



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

June 1, 2015

Dr. Robert Dimeo, Director  
NIST Center for Neutron Research  
National Institute of Standards and Technology  
U. S. Department of Commerce  
100 Bureau Drive, Mail Stop 8561  
Gaithersburg, MD 20899-8561

**SUBJECT: NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY– PLAN FOR  
AUDIT RELATED TO APPLICABILITY OF FUKUSHIMA LESSONS LEARNED  
TO RESEARCH AND TEST REACTORS**

Dear Dr. Dimeo:

The purpose of this letter is to provide you the details of an audit that the U.S. Nuclear Regulatory Commission (NRC) is conducting of your facility to support its evaluation of applicability of Fukushima lessons learned to research and test reactors. The NRC staff's preliminary assessment for your facility, as well as other research and test reactors, is discussed in a paper dated March 2, 2015, "Draft White Paper Applicability of Fukushima Lessons Learned to Facilities other than Operating Power Reactors." The draft white paper can be found in the Agencywide Documents Access and Management System (ADAMS) at Accession No. ML15042A367.

As discussed in the preliminary assessment, the NRC staff plans to conduct additional assessments of three high power research and test reactors including the National Institute of Standards and Technology (NIST) Center for Neutron Research Test Reactor (NBSR). The NRC staff's preliminary assessment states that the NRC staff will perform additional assessments regarding the NBSR's capabilities to prevent or mitigate loss-of-coolant accidents (LOCAs) as a result of beyond-design-basis natural phenomena (e.g., seismic events). This is because the early loss of reactor coolant can result in failure of the fuel cladding and subsequent radiological release unless reactor coolant makeup can be provided from installed facility equipment or from portable external sources.

In addition, at NBSR, if there is an extended loss of electrical power to operate the active decay heat removal systems or damage to the active decay heat removal system that prevents its use, fuel damage could occur unless the decay heat removal systems are restored or reactor coolant makeup using portable external sources can be deployed. As such, in addition to performing additional assessments regarding NBSR's capabilities to prevent or mitigate LOCAs as a result of beyond-design-basis natural phenomenon (e.g., seismic events), the NRC staff will also assess the NBSR's capabilities to prevent or mitigate loss of decay heat removal capabilities (e.g., due to an extended loss of alternating current power that could result from an extreme flood or other extreme natural phenomenon).

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The enclosure to this document provides the details of the NRC staff's plan to audit your facility. At this time the NRC staff envisions the need to visit your facility early in the audit process so that the NRC staff assigned to the audit can become familiar with the layout and design of the facility and to understand what capabilities that the facility may have to mitigate beyond-design-basis events. The NRC project manager will contact you to make arrangements for the site visit.

The NRC staff plans to document the result of its audit in an audit report and subsequent staff assessment. Should you have any questions concerning this audit, please contact Mr. Xiaosong Yin, at (301) 415-1404 or by electronic mail at [Xiaosong.Yin@nrc.gov](mailto:Xiaosong.Yin@nrc.gov).

Sincerely,

A handwritten signature in black ink, appearing to read "Alexander Adams, Jr.", with a stylized flourish at the end.

Alexander Adams, Jr., Chief  
Research and Test Reactors Licensing Branch  
Division of Policy and Rulemaking  
Office of Nuclear Reactor Regulation

Docket No.: 50-184

Enclosure:  
Audit Plan for National Institute of Standards  
and Technology Center for Neutron  
Research Test Reactor Associated  
with Evaluation of Applicability of  
Fukushima Lessons Learned

cc: See next page

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National Institute of Standards and Technology

Docket No. 50-184

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# **Audit Plan for National Institute of Standards and Technology Center for Neutron Research Test Reactor Associated with Evaluation of Applicability of Fukushima Lessons Learned**

## **BACKGROUND AND AUDIT BASIS**

This audit plan was developed in accordance with U.S. Nuclear Regulatory Commission (NRC) Office of Nuclear Reactor Regulation (NRR) Office Instruction LIC-111, "Regulatory Audits" (ADAMS Accession No. ML082900195) to support the NRC staff's assessment of applicability of Fukushima lessons learned to the 20 Megawatt thermal (MW<sub>t</sub>) National Institute of Standards and Technology (NIST) Center for Neutron Research Test Reactor (NBSR).

The staff identified the need for additional information for three high-power research and test reactors (RTRs) (including the NBSR) in a preliminary assessment dated March 2, 2015, "Draft White Paper Applicability of Fukushima Lessons Learned to Facilities other than Operating Power Reactors." The draft white paper can be found in the Agencywide Documents Access and Management System (ADAMS) at Accession No. ML15042A367. In accordance with LIC-111, one of the reasons for performing an audit is to, "establish an understanding of potential concerns to inform future regulatory actions or decisions, such as generic communications."

As discussed in the preliminary assessment, for the three reactors (including the NBSR), NRC staff will perform additional assessments regarding the reactors' capabilities to prevent or mitigate loss of coolant accidents (LOCAs) as a result of beyond-design-basis natural phenomena (e.g., seismic events). This is because for these RTRs, the early loss of reactor coolant can result in failure of the fuel cladding and subsequent radiological release unless reactor coolant makeup can be provided from installed facility equipment or from portable external sources.

NBSR is the highest powered RTR licensed by the NRC at 20 MW<sub>t</sub>. In the case of NBSR, if there is an extended loss of electrical power to operate the active decay heat removal systems or damage to the active decay heat removal system that prevents its use, fuel damage could occur unless the decay heat removal systems are restored or reactor coolant makeup using portable external sources can be deployed. As such, in addition to performing additional assessments regarding NBSR's capabilities to prevent or mitigate LOCAs as a result of beyond-design-basis natural phenomenon (e.g., seismic events), the NRC staff will also assess the NBSR's capabilities to prevent or mitigate loss of decay heat removal capabilities (e.g., due to an extended loss of alternating current power that could result from an extreme flood or other extreme natural phenomenon).

## **AUDIT SCOPE**

The audit scope for the NBSR includes collecting additional information regarding the seismic capabilities of the reactor to assess the level of margin inherent in the design to withstand a beyond-design-basis earthquake and to preclude a seismically-induced LOCA from a beyond design-basis earthquake. The staff will also collect additional information regarding the

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capabilities of this reactor to prevent or mitigate LOCAs as a result of other beyond-design-basis natural phenomena (e.g., tornado born missiles).

#### NRC AUDIT TEAM

<b>Title</b>	<b>Team Member</b>
Team Lead	John Adams
Japan Lessons-Learned Division (JLD) Project Manager	Joe Sebrosky
Seismic Technical Support	Yong Li
Structural Technical Support	Amitava Ghosh
Flooding Technical Support	Yuan Cheng
JLD Mitigating Strategies Technical Support	On Yee
RTR Technical Support	Michael Balazik
RTR Project Manager	Xiaosong Yin

#### LOGISTICS

The staff will perform a desk audit of calculations, licensing material regarding the design of the reactor, and drawings to address the staff information needs. In addition to a desk audit of the above material, two site visits are planned. One site visit will be scheduled to be performed early in the process to familiarize the staff with the design and mitigating capabilities of this test reactor, and a site visit later in the process is envisioned to confirm or collect additional information to support the staff's assessment.

#### DELIVERABLES

An audit report or summary will be issued by December 31, 2015, to document the results of the audit. The staff intends to use the audit report to support a safety assessment for the three RTRs by first quarter calendar year 2016.

#### INFORMATION NEEDS

##### Seismic Review

The RTR staff will work with the licensee to obtain applicable licensee seismic calculations. Once the NRR RTR staff obtains these calculations they will be provided to the NRR seismic and structural reviewer. Once the review of these calculations is completed, these calculations will be either destroyed or returned to the licensee. Additional information needs may be identified based on the review of these calculations.

##### Structural Review

The NRR RTR staff will obtain the necessary drawings and information to allow the NRR structural staff and JLD mitigating strategies staff to determine if other natural hazards (e.g., tornado born missile) have the capability to cause a LOCA, and if so, the staff will assess the mitigation capabilities that the NBSR might be able to employ.

### Extended Loss of AC Power Review

During the first site visit, the staff hopes to gain an understanding of the design of this reactor and to better understand its capabilities to prevent or mitigate beyond design basis events. The NRC staff is particularly interested in:

- Location and capabilities of spool piece connection to allow potable water injection into the reactor.
- Any capabilities for portable pumps or fire trucks to add water to the reactor.
- Locations and capabilities of heavy water tanks that can inject water into the reactor.
- Locations and volumes of any on-site water tanks or other sources available for injection to the reactor.
- Location and capabilities of emergency power sources (e.g., diesel generators, batteries).
- Licensee plans or contingency actions when severe weather is predicted.

Based on the staff site visit, the staff expects that additional information needs will be identified. The staff expects the site visit to be done in one day in the Summer of 2015. The NRR RTR staff will coordinate with the NBSR licensee and the NRC technical staff to establish the date for the site visit and the detailed agenda for the site visit. An additional site visit will be coordinated as needed.

The staff has also identified the need for the following calculation and information related to flooding for this reactor:

- URS Group, Inc. (URS, March 2003); "Geology, Seismology, Geotechnical Engineering, and Hydrology of the NIST Research Reactor Site," Gaithersburg, Maryland.
- Site drainage maps that show the surface runoff drainage system and the roof drainage outlets.

### References

NBSR Safety Analysis Report

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Sincerely,  
**/RA/**

Alexander Adams, Jr., Chief  
Research and Test Reactors Licensing Branch  
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**ADAMS Accession No. ML15153A407**

\* via email

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