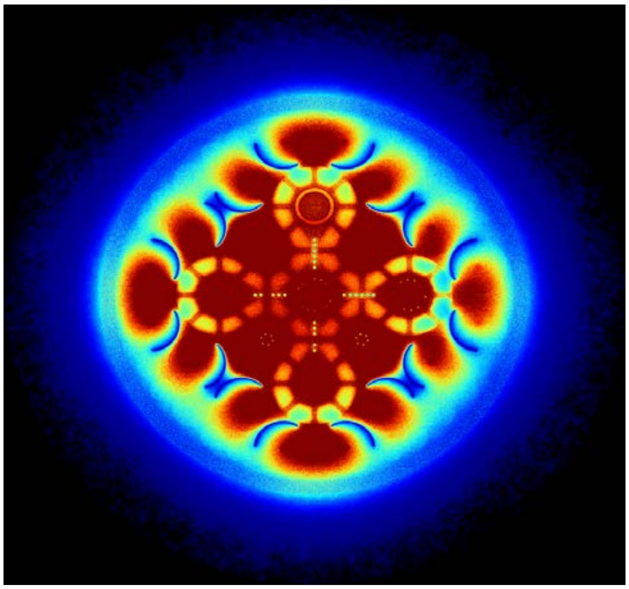
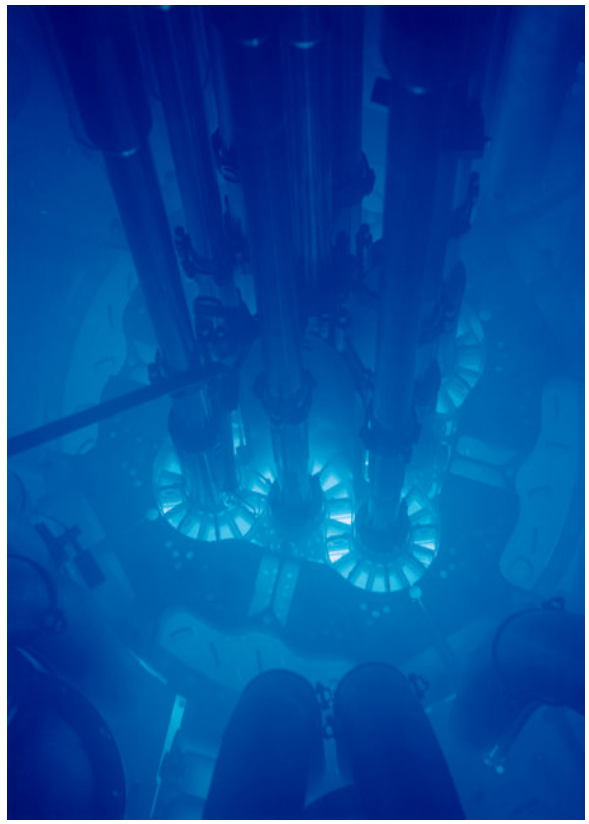
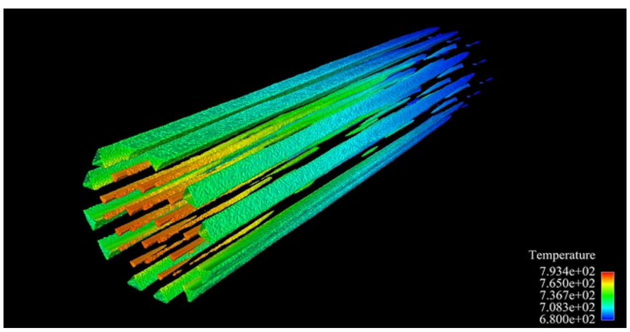
TRTR

2019







Idaho National Laboratory Presents

The National Organization of Test, Research, and Training Reactors

2019 Annual Conference

September 22 – 26, 2019

INL Meeting Center – 775 MK Simpson Blvd – Idaho Falls, ID

2019 Test Research and Training
Reactors Annual Conference

September 22 – 26, 2019
INL Meeting Center
Idaho Falls, ID

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Idaho National Laboratory
Sean.Okelly@inl.gov

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University of Missouri

About Us

The National Organization of Test, Research, and Training Reactors (TRTR) primary mission is education, fundamental and applied research, application of technology in areas of national concern, and improving U.S. technological competitiveness around the world.

Begun as a small technical group in the 1960's, TRTR quickly grew into a national organization and adopted its current name in 1976. TRTR is an affiliation of those associated with the operation, management, and regulation of non-power reactors. TRTR serves as a forum to share useful information with respect to operation, maintenance, and utilization of such facilities. An annual meeting is held in the fall of each year and is usually located at the facility of the current Chair. TRTR presents a common voice, representing all non-power reactors especially on regulatory and funding issues. TRTR also performs peer review audits of research reactors at the request of the facility to be audited. In 1997 TRTR was incorporated as a 501(c)(3) corporation. Further information on the purposes and organization of TRTR can be found in the articles of incorporation and the by-laws.

TRTR membership includes managers and directors of research reactors, educators, administrators, regulators, research scientists, and engineers. A listing of the current Executive Committee and a brief history of TRTR including past Chairs and meeting locations are available on our website.

TRTR also publishes a quarterly newsletter, which provides the latest information in all areas of interest to the membership. The newsletter is widely distributed within and outside TRTR, in the U.S. and abroad. They are currently trying to gather information about the readership and have prepared a short survey. Your input on the newsletter would be appreciated. Please take a few minutes and complete the survey at https://www.surveymonkey.com/r/FYDSWH2 or by using the QR code below.

Additional information regarding TRTR can be found on our website https://trtr.org/

2019 TRTR Meeting
Dr. Sean O'Kelly, Associate Laboratory Director
Advanced Test Reactor Complex
Idaho National Laboratory
2525 North Fremont Ave MS 7117
Idaho Falls, ID 83415
(208) 533-4710

INL Meeting Center
775 MK Simpson Blvd
Idaho Falls, ID 83415

2019 Test Research and Training Reactors Annual Conference

September 22 – 26, 2019
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Idaho Falls, ID

Schedule

Sunday, September 22, 2019		
10:00 am – 12:00 pm	ANS Stds. Mtg	Meeting Center Rm 114
2:00 pm – 5:00 pm	Exec. Comm. Mtg	Meeting Center Rm 114
For US callers dialing in from outside the local calling area: Dial the toll free number. When the auto attendant answers press 1 for conference calls and then dial the five digit Conference DN (60683). Access from Public Network: (208) 526-0683 Toll Free Access: 1-800-414-2147 Conference DN: 60683		
3:00 pm – 8:00 pm	Registration	Meeting Center
6:00 pm – 8:00 pm	Reception	Meeting Center Rm 102
Monday, September 23, 2019		
7:00 am – 5:00 pm	Registration	Meeting Center
7:00 am – 5:00 pm	Exhibits	Meeting Center Foyer/Rm 111, 112, 113
7:30 am – 8:30 am	Breakfast	Meeting Center Rm 111/112/113
8:30 am – 9:00 am	Welcome	Meeting Center Rm 102
9:00 am – 10:00 am	General Session I General Session I-A	Meeting Center Rm 102 Meeting Rm 111/112/113
10:00 am – 10:30 am	Break	Meeting Center Rm 111/112/113
10:30 am – 12:00 pm	General Session II General Session II-A	Meeting Center Rm 102 Meeting Rm 111/112/113
12:00 pm – 1:00 pm	Lunch	Meeting Center Rm 111/112/113
1:00 pm – 2:30 pm	General Session III	Meeting Center Rm 102
2:30 pm – 3:00 pm	Break	Meeting Center Rm 111/112/113
3:00 pm – 5:30 pm	General Session IV General Session IV-A	Meeting Center Rm 102 Meeting Rm 111/112/113
4:50 pm – 5:30 pm	Business Meeting	Meeting Center Rm 102

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Tuesday, September 24, 2019		
6:00 am – 7:00 am	5k Walk/Run	Idaho Falls Greenbelt
7:00 am – 5:00 pm	Exhibits	Meeting Center Foyer/Rm 111, 112, 113
7:30 am – 8:30 am	Breakfast	Meeting Center Rm 111/112/113
8:30 am – 10:00 am	General Session V	Meeting Center Rm 102
10:00 am – 10:30 am	Break	Meeting Center Rm 111/112/113
10:30 am – 12:00 pm	General Session VI General Session VI-A	Meeting Center Rm 102 Meeting Rm 111/112/113
12:00 pm – 1:00 pm	Lunch	Meeting Center Rm 111/112/113
12:30 pm – 5:30 pm	INL Tours	Meet in Meeting Center Lobby
7:00 – 9:00 pm	Evening Activity/ Light Hor d'oeuvre	Museum of Idaho Archimedes Exhibit
Wednesday, September 25, 2019		
7:00 am – 5:00 pm	Exhibits	Meeting Center Foyer/ Rm 111, 112, 113
7:30 am – 8:30 am	Breakfast	Meeting Center Rm 111/112/113
8:30 am – 10:00 am	NRC Session I	Meeting Center Rm 102
10:00 am – 10:30 am	Break	Meeting Center Rm 111/112/113
10:30 am – 12:00 pm	NRC Session II	Meeting Center Rm 102
12:00 pm – 1:00 pm	Lunch	Meeting Center Rm 111/112/113
1:00 pm – 2:30 pm	NRC Session III	Meeting Center Rm 102
2:30 pm – 3:00 pm	Break	Meeting Center Rm 111/112/113
3:00 pm – 5:00 pm	NRC Session IV	Meeting Center Rm 102
7:00 pm – 9:00 pm	Banquet	Downtown Event Center 480 Park Avenue

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Thursday, September 26, 2019		
7:00 am – 12:00 pm	Exhibits	Meeting Center Foyer/ Rm 111, 112, 113
7:00 am – 8:00 am	Breakfast	Meeting Center Rm 111/112/113
8:00 am – 10:10 am	General Session VII	Meeting Center Rm 102
10:10 – 10:30 am	Break	
NRC PUBLIC MEETING 10:30 – 12:30	NEIMA and New Criteria for Commercial Non-Power Reactors	Meeting Center Rm 102 Bridge Number: 888-322-7213 Passcode: 33407#

Monday, September 23

8:30 am – 4:50 pm		
8:30 – 8:45	Welcome	Robert Boston, DOE-ID Manager
8:45 – 9:00	Welcome and INL Overview	Marianne Walck, INL DLD and Chief Research Officer
9:00 – 10:00 General Session I – Versatile Test Reactor Project **Sean O'Kelly, Chair**		
9:00 – 9:30	Fast Test Reactor Experiment Programs	Kemal Pasamehmetoglu
9:30 -10:00	Versatile Test Reactor Preliminary Design Considerations	John Bumgardner
10:00 – 10:30 Break - Meeting Center Rm 111/112/113		
10:30 – 12:00 General Session II - Reactor Upgrades and Age Management **Rm 102 – Tom Newton, Chair**		
10:30 – 10:40	Sponsor Presentation	ThermoFisher Scientific
10:40 – 11:00	A Life Cycle and Aging Management investment strategy to sustain long term strategic irradiations at ATR	Hans Vogel
11:00 – 11:20	Breazeale Reactor Beam Lab Refurbishment Progress Report	Jeffrey A. Geuther
11:20 – 11:40	External Review of the Deuterium Cold Source Project	Mike Middleton
11:40 – 12:00	Update on status of Oregon State instrumented fuel element	Robert Schickler
11:00 – 12:00 General Session II-A - Reactor Upgrades and Age Management **Rm 111/112/113 – Melinda Krahenbuhl, Chair**		
11:00 – 11:20	Conversion of the Idaho State University AGN Control Console to Solid State Circuitry	Ashoak Naragarn
11:20 – 11:40	Lessons Learned from Upgrading the UUTR	Matthew Lund
11:40 – 12:00	UMASS Lowell I&C Upgrades	Thomas Regan
12:00 – 1:00 Lunch Meeting Center Rm 111/112/113		

1:00 – 2:30 General Session III – Research Activities Rm 102 – Steve Reese, Chair		
1:00 – 1:10	Sponsor Presentation	NAC International
1:10 – 1:30	59 Years and Counting – Ongoing Research Activities in the ZED-2 Reactor	Luke Yaraskavitch
1:30 – 1:50	The Future of Neutron Science at NCNR	Tom Newton
1:50 – 2:10	Modernization and enhancement of neutron spectrum correction software for ATR irradiation experiments	Michael Reichenberger and John Boyington
2:10 – 2:30	Innovative measurement systems for in-pile irradiation experiments	Josh Daw
2:30 – 3:00 Break – Meeting Center Rm 111/112/113		
3:00 – 4:50 General Session IV – Operations Rm 102 – Les Foyto, Chair		
3:00 – 3:10	Sponsorship Presentation	MURR
3:10 – 3:30	An Overview of TREAT Operations Since Restart	Andy Beasley
3:30 – 3:50	ATR Path to Excellence	Kelly Estes
3:50 - 4:10	Operational Overview and Capabilities of TREAT	Sam Giegel
4:10 – 4:30	Fuel Examinations at UT-Austin	Larry Hall
4:30 – 4:50	2019 Status Report-Research Reactor Infrastructure Program	Doug Morrell
3:00 – 4:50 General Session IV-A – Operations Rm 111/112/113 – Jeff Geuther, Chair		
3:10 to 3:30	Impact of Samarium on Power Distribution and Consequent Safety Rod Worths, in the Advanced Test Reactor	Nathan Manwaring
3:30 to 3:50	Reactivity Initiated Accident Testing in TREAT	Leigh Ann Emerson
3:50 to 4:10	Automation of Sensitivity Studies for U10Zr	Brenna Carbno
4:10 to 4:30	Low-enriched depletion benchmarks in the ATR	Joseph Nielsen
4:30 to 4:50	DOE Independent Oversight Program	Kevin Witt
4:50 – 5:30	**TRTR Business Meeting**	

Tuesday, September 24

8:30 – 10:00 General Session V – Research and Utilization Dave Schoonen, Chair		
8:30 – 8:40	Sponsorship Presentation	BWXT
8:40 – 9:00	Temperature and flux sensors for test reactors	Troy Unruh
9:00 – 9:20	Reestablishing Liquid Metal Cooled Fuel Testing at TREAT	Bruce Kelly
9:20 – 9:40	ATRC Neutronics Model Validation Efforts	Joshua Peterson-Droogh
9:40 – 10:00	TREAT Experiments: Sweetening Nuclear Fuels Research Through the Use of Additive Manufacturing	Cody Race
10:00 – 10:30 Break - Meeting Center Rm 111/112/113		
10:30 – 12:00 General Session VI – Advanced Instrumentation and Experiments Rm 102 – Sarah Don, Chair		
10:30 – 10:40	Information & Updates	Sean O'Kelly
10:40 – 11:00	Low Activation Materials for Holders and Containments in Test Reactor Experiments	Joe Palmer
11:00 – 11:20	Applications of low-cost computing & IO board *Raspberry Pi*	Garrett Wendel
11:20 – 11:40	TREAT Advanced Instrumentation Deployment	Kevin Tsai
11:40 – 12:00	Real-time axial neutron flux profile measurement at ATR-C	Rose Holtz
10:40 – 12:00 General Session VI-A – Advanced Instrumentation and Experiments Rm 111/11/113 – Clive Townsend, Chair		
10:40 – 11:00	Emulating a GA NM-1000 Wide-Range Channel Using an NMP-1000 and an NLW-1000	Randall Hyde
11:00 – 11:20	Deterioration and Replacement of Reactor Water Cleanup System Resin Columns at MURR	Bruce Meffert
11:20 – 11:40	Breazeale Reactor Control Console Renovation	Jeff Geuther

11:40 – 12:00	Development of a High Temperature Neutron Flux Detector	Martin Shaw
12:00 – 1:00	**Lunch (persons on tours get in line first)**	
12:30 – 5:30	**Tours – ATR and TREAT** **Busses start loading at 12:30 in front of EIL and will leave at 12:45** **Group 1** **1:15 – Tour TREAT** **2:30 – Travel to ATR** **3:00 – Tour ATR** **4:15 – Return to Idaho Falls**	**Group 2** **1:45 – Tour ATR** **3:00 – Travel to TREAT** **3:30 – Tour TREAT** **4:45 – Return to Idaho Falls**
7:00 – 9:00 pm	**Social at Museum of Idaho – 200 N. Eastern Ave**	

Wednesday, September 25

8:30 – 5:00 NRC Day		
8:30 – 10:30	NRC	
	Introduction	Greg Castro
Session #1	NEIMA implementation background and schedule implications	Duke Kennedy
Session#1a	NPUF rulemaking implications for NRC and RTR licensees	Duke Kennedy, Al Adams
Session #2	Discussion of methods available for licensees to licensing amendments more repeatable and efficient	Patrick Boyle
10:30 – 11:00	**Break - Meeting Center Rm 111/112/113**	
11:00 – 12:00		
Session #2a	NRC Summer Intern and hiring programs information	Greg Casto
Session #3	Discussion of 50.59 screening and evaluation practices	Tony Mendiola, Patrick Boyle, Greg Casto
12:00 – 1:00	**Lunch**	
1:00 – 2:30	NRC	
	Introduction	Tony Mendiola
Session #4	Operator licensing information program and revisions to examiner standards	Michele DeSouza
2:30 – 3:00	**Break – Meeting Center Rm 111/112/113**	
3:00 – 5:00	NRC	
Session #5	Facility inspections program	Kevin Roche
Session #6	Security inspection program and Part 71 spent fuel transport regulation	Bill Schuster
7:00 – 9:00 pm	**Banquet – Downtown Event Center – 480 Park Avenue** **Keynote Speaker: Harold McFarlane "70 X 70: A Brief History of Idaho's Reactors"**	

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Thursday, September 26

8:00 – 10:00 General Session VII **Dave Broussard, Chair**		
8:00 – 9:00	NSUF Research Reactor Fitness Workshop Results Panel	Brenden Heidrich
9:00 – 9:20	MIT NRL Initial Operator Training Program	Marshall Wade
9:20 – 9:40	IAEA Integrated RR Utilization Review	Ron Crone
9:40 – 10:00	IAEA Activities in Support Of Capacity Building With Use And Access To Research Reactors	Ram Sharma
10:00 – 10:10	Closing Remarks	Sean O'Kelly
10:10 – 10:30 Break		
10:30 – 12:30	NRC Public Meeting - Section 106 of the Nuclear Energy Innovation and Modernization Act (NEIMA) and New Criteria for Commercial NPUF	Duke Kennedy and Al Adams

September 23 Abstracts

9:00 – 9:30

The Need for a Fast Spectrum Materials Testing Program

Kemal Pasamehmetoglu, Director for Versatile Reactor-Based Fast Neutron Source
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Several of the proposed advanced small modular reactor (SMR) designs are fast reactors. The fuels and materials used to construct these new reactors must be tested in a prototypic reactor environment to qualify for use in the next generation fast spectrum reactors. This presentation will provide an overview of the need for a fast reactor testing program in the US and discuss some of the expected experimental programs and potential reactor designs that could be tested in the Versatile Test Reactor.

9:30 – 10:00

The Versatile Test Reactor

John Bumgardner, Associate Laboratory Director
Nuclear Science & Technology
Idaho National Laboratory
PO Box 1625 MS 3898
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John.Bumgardner@inl.gov

The first step (CD-0) to start the project that will construct a new fast spectrum reactor, the Versatile Test Reactor (VTR) was approved in 2019. Since that time, a reactor design vendor has been selected and there has been significant progress towards a conceptional test reactor design to inform budget and schedules as the next step to construct and operate the VTR by 2026. Conceptional design and potential specifications for the VTR will be discussed.

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General Session II

10:40 – 11:00

A Life Cycle and Aging Management Investment Strategy to Sustain Long Term Strategic Irradiations at ATR

Hans Vogel, Strategic Irradiation Capabilities Division Director
Advanced Test Reactor Complex
Idaho National Laboratory
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Hans.Vogel@inl.gov

This presentation will highlight ATR's Plant Health evaluation and planning for long term strategic irradiation capabilities. With US DOE direction to INL/ATR to develop a business case that includes the potential for maintaining the existing reactor operations beyond the year 2040, the cost, schedule, and risks (to operations and mission delivery) as it relates to the ATR Plant Health investment and operations strategy will be outlined.

This presentation will describe the background related to ATR maintenance and long term operations infrastructure investments, trends of operational predictability and reliability impacted by the historical investment strategy, and the path forward envisioned for ATR to be able to sustain a balance between major system, structure, and component (SSC) repair/replacement evolutions tied to the needs of sponsors and their experiment irradiation needs. Utilizing a commercial nuclear approach to Life Cycle and Aging Management programs supporting license extensions, ATR has contracted with ENERCON to benchmark and develop an overarching investment strategy tied to ATR SSC's and commercial nuclear industry experience.

Incorporation of this strategy into the elements of the ATR Beyond 2040 Business Case, a DOE directed deliverable at the end of FY 2022, is the intended outcome of this Life Cycle and Aging management approach will be presented.

11:00 – 11:20

Breazeale Reactor Beam Lab Refurbishment Progress Report

Jeffrey A. Geuther, Associate Research Professor
Pennsylvania State University
201 Old Main
University Park, PA 16802
Jag671@psu.edu

During the summer of 2018 a major infrastructure project was successfully completed at the Penn State Breazeale Reactor. The reactor support tower and grid plates were replaced, the heavy water moderator tank which couples the reactor to the beam ports was replaced, and new beam ports were installed to better utilize the Neutron Beam Lab (NBL). The reactor outage lasted three months. Since August 2018 the reactor has been operational and usable for beam lab experiments. However, a significant amount of work remains before the NBL is fully utilized. This progress report will include the installation of a new radiography cave and neutron transmission apparatus. Beam lab shielding and the disposal of retired radioactive apparatus from the reactor pool will be discussed. The plans and a status update for the expansion of the beam laboratory and reactor office and teaching space will be shared. Neutron flux measurements from several beam ports using bare and Cd-covered gold foils will be presented.

11:20 – 11:40

External Review of the Deuterium Cold Source Project

Mike Middleton
NIST Center for Neutron Research
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Gaithersburg, MD 20899 NCNR
Michael.middleton@nist.gov

As part of the process to convert the NBSR 20 MW research reactor to LEU fuel, funding has been granted by the National Nuclear Security Administration of the Department of Energy for an upgrade of NCNR's Cold Source Capability. This upgrade involves the conversion from a hydrogen moderated cold source to a deuterium moderated cold source. This upgrade is significant in scope, including the need for a larger helium refrigerator. The new 7kW helium refrigerator has been installed and commissioned providing the necessary cooling capacity. Most major components except for the cryostat have been procured and delivered to NCNR. There are still numerous issues to resolve and planning for installation in 2023 is underway.

At this point, NCNR wishes to evaluate the risk associated with the installation and future operation of the new deuterium moderated cold source. An external review was held May 14th and 15th of this year. The review committee consisted of three internationally known experts and the fourth member was the Lead Engineer from the NIST Fire Protection Group. The purpose of the review was to assess and potentially reduce the risk associated with such a large and complex project as well as, to ensure the project will be ready to proceed to the installation phase and to identify issues that may impede the installation and operation of the new deuterium source. Numerous issues were identified during the preparation of presentations for the review and as a result of these presentations to the Review Committee. Identifying and resolving critical issues before they become serious problems serves to reduce the overall risk. The value of an external review cannot be overstated as a means for risk management and mitigation.

The charge of the review committee was to determine if the design goals of the new deuterium cold source could be realized, ensure all safety issues are being addressed and evaluate the progress of the project as a whole. Additionally, any additional concerns should be brought to the project teams' attention. A Report from the Review Committee has been issued and the project team is working to address each one of the issues and report back to the committee members.

11:40 – 12:00

Update on Status of Oregon State Instrumented Fuel Element

Robert Schickler
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This presentation will give the TRTR community an update on the status of OSU's Instrumented Fuel Element. Oregon State worked with the Nuclear Regulatory Commission to obtain a license amendment to remove the requirement of an IFE for reactor operations, with the concession that transient operations would be precluded. The future desire for OSU is to obtain another license amendment to allow for transient operations without an instrumented fuel element, which will require some thermal hydraulic analysis.

General Session II-A

11:00 – 11:20

Conversion of the Idaho State University AGN Control Console to Solid State Circuitry

Mary Lou Dunzik-Gougar, Ashoak Nagarajan, Craig Shull, Jay Kunze
James Larson, William Phoenix, and Stuart Bonduarant - Consultants
Idaho State University
921 South 8th Avenue
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kunzejay@isu.edu

The AGN 201 Training Reactor at Idaho State University, has been licensed by the NRC as R-110 since 1965. It was originally built by Aerojet Nuclear about 1955. In 2017 a team was assembled to develop a new console design, The challenge was to replace the vacuum tube circuitry with solid state circuitry, capable of operating with input detector currents as low as 10-14 amperes, using the same nuclear detectors that we presently providing input to the control console.

To avoid changes to the main licensing document, the Technical Specifications, it was decided to essentially duplicate all of the current circuitry with equivalent solid-state circuitry, replacing the vacuum tubes with equivalent transistor components, and the 1950 era relays with modern solid-state relays. The ultimate goal of the new design was to make the circuitry, the signal outputs, and the controls essentially the same as in the original console. A deliberate decision was made to not transition to digital electronics for the nuclear instruments and trip functions, to avoid the complexity associated with digital electronics reliability issues.

It was determined that safety set points for the automatic shutdown circuits were to be the same as in the original console and as described in the Technical Specifications. However, it was decided to replace the outdated gear drive control rod position indication with digital encoders feeding into digital displays for rod position indication, replacing the gear system readout for the fine control and course control rods. The two safety rods would be maintained with merely "full-in’’ and "full out" position indication. The 50.59 Evaluation clearly showed that the electronic light position indicators would be as reliable the original system. Furthermore, the design basis accident analyzed in the existing Final Safety Analysis Report was unaffected by the operator’s knowing the rod position indication.

The design basis accident does not involve the control rod positions, or an ability of the control rods to influence that accident. That analysis does not depend in anyway on the protection that the control rods and their automatic scram ability could have on safe operation of the reactor. All of the other changes in the circuitry were analyzed in the 50.59 Evaluation, and none violated the requirements that a change occurred in the severity or probability of the design basis accident.

Acknowledgments: The authors wish to acknowledge the contributions made by professional nuclear engineering employees at Idaho State University: Maxwell Daniels, Ted Pollock, Chad Pope, and Matthew Beatty.

11:20 – 11:40

Lessons Learned from Upgrading the UUTR

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The University of Utah TRIGA reactor (UUTR) is completing installation of three new neutron monitoring channels and starting the initial phase of replacing the console. This presentation outlines lessons learned from the installation of the new channels, including improving signal with cable routing, in-core detector installation, calibration, and 50.59 process. This presentation also outlines the initial phase of replacing the UUTR console, which is the initial engineering phase with the vendor. Lessons learned include strategies for creating a detailed scope of work for bidding, selection of sensors, ways to speed up the process, and effective project management.

11:40 – 12:00

UMASS Lowell I&C Upgrades

Thomas Regan, Reactor Engineer
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The UMass Lowell Research Reactor (UMLRR) has had several I&C challenges this year. These issues were a result of aging equipment with obsolete components that could no longer be maintained or repaired. The overall effect of these I&C issues was mitigated by the installation and upgrade of our existing circa 1990’s detectors and amplifiers. The issues to be discussed in this presentation include the following: 1. CIC detector replacement and re configuration; 2. Linear power amplifier replacement; and 3. Replacement of the LogN Period/Power channel (detector and amplifier) in its entirety with a fission chamber-based system.

General Session III

1:10 – 1:30

59 Years and Counting – Ongoing Research Activities in the ZED-2 Reactor

Luke Yaraskavitch, Applied Physicist
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ZED-2, a zero power and heavy water moderated research reactor, has been operational since its first criticality in September 1960. The large test volume (3.3 m diameter, 3.3 m in height) made it an essential part of the CANDU power reactor program over the years, along with advanced fuel studies and research reactor support. While ZED-2 still offers significant CANDU physics capability in continuing support to programs with the national regulator and the CANDU industry, an ongoing broadening of pursuits for the experimental program has complemented historic large-scale power reactor physics validation programs. In recent years, the interest has focused on new experimental techniques, advanced fuel studies, and kinetics measurements. One of our goals is to challenge the quality of delayed neutron data (including photoneutrons, a problem reserved for reactors containing deuterium and beryllium) and the spatial simplifications of the reactor. In this talk, we present recent kinetics measurements encompassing (Pu, U), (Pu, Th), and (233U, Th) oxide fuels, and new reactor kinetics measurement techniques. We also highlight efforts to better align our educational offerings with the needs of the community.

1:30 – 1:50

The Future of Neutron Science at NCNR

Thomas Newton PhD, Deputy Director
Chief of Reactor Operations and Engineering
NIST Center for Neutron Research
Building 235, Room K105
100 Bureau Drive, Stop 6100
Gaithersburg, MD 20899
Newton, Thomas H. (Fed) via Rarcc <rarcc@workspace.ans.org>

Neutron scattering research at the NIST Center for Neutron Research has grown enormously over the last generation, with over 2500 researchers using the NCNR each year. Neutrons to each of the thirty neutron instruments are supplied by the 51-year-old NBSR. Recent interest in the future of the NCNR neutron source has precipitated discussions of options, including designing and building a new reactor at NIST.

The preliminary design for the new NIST reactor is for a 20 MW compact LEU core with options for multiple cold sources, with the potential for a vast improvement in neutron science capabilities, putting the new facility on par with any existing or planned neutron scattering facility worldwide.

1:50 – 2:10

Modernization and enhancement of neutron spectrum correction software for ATR irradiation experiments

Michael Reichenberger, PhD and John Boyington
Radiation Measurement Laboratory
Idaho National Laboratory
PO Box 1625 MS 7111
Idaho Falls, ID 83415
Michael.Reichenberger@inl.gov
Johh.Boyington@inl.gov

Neutron activation dosimetry is still the most common method of monitoring neutron fluence for irradiation experiments. Several software packages exist to perform neutron spectrum corrections based on these measurements. However, these tools, like many nuclear calculation tools, do not utilize advantages of modern programming languages and can be challenging to implement. Recent efforts at the ATR Radiation Measurement Laboratory have translated the capabilities of the STAYSL PNNL software suite for reactor dosimetry into a Python module. The features of the Python module not only reduce the procedural complexity of neutron spectrum corrections, but also greatly improve the flexibility of the software to enable users to perform new calculations, incorporate these calculations into other software, and present their results in different ways. To illustrate this capability, a new method was developed which calculates the saturation ratio for an irradiated material under a transient neutron flux. The conventional approach requires steady-state powers be input, but the more flexible Python module can accommodate this improved method.

2:10 – 2:30

Innovative measurement systems for in-pile irradiation experiments

Joshua Daw, Instrument Engineer
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Innovative measurements in nuclear reactors must overcome unique challenges to be successful. The next generation of data collection and validation is expected to require acoustic and optically based sensors to provide high resolution data in specially designed measurement systems. Current activities under development at INL and deployment in test reactors worldwide includes optical fiber and acoustic sensors and measurement systems including the Resonant Ultrasound Spectroscopy - Laser instrument.

General Session IV

3:10 – 3:30

An Overview of TREAT Operations Since Restart

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The Transient Reactor Test (TREAT) Facility was restarted in November 2017 after a 23-year hiatus in operations. Irradiation of fueled experiments commenced in September 2018. This presentation will provide a review of TREAT operations since restart. The primary focus will be on experiment operations during the first year of fueled TREAT experiments. Additionally, the presentation will provide a look ahead at the next year's planned operation.

3:30 – 3:50

ATR Path to Excellence

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Operating a nuclear test reactor can be a delicate balance between maintaining a rigorous, formal operational environment guided by stringent procedures verses that of a university environment. Either environment must satisfy requirements of the oversight regulator while maintaining the trust of the local community. Test reactor operators are hired with diverse backgrounds that may, or may not, instill an appreciation for the value of a structured Conduct of Operations framework. This presentation looks at the Advanced Test Reactor's approach to hiring a diverse workforce that balances university graduates and Navy veterans then transforms the cohort into a workforce focused on Conduct of Operations principles outlined by the Institute of Nuclear Power Operations (INPO). The process is designed to optimize ATR's operational tempo and intended to position ATR as the national and international materials and fuels irradiation testing facility of choice.

3:50 – 4:10

Operational Overview and Capabilities of TREAT

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The Transient Reactor Test (TREAT) facility operated for over 30 years with the purpose of providing accident type events to test the limits of prototypical nuclear fuel specimen. Since TREAT's official restart in 2018, the facility has performed a variety of transients and has provided valuable tests for programs such as Accident Tolerant Fuels (ATF) and the National Aeronautics and Space Administration (NASA). TREAT has developed a unique process to evaluate an experiment's goals while remaining within the safety limits of the reactor core. This process involves reconfiguring the core, characterizing the new configuration, and testing the desired transients using simulations and trial transients. The Automatic Reactor Control System (ARCS) controls and monitors the reactor while performing these transients and has the capabilities to perform temperature limited and shaped transients similar to Reactivity Insertion Accidents (RIA) or Loss of Coolant Accidents (LOCA).

4:10 – 4:30

SUPPORTING FUEL EXAMINATIONS OF SPENT FUEL IN SUPPORT OF INTEC FUEL EXAMINATION TEAM

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The inspection of spent fuels is a required step within the process to transfer spent fuel from a site to Idaho National Laboratory (INL) for storage at INTEC CPP-603 IFSF. Utilization of The University of Texas at Austin TRIGA reactor has been steadily increasing over the years. To assist in the extension of life of the reactor, The University of Texas at Austin received two shipments of partially used fuel. The partially used fuel shipments, the spent fuel stored and the requirement to be able to unload the reactor if required for maintenance on, or around the core, has filled all available fuel storage positions. To provide the ability for The University of Texas at Austin to receive more fuel for continued operations, it must first transfer spent fuel to INL.

Spent fuel is stored in wells in the floor of the reactor bay. The spent fuel must be moved to the reactor pool to support inspection of each element. Additionally, a fuel inspection jig must be used to measure the location of scratches or other flaws and take a gamma reading of each element. Finally, a camera system must be suspended in the pool with the ability to traverse the entire length of the fuel element and zoom in and out in order to record all aspects of the inspection.

The fuel must be able to rotate to examine all surfaces for scratches, pitting, discoloration and holes. All locations of deformations are required to be annotated on fuel examination data sheets and voice and video recordings. The process is slow, so all fuel to be inspected should be in the pool to reduce time between element inspections. Damaged fuel stored in a different area needs to be noted prior to inspection, and a means to shield it during an inspection, in a medium of air or other material, must be determined prior to the start of the inspection.

The completion of spent fuel inspections allows for the identification of any fuel elements that may require further inspection to determine if alternative shipment will be required. Early inspection of fuel allows for a current inspection to be on file ensuring a timely production of documentation and the ability to determine a means for modified transfer of any damaged elements. Even with no current plans for a shipment of spent fuel out of The University of Texas at Austin, the early inspection of elements will allow for a much easier process when future shipments become authorized.

4:30 – 4:50

2019 Status Report - Research Reactor Infrastructure Program

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This presentation will discuss the purpose and scope of the Department of Energy - Research Reactor Infrastructure (RRI) Program. Personnel involved in the program will be introduced and contact information will be provided for team members. Information will be provided to conference attendees as to the status of the core activities of the program. These activities include fresh fuel element fabrication and spent nuclear fuel shipment returns to the DOE. Current and future issues pertinent to the RRI program will also be presented.

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General Session IV-A

3:10 – 3:30

Impact of Samarium on Power Distribution and Consequent Safety Rod Worths, in the Advanced Test Reactor

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For each operating cycle of the Advanced Test Reactor (ATR) at Idaho National Laboratory, a Core Safety Assurance Package (CSAP) is necessary to demonstrate compliance with the safety basis approved by the United State Department of Energy (DOE). One tool used in CSAP development is the RHODOL computer code. The safety-significant use of RHODOL is prediction of Samarium-149 (Sm-149) reactivity in each of five power-producing lobes. Sm 149 reactivities are used to predict power distribution, which is necessary to predict safety rod worths. This model can be further simplified by using only an assumed inventory of Sm-149. This work demonstrates that Sm-149 reactivities can be conservatively assumed instead of calculating with RHODOL.

3:30 – 3:50

Reactivity Initiated Accident Testing in TREAT

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The Transient Reactor Test facility (TREAT) was constructed in the late 1950's. The reactors flexible design and multi-mission nature provided thousands of transient irradiations for numerous reactor fuels and transient types before being placed in standby in 1994. The reactor resumed operations in 2017 to reclaim its crucial role in nuclear-heated safety research. A principal goal of restarting the reactor was to perform transient testing of Accident Tolerant Fuels (ATF), supporting their safe adoption by the commercial Light Water Reactor (LWR) fleet.

In support of the Accident Tolerant Fuels mission, multiple capsules have been designed and are currently being designed to test fuel specimens under varying conditions. The Minimal Activation Retrievable Capsule Holder (MARCH) system was designed to support high throughput testing by using a modular approach where an outer containment structure will act as the primary safety containment. The MARCH system is designed to house various modules for testing different fuel systems in different environments. The near-term tests for the ATF concepts will use the Static Environment Rodlet Transient Test Apparatus (SERTTA), aka MARCH-SERTTA. MARCH-SERTTA is capable of testing a single ATF rodlet 10 cm in length in a static pool of water with initial conditions up to 200°C and 500 psi.

The purpose of the MARCH-SERTTA device is to perform integral tests evaluating the Pellet Clad Mechanical Interaction (PCMI) performance of LWR fuel concepts in design basis Reactivity Initiated Accidents (RIA). This will be accomplished by testing a variety of ATF fuel concepts under varying initial thermal-hydraulic conditions and varying prompt energy pulses. The flexibility of TREAT and the MARCH-SERTTA capsule enables testing of a unique, non-fueled, rod specimen under similar conditions as the fueled specimens to perform separate-effect tests. This non-fueled rod will be used to study the thermal-hydraulic behavior (specifically determine the critical heat flux) during these fast prompt transients.

3:50 – 4:10

Automation of Sensitivity Studies for U10Zr

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The Advanced Test Reactor at Idaho National Laboratory is the world's premier nuclear test reactor. It brings together the areas of academia, commercial nuclear power industry, and the federal government. To help with the process of preparing experiments for irradiation in the Advanced Test Reactor, many new computer tools are being developed. For this research a tool was developed to automate sensitivity studies. The program comes in two parts. First a material converter that breaks a given material into its constituent parts and gives the density of each of those parts. The second part is a keyword replacement program that looks through a Monty Carlo N-Particle input file and replaces a specific cell with a new material and density. It will also append a new material card to the end of the file. This tool was used to test the sensitivity of part of the Marmot Validation Plan. It was tested to see if enrichment values of Uranium 235, 0.2%, 0.71%, 1%, 2% 5% and 10%, would significantly affect the experiment. The results were examined, and it was seen that the 10% enriched Uranium produced significantly more heat than the depleted Uranium. This could have significant impact on the experiment depending on the design of the experiment.

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4:10 – 4:30

Low-Enriched Depletion Benchmarks in the Advanced Test Reactor

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Validation benchmark experiments for low-enriched uranium (LEU) U-Mo fuel systems are currently being developed from existing experiments irradiated in the Advanced Test Reactor (ATR) and ATR Critical Facility (ATRC). The experiments chosen include the ATR Full-size plate In center Flux trap Position (AFIP-7) experiment and the Ki-Jang Research Reactor Lead Test Assembly (KJRR-LTA) located in the Northeast Flux Trap. Each experiment was modeled using a high-fidelity three-dimensional Monte Carlo code with depletion capabilities. This paper focuses on the AFIP-7 experiment. The AFIP-7 experiment was irradiated in the center flux trap of the ATR during operating cycles 149B and 150B for approximately 54 and 41 days respectively. The AFIP-7 experiment consisted of four curved plates composed of U-10Mo with an enrichment of 19.75% U-235. The active fuel meat was approximately 38.5 inches (97.8 cm) long and 0.013 in. (0.03302 cm) thick. The plates were inserted into the center flux trap such that the axial center of the plates was located approximately at core midplane of ATR. The experiment model for each plate was discretized into 10 azimuthal and 77 axial regions to support high-fidelity burnup calculations to compare to Post Irradiation Examination (PIE) data.

The ATR model consisted of the actual fuel loading, as reported by the ATR Reactor Engineering organization. The other experiments were modeled as simplified experiments with similar loadings and compositions to maintain reactivity, which have been shown to result in minimal effects on the benchmark results. The ATR was modeled with actual Outer Shim Control Cylinder (OSCC) and Neckshim positions as well as Reactor operating power, as reported by the reactor data acquisition system.

This paper provides the following results in support of the benchmark:

1. Calculated eigenvalue (k_{eff}) for the Monte Carlo model as during the depletion simulation for each operating cycle.
2. Calculated ATR Lobe Powers for each timestep from the Monte Carlo simulation.
3. Detailed power distribution of the AFIP-7 experiment at the beginning of life.
4. Detailed distribution of the fission density at the end of irradiation of the AFIP-7
5. experiment.
6. Comparison of the burnup between the calculated results and the PIE data.

The results of this work can be used to validate reactor physics codes used in the support of reactor design and conversion from high enriched uranium to low enriched uranium.

4:30 – 4:50

DOE Independent Oversight Program

Kevin Witt
Department of Energy

The purpose of this presentation is to provide an overview of the DOE Office of Enterprise Assessments (EA) and a synopsis of recent assessment activities that pertain to DOE reactor facilities.

EA performs independent assessments for DOE senior leadership that report on whether Departmental operations provide for the safety of its employees and the public. Because EA reports directly to the Office of the Secretary, it is organizationally independent of the DOE entities that develop and implement security and safety policy and programs; therefore, EA can provide a “check and balance” function by objectively observing and reporting on the performance of DOE Federal and contractor organizations’ implementation of security and safety policies and programs.

A brief overview of recent EA assessments at DOE nuclear facilities can provide helpful considerations for DOE reactor facilities to make improvements in various processes and programs that can result in increased effectiveness and efficiency.

September 24 Abstracts

General Session V

8:40 – 9:00

Temperature and Flux Sensors for Test Reactors

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Development, deployment, and commercialization projects of new or enhanced temperature and neutron flux sensors are currently being led by the High Temperature Test Laboratory at Idaho National Laboratory. These sensor projects include the commercialization of high temperature irradiation resistant thermocouples, the commercialization of delayed and prompt response self-powered neutron detectors, and the research and development of advanced manufactured sensors for irradiation experiments. This includes the technology maturation of sensors using TREAT, ATRC, and ATR as testbeds for understanding sensor performance in a variety of radiation environments.

9:00 – 9:20

REESTABLISHING LIQUID METAL COOLED FUEL SAFETY TESTING AT TREAT

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The historic Mk series experimental sodium loops were the prominent testing platform for Transient Reactor Test facility's (TREAT) period of historic sodium fast reactor (SFR) safety research, but their design bases, supply chain, fabrication and operational expertise has been greatly diminished. It is necessary to re-establish sodium loop experimental capabilities to support future SFR safety research at TREAT.

The TREAT sodium loop cartridge (NLC) is to provide the support configurations necessary to conduct liquid metal-cooled fuel safety research experiments with up to seven uranium and/or plutonium-bearing fresh or pre-irradiated fuel pins. The NLC will provide prototypic liquid metal-cooled fast reactor thermal-hydraulic conditions, provide heating and sodium re-melt capabilities, facilitate the use of test fuel motion diagnostics, support test instrumentation, and provide containment for associated hazards.

A Concept of the NLC has been realized and consists of an annular piping system that provides pre heated flowing liquid sodium through an experiment during induced nuclear heating in specimens to simulate power cooling mismatch conditions in nuclear reactors at the (TREAT) facility. The NLC is intended for use with a wide variety of test fuel types and bundles in the form of a removable test train that contains the instrumented test fuel bundle specific to a program. The test leg of the loop also includes an extension which serves as a gas plenum and provides the entrance through which the test train is inserted into the loop. In operation, sodium flows upward past the test fuel. During the transient test the NLC will record conditions of pressure, temperature, and coolant flow (sodium) at multiple pre-determined locations in the cartridge and test specimen. A specially designed Annular Linear Induction Pump (ALIP) circulates the liquid sodium.

The NLC testing platform will be a versatile and reusable experiment platform for use at the TREAT facility. While utilizing modern materials and fabrication techniques the NLC will be a more efficient and capable testing loop than its predecessors.

9:20 – 9:40

ATRC Neutronics Model Validation Efforts

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Some of the experiments located near the ATR fuel have the potential to impact the ATR core fuel performance. These types of experiments sometimes are inserted and measured first in the ATRC before being approved for irradiation in the ATR. Two of the main parameters looked at in the ATRC include a change in reactivity and changes to the axial fission profile in the ATRC fuel plates. With the advancements in computational power and improvements in neutronic codes, it is expected that the changes in reactivity and change to the axial fission profile in the ATRC fuel plates can be accurately predicted with neutronics codes instead of in core ATRC experiments. However, to switch from using the ATRC to using an advanced neutronic code a comprehensive validation effort is needed to demonstrate the accuracy and predictability capability of the advanced Monte Carlo code neutronic code. The validation plan includes creating a detailed model of the ATRC based on engineering drawings, assessing potentially gaps in previous ATRC experiments and performing experiments to fill those gaps, and validating the results from the advanced Monte Carlo code model to the experimental results. The first step was to compare all of the neutronic model input variables, including dimensions and materials against current engineering drawings of the ATRC. These references for each dimension and material will be permanently stored in a git repository. The next step is to assess potential gaps in previous ATRC experiments and performing experiments to fill those gaps. From a preliminary analysis of the ATRC model, it was determined that there were differences in the model as compared to experimentally results from the NW and SE lobe. Also, after assessing the experiments, it was found that almost all of the experiments never significantly perturbed the axial fission profile density. Based on these findings, additional experiments have been scheduled for the ATRC to fill in these gaps. The final step in the validation effort will be to validate the ATRC model with neutronic experiments over a wide range of experiments and experiment positions. For the multitude of experiments performed in the ATRC the data that is currently available include the following information: changes in reactivity, fuel plates axial fission profile in multiple locations within the same fuel plate and within multiple fuel plates, power distribution and power split within the 40 fuel elements, shim rotation needed to achieve criticality. It is expected that there will be differences between the advanced Monte Carlo code model and the experimental results. However, to validate the advanced Monte Carlo code model with the experimental results, the difference will need to fall within the uncertainty of the model and the experiments. It is only after the model has been updated to the current engineering drawings, and the model has been validated against a wide range of experiments will there be enough evidence to justify using the advanced Monte Carlo code models to predict the changes in reactivity and axial fission profile in the ATRC fuel plates.

9:40 – 10:00

TREAT Experiments: Sweetening Nuclear Fuels Research through Use of Additive Manufacturing

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Since being restarted in late summer of 2017 TREAT has already completed multiple experiment campaigns. In addition, TREAT experiment designs have been pushing the envelope for use of additive manufacturing in the nuclear fuels research. The use of additive manufacturing for TREAT experiments has lowered the cost and allowed for intricate experiment design and capability. This presentation shows how additive manufacturing was used for some of the various experiments as well as future planned uses.

General Session VI

10:40 – 11:00

Low Activation Materials for Holders and Containments in Test Reactor Experiments

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For fueled experiments or experiments with highly activated specimens, there is no benefit to selecting low activation materials for holders or containments. However, some experiments, such as those with graphite or SiC specimens, or most medical isotopes, can be benefited by selecting low activation materials. For many experiments the bulk of the cost and time required to complete, is expended in the post irradiation phase. For some of these experiments, shipping and examination costs can be dramatically reduced by careful selection of materials. This presentation will discuss low activation material candidates, the effects of impurities in these materials, and other practical issues associated with such materials. Examples of Advanced Test Reactor experiments utilizing low activation materials will also be provided.

11:00 – 11:20

Applications of low-cost computing & IO board *Raspberry Pi*

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The Raspberry Pi is a low cost, fully functional, Linux computer and I/O device. Of primary interest is the Raspberry Pi's flexibility, cost effectiveness and community support. Each of these qualities allows the effective use of a Raspberry Pi for developmental platforms. This device has been employed for a variety of systems at The Radiation Science and Engineering Center (RSEC).

A few illustrative projects were selected to showcase unique environments where the Raspberry Pi was utilized. One example involves a string of several interrelated projects pertaining to real-time processing of The RSEC's TRIGA reactor parameters from the digital control system. A second example focuses directly on the Raspberry Pi's ability to act as an interface for controlling a neutron beamport shutter. Finally, an example that integrates several of these features in a single project; a Raspberry Pi that controls and acts as an interface for experiments testing the areal density of borated aluminum.

11:20 – 11:40

TREAT Advanced Instrumentation Deployment

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Capability development and qualification of advanced in-pile instrumentation is ongoing to support the goals of advanced reactor technologies and a variety of other science missions. Irradiation testing of in-pile instrumentation in the Transient Reactor Test (TREAT) facility is a unique and critical component of instrument qualification for experiment deployments. To date, seven different types of sensors measuring neutron flux, temperature, and various mechanical properties have been tested or are undergoing testing at TREAT, with few already deployed in experiment capsules.
Irradiation testing of in-pile sensors at TREAT are mostly facilitated by guide tubes in the form of removable titanium holders. Sensors are first assembled in the Ti-holders and are then inserted into TREAT cooling channels. Since transient prescriptions and trials performed at TREAT are experiment driven, the neutron flux and temperatures experienced by the sensors are prototypic of upcoming experiments providing researchers baseline measurements. Additional irradiation capability termed the Materials and Instruments Modular Irradiation Capability (MIMIC) uses TREAT experiment hardware to provide a core center testing location of multiple sensors near each other for benchmarking and comparison. In-pile testing of sensors in TREAT provides useful information on baseline sensor behavior. The instrument technologies are of strategic importance for achieving near- and long-term, cross-cutting experiment objectives at TREAT. Instrument characterization in TREAT is critical for providing qualified instruments for future experiments.

11:40 – 12:00

Real-time axial neutron flux profile measurement at ATR-C

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Real-time characterization of irradiation facilities is necessary to improve the utilization of the core capabilities of test nuclear reactors. Observing how the local neutron flux level changes as control elements are moved will transform our understanding of the underlying physical phenomena that govern the operation of present and advanced nuclear reactors, ultimately providing valuable information for the nuclear energy industry. Therefore, advanced sensors can significantly reduce time and cost of experiments, improve our understanding of the experimental environment, and enable verification and validation of simulation and modeling methods. We propose to fabricate and deploy a real-time axial neutron flux monitor, leveraging proven technologies, to characterize the transient that occurs in the small B positions at the Advanced Test Reactor Critical facility. The knowledge gained from this experiment will improve the analysis capabilities of reactor experimenters and reduce uncertainties in irradiation experiments. This proof-of-concept measurement will lay the foundation to support future testing at the Advanced Test Reactor and other advanced reactors, opening the door for both external and direct programmatic funding.

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General Session VI-A

10:40 – 11:00

Emulating a GA NM-1000 Wide-Range Power Channel Using an NMP-1000 and an NLW-1000 at NTHU

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The first- and second-generation General Atomics' digital TRIGA™ Consoles used a circa-1985 NM-1000 channel. This was a digital channel controlled by an RCA 1802 microprocessor board that computed linear percent power across 11 decades (10-9to 102%Pwr). Needless to say, the NM-1000 has been obsolete for several decades at this point. The TRIGA reactor at National Tsing-Hua University (NTHU) has one of these units that was failing. Budgetary constraints prevented the replacement of the full console and I&C system; they needed to replace the NM-1000 with one (or more) channels that would exactly replace their NM-1000 without any modifications to the console's QNX application code.

The closest relative of GA's NM-1000 is the combination of the NLW-1000 and NMP-1000. The NLW-1000 is a wide-range log power and period channel, the NMP-1000 is a wide range linear channel. Unfortunately, these two channels communicate with a host computer system using Ethernet, whereas the NM-1000 connects via RS-232. Furthermore, the communication protocols for the NM-1000 are completely different from the Ethernet protocols the NLW/NMP use. Because the NTHU console software could not be changed, some mechanism was needed to translate the information from the NMP/NLW channels into a form acceptable to the QNX console application.

The solution was to devise the *NMemu*(NM-1000 emulator). This was a small box containing a small Ethernet-based single board computer with an RS-232 port. The NMemu device reads the current power and period values from the NMP-1000 and NLW-1000 instruments, applies appropriate filters and modifications to the data, and then transmits it to the QNX application across RS-232 using the NM-1000 protocol.

11:00 – 11:20

Deterioration and Replacement of Reactor Water Cleanup System Resin Columns at MURR

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After 52+ years on service, the carbon steel, rubber-lined resin columns of the reactor water cleanup system at the University of Missouri Research Reactor (MURR) were replaced with new stainless-steel columns with minimal effect to reactor operation. Age and gamma radiation dose caused the natural rubber inside the columns to deteriorate reducing the resin and overall water cleanup performance. This presentation will provide a brief overview of the system, chemical and mechanical indications of the column liner deterioration, direct and indirect effects of the column liner deterioration, planning and procurement for replacement resin columns, timeline and process of the column replacements, design improvements to the system, and the post-replacement performance indicators of the reactor water cleanup system with new resin columns.

The presentation will include several pictures to allow the audience to grasp the full extent of this project.

11:20 – 11:40

Breazeale Reactor Control Console Renovation

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The Penn State Breazeale Reactor is controlled by an analog-digital hybrid console. The safety channels are all analog circuits, but the operator interface, rod control, and uncredited safety functions are provided by a computer-based digital console. The digital control console (DCC) was originally developed by AECL in the early 1990's and was later upgraded; however even the upgraded computer hardware has been obsolete for more than a decade, and the reliability of the digital console is beginning to decline.

A FY2016 NEUP reactor infrastructure grant provided the facility with the funding necessary to replace both the DCC with a more modern system, and also to install a digital safety system. A Triconex digital safety system will be installed side-by-side with the analog drawers until sufficient data are gathered to support a license amendment request. The operator interface and rod control functionality of the DCC can be replaced through the 50.59 process, and a Foxboro system will be installed to replace the existing AECL system.

This presentation will summarize the functionality of the digital console component at PSU and the plans for console programming, installation, and testing.

11:40 – 12:00

Development of a High Temperature Neutron Flux Detector

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Ultra Electronics has "re-developed" a neutron detector that has been successfully tested to 1000 degrees Celsius and suitable for monitoring of reactor power for advanced high-temperature gas reactors, such as some proposed SMRs. This presentation will discuss some of the design details and operating characteristics of the neutron flux monitors.

September 26 Abstracts

8:00 – 9:00

NSUF Research Reactor Fitness Workshop Results Panel

Brenden Heidrich – Lead
Infrastructure – Matt Lund (Utah); Regulation – Bruce Meffert (MURR);
Staffing – Jeff Geuther (Penn State); Utilization – Clive Townsend (Purdue)
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The Nuclear Science User Facilities has been working with the National Organization of Test, Research, and Training Reactors to collect input from the US university reactor community on their current and future needs. The effort started with a web survey in March to collect initial data. NSUF held a follow-up workshop in July at the Center for Advanced Energy Studies in Idaho Falls. We identified four areas of interest in the university research reactor community that can affect future operations and sustainability of the reactors: capital infrastructure, regulatory burden, staffing and knowledge transfer, and utilization and relevancy. Members of the community presented challenges and best practices from their facilities. Discussions were held to create and distill the list of challenges for each area. A working group was formed for each area to continue the discussion and prioritize the challenges. NSUF and the working groups intend to create a final recommendations report by the end of the year. This panel session will discuss the workshop and summarize the discussion in the four topic areas. The audience is encouraged to add to the discussion.

9:00 – 9:20

MIT NRL Initial Operator Training Program

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The MIT Nuclear Reactor Laboratory supports a structured, comprehensive Initial Operator Training Program to prepare new hires for the NRC licensing examination. Each year the NRL staff train 5-10 new operators, whose backgrounds range from Navy nuclear veterans to college freshmen with no prior nuclear education – similar to most other TRTRs.

The training program is based on a Navy-style qualification process in which trainee's self-study specific knowledge modules and then demonstrate their understanding of these topics through oral and written checkouts. In addition to book learning, lectures, and quizzes, the trainees receive hands-on training with routine and non-routine practical factors, including reactor startups and shutdowns, operational checklists, instrument calibrations, and refuelings.

This presentation outlines the elements of the NRL Initial Operator Training Program and describes the training process culminating in the NRC licensing examination.

9:20 – 9:40

IAEA Integrated RR Utilization Review

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There are 252 research reactors currently considered to be "in operation" in 55 countries, some are utilized to full capacity in education, research, the production of medical isotopes and the modification of materials for industrial purposes. Several countries have expressed the need for support from the IAEA to review the strategic plans and improve the utilization of their facilities. A new assessment service is now available to research reactor operators to evaluate facility utilization and offer advice to increase that utilization. Recently, a team of experts from the IAEA provided a pilot assessment of the 250 kW TRIGA Mark II research reactor at the Pavia University's Laboratory of Applied Nuclear Energy, assessed the strategic plan and corresponding action plan for the reactor, the utilization level based on key performance indicators, opportunities and constraints that could limit further development of its services and products, and gaps and areas of improvement for effective, efficient and sustainable utilization of the facility. This presentation will outline the scope of a typical assessment and inform the TRTR community of this IAEA service.

9:40 – 10:00

IAEA ACTIVITIES IN SUPPORT OF CAPACITY BUILDING WITH USE AND ACCESS TO RESEARCH REACTORS

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The IAEA, in its programme on research reactors (RRs), supports Member States in enhancing safe and sustainable operation and effective utilization of RRs; also including capacity building with use and access to RRs. About 70% of 255 operational RRs are involved in activities related to education and training; covering wide range of candidates from students to highly qualified professionals (RR and NPP operators & regulators). Such activities support the development and use of nuclear technology and help in greater public acceptance of nuclear technology and enhancing stakeholder's support.

The major IAEA activities in this field are (a) Internet Reactor Laboratories (IRL), (b) Regional Research Reactor Schools; (c) Eastern European Research Reactor Initiative (EERRI) course and (d) International CEntres based on Research Reactors (ICERR). IRL connects a host RR to guest institutions. Experiments (approach to criticality, rod calibration, temperature coefficients, etc.) conducted at host RR are broadcasted to guest institutions in a country, which does not have RR. It complements theoretical lectures by RR experiments giving a practical insight into reactor physics, safe operation and applications. Regional Research Reactor Schools offer a two-week course combining theoretical classes and hands-on exercises on reactor physics, safe operation and utilization for young professionals with a technical degree and assignment linked to research reactor activities or to the development of NPP programme. EERRI group fellowship training course has been developed in collaboration with the EERRI coalition and it offers unique hands-on-training experience on different RRs; provides the background to carry out activities related to RR planning, commissioning, operation and utilization to young professionals with some nuclear experience or involved in the development of a national NPP programme. This six-week course involves theoretical classes, site visits and extensive hands-on experimental activities. Advanced training at ICERRs is intended to help MSs gain timely access to relevant infrastructure based on RR facilities to achieve both nuclear R&D and Capacity Building. Access to an ICERR is provided through a bilateral agreement between ICERR and user to avail broad spectrum of offers related to nuclear capacity building such as education and specific training for young professionals; specific hands-on-training programme (e.g. irradiation and testing services, hot cells or analytical laboratories) and on-the-job training for RR operators, maintenance personnel, radioprotection specialists or regulators.

The presentation will cover current status and future plans for above mentioned activities.

10:00 – 10:10

Closing Remarks

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