019 and 2020 annual operating reports