



**BRIEFING ON RESEARCH
AND TEST REACTOR (RTR)
LICENSE RENEWAL
STATUS**

**Office of Nuclear Reactor Regulation
March 27, 2012**

AGENDA

- **Organizational Structure for RTRs and the License Renewal Backlog and Its Causes**
- **Backlog Reduction Efforts and Current Status**
- **Long-Term Plan**

Organizational Structure for RTRs

- **Two NRR/DPR Branches Share Responsibility for RTR Oversight and Licensing**
- **Licensing Branch Responsible for Renewals**
- **31 NRC Licensed RTRs**

License Renewal Backlog and Its Causes

- **Deferral of License Renewal Work**
 - **Post TMI Safety Initiatives**
 - **Post 9/11 Security Initiatives**
- **Delays In Augmenting RTR
Licensing Staff**
- **Priority on HEU to LEU Conversion
Projects**

License Renewal Backlog and Its Causes (con't)

- **Limited Licensee Resources**
- **Formalization of the RTR
Licensing Infrastructure**
 - **Defined Format and Content of SARs
(NUREG-1537 Part 1)**
 - **Defined Staff's Review Criteria
(NUREG-1537 Part 2)**

License Renewal Backlog and Its Causes (con't)

- **SECY-08-161 Provided Options for Elimination of the Backlog**
- **SRM Direction for the Short-term**
 - **Develop Interim Staff Guidance for Focused Reviews**
 - **Use Graded Approach**
- **SRM Direction for the Long-Term**
 - **Streamline the Renewal Process**

Backlog Reduction Efforts

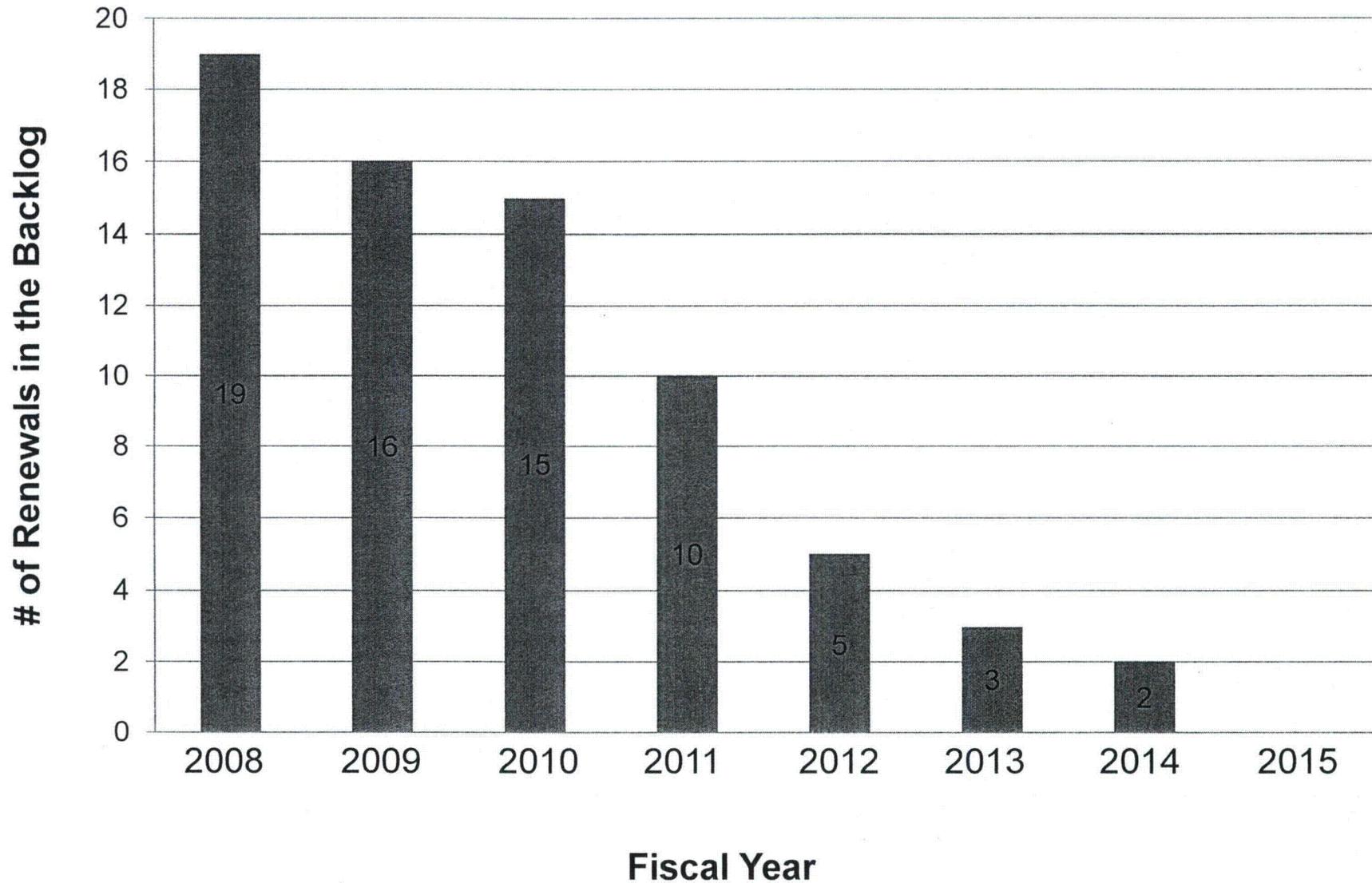
- **RTR Fully Staffed in 2010**
- **Implementation of the ISG**
 - **Focused on Safety and Security**
 - **Streamlined NRC Review Process**
- **NRC Highlighted Availability of DOE Resources**

Backlog Reduction Efforts (con't)

- **Stakeholder Involvement**
- **NRC Outreach Activities**
- **Updated SAR**
 - **Reflective of Facility Operations**
 - **Documented Analyses**
 - **Provides Clarity**

Current Status

RTR Backlog Inventory by Fiscal Year



The Long-term Plan

- **SRM-SECY-08-0161**
- **SECY-09-0095, Enclosure 2**
- **Work Commenced in April 2011**

The Long-term Plan (con't)

- **Completed Tasks:**
 - **Analysis of Current Requirements**
 - **Conducted Two Public Meetings**
 - **Analysis of the Segregation of RTR Regulations**
 - **Benchmarking Against Other License Renewal Methodologies**

The Long-term Plan (con't)

- **Remaining Work on the Regulatory Basis**
 - **Staff to Develop Draft Regulatory Basis and Recommendations**
 - **Hold Public Meeting**
 - **Develop the Final Regulatory Basis**

The Long-term Plan (con't)

- **Beyond the Regulatory Basis:**
 - **Common Prioritization of Rulemaking Process**
 - **Ranked as a Medium Priority**
 - **Proposed Rule Development**
 - **Implementation of Guidance Development**
 - **Final Rule Development**

In Summary

- **NRC Focused on Emergent Work Resulting in a Backlog**
- **Staff Actions to Address the Backlog**
 - **Streamlined Review Process**
 - **Proactively Engaged Stakeholders**
- **Significant Reduction of the Backlog**
- **Developing a Long-term Solution**

Acronyms

- **DPR** **Division of Policy and Rulemaking**
- **HEU** **Highly Enriched Uranium**
- **LEU** **Low Enriched Uranium**
- **NRR** **Office of Nuclear Reactor Regulation**
- **RTR** **Research and Test Reactors**
- **TMI** **Three Mile Island**

***License Renewal for Research
and Test Reactors***

March 27, 2012

Leo Bobek, Chair

***National Organization of
Test, Research and
Training Reactors (TRTR)***

TRTR Overview

- National Organization of Test, Research, and Training Reactors (TRTR)
- Professional organization with members from 40+ research reactors in U.S. and Canada, and adjunct members from other nations
- Promotes science and engineering education, fundamental and applied research, the application of technology in areas of national concerns, and improving U.S. technological competitiveness

Research and Test Reactors (RTRs)

- Research and Test Reactors are termed “Non-power Reactors” under 10CFR 50.2 definitions.
- Test Reactors (“Testing Facility” under 10CFR 50.2)
 - *Power level greater than 10 MW, or*
 - *In-core circulating loop with fueled experiments, or*
 - *Liquid fuel loading, or*
 - *In-core experiments greater than 16 square inches in cross-sectional area.*

RTRs Overview (cont.)

- 42 RTRs currently licensed under NRC
- 31 operating
- 25 operating RTRs at universities
- Most are class 104 research and development licenses (10CFR 50.21)
- Most were built in 1960 -1980
- Licensed thermal power levels range from a few watts to 20 MW.

RTRs Overview (cont.)

- RTR usage requires a different design from power reactors.
- RTRs are designed to produce high thermal neutron fluxes at much lower thermal outputs than power reactors.
- RTR core volumes are physically much smaller than power reactors (a cubic meter versus tens of cubic meters)

RTRs Overview (cont.)

- RTRs require much less fuel (a few kilograms versus thousands of kilograms).
- RTRs have far lower fission product inventories.
- RTRs lack the thermal hydraulic energy to disperse fission products in the event of an accident.

RTR Usage

- *Neutron* physics studies.
- *Neutron* scattering for materials studies.
- *Neutron* radiography studies – imaging for aerospace, automotive and other engineering uses.
- *Neutron* induced radioisotope production for medical and other research and industrial applications.

RTR Usage (cont.)

- *Neutron* activation analysis - non-destructive measurement of trace elements in environmental, nutritional, archaeological, geological and forensics.
- *Neutron* irradiated materials - doping silicon for semiconductors and development of membranes used in dialysis and water purification.

RTR Usage (cont.)

- RTRs offer a unique tool for instructing the next generation of nuclear engineers and technicians in reactor physics, radiation safety, and nuclear technology – providing unparalleled hands-on experience in a safe and controlled environment.
- Most RTRs are designed for educational use, but all are designed to perform some type of research.

RTR Usage (cont.)

- RTRs are a unique tool for educating the public about the science of nuclear technology and demonstrating the safe and effective use of nuclear reactors.

Position on License Renewal

- TRTR recognizes the unique challenges imposed on NRC during RTR relicensing in the past decade (staffing issues, 9/11, etc.)
- TRTR appreciates the efforts made by the Commission to alleviate the relicensing backlog.
- TRTR appreciates the efforts of the NRC RTR group to update guidance for future relicensing efforts and the opportunity to participate in the update process via public meetings.

Generic Suggestions for Streamlining Relicensing

- The process has become excessively complex compared to 20 years ago, with no quantifiable improvement to safety.
- Consider the development of generic thermal hydraulic analysis models for TRIGA and plate-type fueled RTRs (1MW or less)
- Similarly for the Maximum Hypothetical Accident analysis

Generic Suggestions for Streamlining Relicensing

- Develop a systematic way outside of the RAI process to correct typographical and editing errors
- Develop a generic decommissioning cost analysis based on previous experiences, indexed to power level and inflation
- Endorse the use of ANSI/ANS Standards in Regulatory Guidance

On behalf of TRTR, thank you for the opportunity to provide this briefing.

***Lessons Learned from
Licensing of Rensselaer
Reactor Critical Facility***

March 27, 2012

Sastry Sreepada

Director

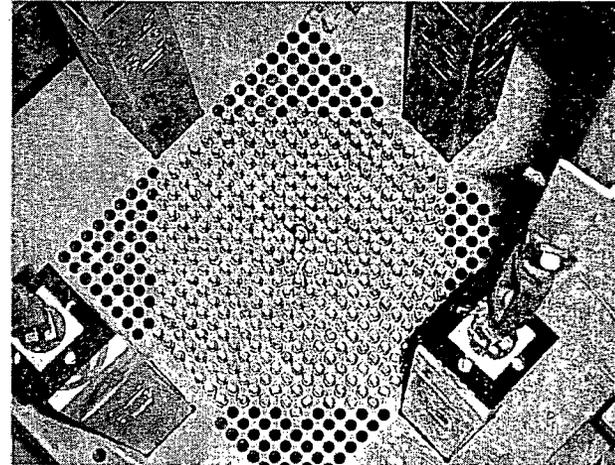
Walthusen Reactor Critical Facility

Rensselaer Polytechnic Institute

Rensselaer Reactor Critical Facility

Characteristics:

- ***Power: 100 W,***
- ***Negligible burn-up.***
- ***Open reactor tank***
- ***SPERT F-1 Fuel Pins***



History of Renewals

	<i>Submitted</i>	<i>RAIs</i>	<i>Date Licensed</i>
<i>Original -HEU</i>			<i>July 20, 1965</i>
<i>Renewall HEU</i>			<i>June 19, 1969</i>
<i>Renewal IHEU</i>	<i>May 14, 1979</i>	<i>One</i>	<i>December 2, 1983</i>
<i>HEU/LEU</i>	<i>October 3, 1986</i>	<i>One</i>	<i>August 1987</i>
<i>Recent Renewal</i>	<i>November 19, 2002</i>	<i>Nine</i>	<i>June 27, 2011</i>

What Worked Well

- ***The initial submittals for the last 3 renewals/amendments were prepared under the same director***
- ***The submittals were prepared by experienced part time adjuncts with active full time nuclear jobs in industry***
- ***Bulk of the submittal was based on previous license with material/methods updated***

What Worked Well

- ***Time from first Request for Additional Information to renewal is about 3 years.***
- ***Direct telephone contacts between the director, operations supervisor and the NRC project manager***

What Didn't work well

- ***Substantial turn over of people during the renewal process (5 directors, 5 operations supervisors, 5 Nuclear Safety Review board chairmen, 3 Radiation safety officers)***
- ***First Request for Additional Information was almost 6 years after the submittal.***

What Didn't work well

- ***Difficult to be on the same page with constant change in personnel***
- ***This situation could not be changed by face to face contact***

Where did we spend Most of the time

- ***In decreasing order major time was spent on***
 - 1. Technical Specifications***
 - 2. Safety Analysis***
 - 3. Other sections***
- ***Most revisions in Technical Specifications were related to terminology, clarifications and editorials.***

Lessons Learned

- ***It is necessary to have continuity of personnel throughout the process***
- ***Some documentation of discussions with the project manager, in the absence of face to face meetings when staff changes occur could have helped somewhat.***

Beneficial Outcomes

- ***The documents and methods have been updated and are in editable formats for any future changes.***
- ***The student design projects can rely on the new documentation***
- ***We should strive to increase the participation of full time faculty, due to the attrition in the past and present***

***University of Missouri
Research Reactor (MURR)
License Renewal Experience***

March 27, 2012

Ralph A. Butler, Director

***University of Missouri-Columbia
Research Reactor***

Facility Overview

- Location: Just off the main campus of the University of Missouri, Columbia, Missouri
- Design: Pressurized, reflected, open pool-type, light-water moderated and cooled
- Purpose: Multi-disciplinary research and education facility also providing a broad range of analytical and irradiation services

Facility Overview

- 1966: First achieved criticality in October – licensed to operate at 5 MW
- 1974: Power uprate to 10 MW
- 1977: Started \geq 150 hours/week operation
- 2006: Submitted license renewal application to the NRC on August 31

Relicensing Timeline

Request for Additional Information (RAI):

- July 2009: Decommissioning and Financial (4 questions - 60 days to respond)
- December 2009: Reference Material (1 question - 20 days to respond)
- December 2009: Environmental Report (4 questions - 30 days to respond)

Relicensing Timeline

Request for Additional Information (RAI):

- April 2010: National Historic Preservation Act (6 questions - 30 days to respond)
- May 2010: Technical - Complex (19 questions - 120 days to respond)
- June 2010: Technical (167 questions - 45 days to respond)

Comments/Observations

- Due to delay in starting the NRC review process, many questions dealt with updating previously submitted information
- Very large number of questions, of varying complexity – limited resources to answer in time allotted

Comments/Observations

- Some questions required significant amount of computer code work – very resource intense
- We felt some questions had already been answered, needed to direct reviewer to location in the Safety Analysis Report

Comments/Observations

- Increase in the number of site visits to discuss questions could be beneficial – only 2 have occurred thus far
- For common design features among the reactors, a lesson learned database would be beneficial to the research reactor community

Comments/Observations

- Discrepancy found in Safety Limit Analysis while answering a relicensing question – required significant resources to be redirected on submitting a License Amendment
- Need more realistic timelines to answer the RAIs

Comments/Observations

- Very fortunate to have great support from Argonne National Laboratory – LEU Fuel Conversion Project
- Good support from our Senior Project Manager – constant contact
- NRC staff very understanding of our requests for additional time to respond to remaining questions

Current Status

- 6 questions remain unanswered – 5 requiring RELAP thermal-hydraulic code work and the other requiring support from MU Mechanical Engineering
- Partial rewrite of Chapter 4 is also required based on the Safety Limit Amendment
- Next deadline is April 13, 2012

***Thank you for your attention,
Questions?***

***License Renewal Issues – Timely
Responses to RAIs in an
Environment Limited by the FAR
and other challenges
27 March 2012***

***Stephen Miller, Head, Radiation
Sciences Department, Reactor
Facility Director, Armed Forces
Radiobiology Research Institute***

Brief History

- ***First criticality in August 1962, licensed power 10kW.***
- ***Second license issued in August, 1984.***
- ***Current license renewal package submitted July 2004 for timely renewal.***
- ***To date, The AFRRRI TRIGA has logged 50 years of safe and incident free operations.***

License Renewal Timeline

- ***August, 2005 - NRC/BNL visit AFRRRI to discuss first round of 95 RAIs. All but 7 are answered verbally on the spot.***
- ***June, 2010 - 4 RAIs arrive with financial qualification questions. A full financial statement is prepared and submitted.***

License Renewal Timeline

- ***July 2010 - First round of 41 RAIs under focused review process.***
- ***Sept 2010 – Three of the original RAIs require modeling assistance from GA. The budget year is closed out, and no avenue to get funding until the next FY (October).***

License Renewal Timeline

- ***A budget was not approved in FY11. The entire year was handled under a CRA. No funding available to address the remaining 3 RAIs.***
- ***With the arrival of the Institute budget on 8 March 2012, the contracting process can commence to address the last three RAIs. Hopefully this will complete the process.***

Current Status

- ***To date, 143 RAIs have been exchanged. Some as simple as “are you government owned”, many are multi part and require sophisticated modeling.***
- ***The estimated total cost of renewing the AFRRI license is in excess of \$1M, excluding the cost to NRC.***

Current Status

- ***Estimated completion by the end of FY12***

The AFRRI Experience

- ***I personally have been involved in two relicensing activities for license R-84 over 30 years.***
- ***The first spanned 4 years, the license was issued in 1984.***
- ***The current effort began with timely renewal in 2004. The effort under the focused review process began June, 2010.***

The AFRRI Experience

- ***Without exception, all NRC staff and contractors involved were professional, helpful, and reasonable.***
- ***The NRC staff was always flexible and willing to discuss timelines for RAI responses.***

Discussion

- ***The Atomic Energy Act (as amended) stipulates that “the Commission shall impose the minimum amount of such regulations and terms of license as will permit the Commission to fulfill its obligations under this Act to promote the common defense and security and to protect the health and safety of the public”***

Discussion

- ***NUREG 1537 part 1, CH 13.1.1 states that for a TRIGA the MHA is a fuel element cladding failure in air after sustained continuous operations.***
- ***The analysis demonstrates that the resulting hypothetical release falls within part 20 public release constraints.***

Discussion

- ***Question: Once the licensee demonstrates that the reactor does not pose a risk to the health and safety of the public, what is the benefit provided to the public by the expenditure of \$1M to answer the additional 142 RAIs?***

Discussion

- ***Are the analyses that predict the safety margin more exact than the empirical data collected and published during destructive testing done in the 60's?***
- ***The analyzed safety margins provide no greater level of safety beyond what was determined 50 years ago.***

Discussion

- ***Is there a more efficient way to renew the RTR licenses?***