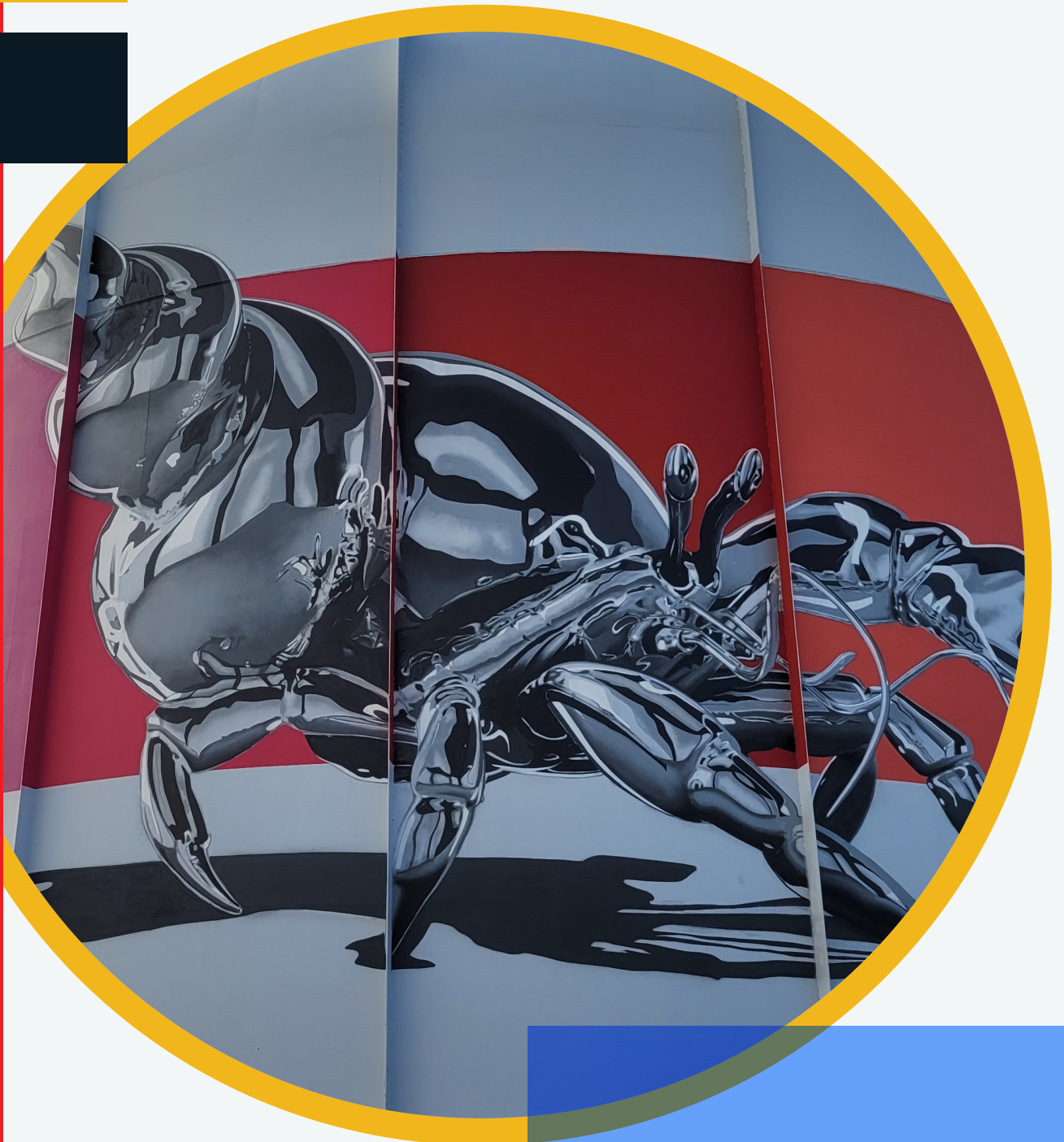


TRTR

Q4 2022

Newsletter



Letter from the Chair

It seems like the conference happened just a week or two ago, but Thanksgiving has already blown by and the holiday season is looming like a freight train to remind me that I still haven't figured out what happened to the first eleven months of this year. Time flies faster and faster. I hope you all are settled in for a long winter's nap at some point.

The many great presentations and conversations we had in State College present us all—as a community—with many opportunities. From license amendment requests we can all help each other with, to sharing information and assistance when needed, it becomes more evident all the time that we need each other more than ever. We should also be sure to invite and welcome the staff associated with the many new research reactors that are in the planning or licensing stages. We are stronger and more able as a group, even though we often joke that we are only a very loose association of reactors.

Our continued support from Hilary Lane and the Nuclear Energy Institute has been so valuable to the community. If you haven't gotten your accounts set up there, where you can get access to all the very useful documents in the NEI Library, I encourage you to do so. We used the NEI document (NEI 06-02), "License Amendment Request Guidelines," for an LAR we submitted last year. It was a great help to ensure that we included all the information we needed to. Sure, it was an easy change to our license conditions, but the information was complete enough that there were no Requests for Additional Information, and we got the amendment in a timely manner.

There are so many resources available to the community and there is likely someone who knows about it. Please make sure you utilize the general TRTR Listserv or the Facilities Listserv when you need to. Or, better yet, pick up the phone and call another facility. Let's stay in touch.

One more time, we should thank Jeff Geuther the previous TRTR Chair and Conference host. Jeff and the rest of the Penn State crew did an incredible job putting on a great meeting in a

very nice location. I'd also like to thank all of you for everything you have done this year. Have the happiest of holiday seasons, and best wishes to you all in the New Year.

Jere Jenkins, TRTR Chair



Letter from the Editor

Hello TRTR Friends!

Last month I had the amazing opportunity to participate in the [International Ministerial Conference on Nuclear Power in the 21st Century](#) in Washington DC. I served on a panel where I was able to highlight the efforts of the research reactor community in [Re-imagining Nuclear and Inspiring Youth](#). Part of the re-imagining nuclear was to talk about the electric guitar we had recently made using high energy electrons. We needed something flashy and relatable to begin a conversation about nuclear science and energy. What better than an acrylic body electric guitar with LEDs and a lightning pattern etched in by electrons!

We crowd sourced a name: Master of Protons and are now looking to learn how to play.

Best,
Amber Johnson, Editor



Luke Gilde, Content Editor



In This Edition

Letter from the Chair	2
Letter from the Editor	2
Upcoming Events	4
License Renewal UC Davis	5
Inspections	6
NRC Quarterly Call Summary	7
Reportable Occurrence	7
Nobel Prize	8
TRTR 2022	9
News	10
Know More Nukes	12
Master of Protons	14

Cover image: "[Chrome Corbita](#)" on the University of Massachusetts Lowell containment building
Image credit: Leo Bobek
Back page: Master of Protons guitar
Image credit: Michael Cooke

Upcoming Events

FEBRUARY 6-9, 2023

Amelia Island, FL, United States
[Conference on Nuclear Training and Education](#)

APRIL 13-15, 2023

Knoxville, TN, United States
[2023 ANS Student Conference](#)

APRIL 16-20, 2023

Antwerp, Belgium
[European Research Reactor Conference](#)

JUNE 11-14, 2023

Indianapolis, IN, United States
[American Nuclear Society Annual Meeting](#)

JUNE 18-22, 2023

College Park, MD, United States
[Joint Test, Research and Training Reactor and International Group on Research Reactors Conference](#)

JULY 23-26, 2023

Scottsdale, AZ, United States
[U.S. Women in Nuclear Conference](#)

NOVEMBER 5-8, 2023

Washington DC, United States
[2023 ANS Winter Meeting and Technology Expo](#)

NOVEMBER 27-30, 2023

Dead Sea, Jordan
[International Conference on Research Reactors: Achievements, Experience and the Way to a Sustainable Future](#)



License Renewal UC Davis

[The University of California - Davis McClellan Nuclear Research Center \(MNRC\) has received a renewed operating license for its TRIGA reactor.](#) The facility, originally constructed for and licensed by the U.S. Air Force to perform neutron imaging on aircraft components, began operations in January 1990. Due to the closure of the McClellan Air Force Base, the facility applied for an NRC operating license in October 1996, and received it in August 1998. The license was transferred from the U.S. Air Force to the University of California in 2000. Prior to the expiration of the initial 20 year license term UC - Davis applied for a renewed license in June 2018. The renewed license was issued in November 2022.

The new license reduces the maximum licensed reactor power from 2 MW to 1 MW, and removes the ability to pulse the reactor. In 2019 Dr. Wesley Frey, the director of the McClellan Nuclear Research Center explained that these changes would not significantly impact the operations of the reactor. Frey stated, "We have not operated routinely above 1.0 MW since 2007 and we have only done maybe 5 pulses over the same time period. The vast majority of our work is commercial radiography and 1.0 MW is really the highest power we need to utilize. Right now we have 5-6 years of excess reactivity before we cannot sustain daily 1.0 MW operations. [...] At 2.0 MW certain fuel shuffles and the utilization of low burn up 8.5 wt% fuel (which we have some of) will result in a CHF of less than 2.0 which is unacceptable to the NRC. However at 1.0 MW these restrictions go away and we will have sufficient excess for an additional 12-15 years [...] Though there was a lot of physics involved in the decision, it was economics and the need to keep operating long term that was the dominant force."

Image on opposite page includes panelists and IAEA organizers. From left to right: Anushya Ramaswamy (IAEA), Lena Andriolo ([International Youth Nuclear Congress](#)), Eric Meyer ([Generation Atomic](#)), Amber Johnson, Princy Mthombeni ([Africa4Nuclear](#)), Joseph Mahanes (IAEA), Zion Lights ([Emergency Reactor](#)), and Irena Chatzis (IAEA)

Image credit: Department of Energy and the IAEA

Inspections

IDAHO STATE UNIVERSITY AGN-201 RESEARCH REACTOR

June 13-16, 2022. The inspection included a review of organization and staffing, procedures, health physics, design changes, committees, audits and reviews, emergency planning, and transportation activities. No violations were identified. [ML22181B183](#)

June 13 - 14, 2022. The inspection included a review of security compliance. No violations were identified. [ML22181B180](#)

ARMED FORCES RADIOBIOLOGY RESEARCH INSTITUTE TRIGA REACTOR

July 25-28, 2022. The inspection included a review of procedures, surveillance and limiting conditions for operation, experiments, health physics, design changes, committees, audits and review, fuel handling logs and records, and transportation of radioactive materials. No violations were identified. [ML22230D058](#)

UNIVERSITY OF UTAH TRIGA NUCLEAR REACTOR FACILITY

July 11-14, 2022. The inspection included a review of organization and staffing, procedures, health physics, design changes, committees, audits, and reviews, emergency planning, and transportation of radioactive material. No violations were identified. [ML22223A211](#)

July 11-13, 2022. The inspection included a review of security compliance. One Severity Level IV violation was identified. [ML22229A483](#)

WASHINGTON STATE UNIVERSITY NUCLEAR SCIENCE CENTER

June 27-30, 2022. The inspection included a review of organization and staffing, procedures, health physics, design changes, committees, audits and reviews, and transportation activities. No violations were identified. [ML22227A194](#)

UNIVERSITY OF MASSACHU- SETTS LOWELL RESEARCH REACTOR FACILITY

August 15-17, 2022. The inspection included a review of procedures, experiments, health physics, design changes, committees, audits and review, and transportation of radioactive materials. [ML22244A150](#)

UNIVERSITY OF NEW MEXICO AGN-201M REACTOR

September 12-14, 2022. The inspection included a review of procedures, experiments, health physics, design changes, committees, audits and review, and transportation of radioactive materials. No violations were identified. [ML22305A70](#)

On November 2, 2022 the University of Texas - Austin Nuclear Engineering Teaching Laboratory notified the NRC of a reportable occurrence ([Event # 56198](#)) at the University of Texas Research Reactor. Between January and October 2022 the reactor operated with 2 aluminum clad TRIGA fuel elements. The facility is only licensed for operations with stainless steel clad elements. There is no indication of any fuel damage or radioactive material release. The facility has not yet been able to identify what led to the elements being placed in the core. The NRC conducted a [special inspection](#) on November 7th.

Reportable
Occurrence

NRC Quarterly Call Summary

[IMC0615](#) RTR Inspection Reports is being updated to reflect the use of an auto-report generator tool and eliminate the use of Inspection Follow Up Item.

[MD 8.3](#) NRC Incident Investigation Program supplemental guidance for RTRs was recently issued.

Oversight Observations:

- Safety Culture
 - Procedures-quality and adherence
 - 50.59 (change management process)
- Expect a generic communication to document these items.

Follow up to items raised during the annual meeting:

Positive progress is being made towards the revision of NUREG 1478. Possible public meeting in Q1 2023.

Operator Exam schedule for FY 2023 is complete. Examiners should be reaching out to finalize dates. Please provide materials with enough time to allow for the preparation of the exam.

Remember that operator license renewal applications must be submitted 30 days prior to expiration to be considered timely.

Advance notification of exam results will be sent in an email. This is sufficient documentation to allow an individual to assume the duties of a licensed operator. Due to the sensitive nature of medical information, it will not be included in the email. If you have questions, please contact Travis or your examiner to clarify conditions.

Frequency of Project Manager site visits will be evaluated.

Efforts are underway to crosstrain individuals to account for turnover.

Updated organization charts shall be shared with the community once finalized. A list of the PMs and inspectors for each facility is maintained [here](#).

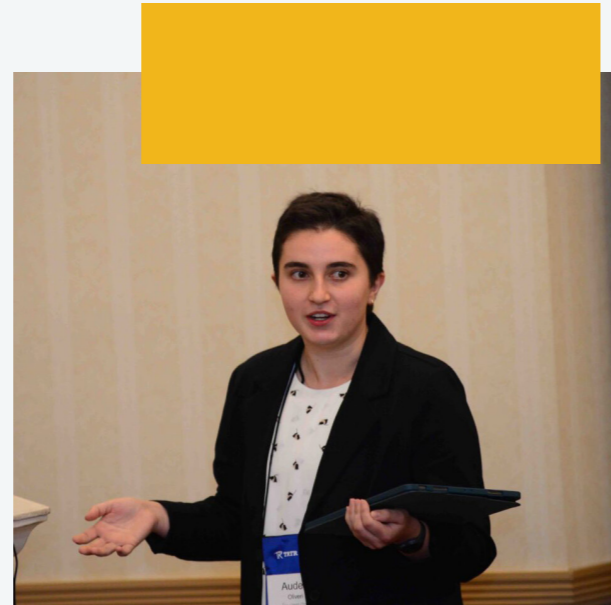
The SNM enhanced rulemaking steering committee and working group are considering the comments raised at the annual meeting.

Finalizing NRC staff participation on ANSI/ANS standards that are of importance to the community.

Former Researcher at MIT Nuclear Reactor Lab Awarded Nobel Prize

Anton Zeilinger was one of three people awarded with the 2022 [Nobel Prize in Physics](#) for “for experiments with entangled photons, establishing the violation of Bell inequalities and pioneering quantum information science” along with Alain Aspect and John F. Clauser. Dr. Zeilinger formerly performed research at the MIT Nuclear Reactor Lab with Dr. Clifford Schull (another Nobel Laureate) in the 1980s using [neutron interferometry to study the linearity of the wave equation](#) (pg.112). Although his work at MIT is not what ultimately led to the Nobel Prize, Dr. Zeilinger is well regarded at MIT as kind and approachable.

Special thanks to John Bernard for providing this information!



Top: New University Reactors: Projects and Partnerships panel Elia Marzari (Penn State University), True Miller (Purdue), and Clive Townsend (UIUC)

Middle: Auden Oliveri (Reed College)

Bottom: Kenan Ünlü (Penn State Radiation Science and Engineering Center, Director)



The conference banquet at the Toftrees Golf Resort

TRTR 2022



TRTR Chair Jeff Geuther kicks off the 2022 TRTR Annual Meeting

The 2022 TRTR Annual Meeting was hosted by Penn State University from October 10th-14 at the Toftrees Golf Resort in State College, Pennsylvania. The meeting included the TRTR Executive Committee Meeting, Doug Morrell’s annual presentation on the DOE’s support of university research reactors, 34 presentations from 13 TRTR facilities, the DOE, and the NRC. Some highlights of the meeting were panels on new Advanced Reactor projects at universities and an update on the University Research Reactor Fitness Program. Presentations can be found in the meeting [archives](#).

The meeting included a technical tour of the [Penn State Radiation Science and Engineering Center](#) including the Penn State Breazeale Reactor, Co-60 Irradiator facilities, and neutron beam hall. The [Tawfik M. Raby Scholarship](#) was awarded to Robert Dwyer of the University of New Mexico.

[TRISO Fuel Plant Opens:](#) Ultra Safe Nuclear Corporation (USNC) has opened the Pilot Fuel Manufacturing facility in Oak Ridge Tennessee to produce USNC's Fully Ceramic-Microencapsulated TRISO fuel.

[Subcritical Assembly Begins Operation in Philippines:](#) The Subcritical Assembly for Training, Education and Research has begun operations at the Philippine Nuclear Research Institute utilizing TRIGA fuel originally used in the Philippine Research Reactor 1.

[New Research Reactor in Korea:](#) Daewoo Engineering and Construction has started construction on a new 15 MW research reactor in Gijang-gun, Busan.

[McMaster Nuclear Reactor Profile:](#) The McMaster Nuclear Reactor was covered in the McMaster Daily News.

[NRC Considers Regulations for Nuclear Fusion:](#) The NRC has released a whitepaper laying out various options for regulating fusion energy devices.

[Oklo Resubmits License Application:](#) Oklo has resubmitted the combined license application for its 1.5 MW Aurora reactor. Oklo's application was previously denied "without prejudice" by the NRC for lack of sufficient information.

[Bomb Threat to University of Utah Nuclear Reactor:](#) A 21-year-old University of Utah student was arrested after making bomb threats towards the university's TRIGA reactor.

[NNSA And Japan Commit to Convert HEU Reactor:](#) The US National Nuclear Security Agency (NNSA) and Japan's Ministry of Education, Culture, Sports, Science and Technology (MEXT) have committed to converting the Kindai University Teaching and Research Reactor (UTR-KINKI) from highly enriched uranium (HEU) to low-enriched uranium (LEU) fuel. UTR-KINKI is the last HEU fueled research reactor in Japan. The effort builds on the recent conversion of the Kyoto University Critical Assembly from HEU to LEU in August.

[Developing a Nuclear Workforce may be a Challenge:](#) An aging workforce may present problems for expanding the nuclear field, however, student interest in Nuclear Engineering is growing.

[Molten Chloride Test System In Place:](#) Southern Company and TerraPower have completed the Integrated Effects Test Facility at TerraPower's laboratory in Everett, Washington. The facility will be used in the development of the Molten Chloride Fast Reactor (MCFR).

[New Research Reactor In Iran:](#) Construction has begun on a new 10 MW Research Reactor in Iran.

[Nuscale Reactor Simulator at ISU:](#) A new reactor simulator at the Idaho State University College of Technology allows students to gain hands-on experience and enhances the university's mission to train a nuclear workforce.

[Kazakhstan IVG.1M Reactor Starts Up with LEU Fuel:](#) IVG.1M reactor has been converted to LEU and the restart process is nearly complete.

[Neutrons Canada Established:](#) The University of Saskatchewan (USask) and McMaster University have incorporated a new not-for-profit research organization, Neutrons Canada. The new organization aims to govern, manage, and represent Canada's infrastructure program for research and development with neutron beams.

[Funding for HALEU Demonstration:](#) The US Department of Energy has awarded funds to Centrus Energy Corp to demonstrate a capability to produce high-assay low-enriched uranium (HALEU) in the US.

[Kansas State Feels Effects of Reactor Shutdown:](#) The Kansas State University TRIGA Reactor is in a long-term shutdown due to unknown corrosion found on fuel elements. The university hopes to restart the reactor by 2023.

[Bulk Shielding Reactor Demolished:](#) Oak Ridge Office of Environmental Management (OREM) announced that the Bulk Shielding Reactor has been demolished. This is the first reactor to be fully decommissioned at Oak Ridge National Laboratory.

[KIPT Subcritical Reactor Damaged:](#) The IAEA has found that the accelerator driven subcritical reactor at the Kharkiv Institute of Technology (KIPT) in Ukraine has been heavily damaged, but no radioactive material has been released.

[Penn State Breazeale Reactor Neutron Beam Facility:](#) The Penn State Breazeale Reactor is now able to operate 7 neutron beamlines simultaneously. This represents a major capability upgrade, the facility plans to install the first Small Angle Neutron Scattering instrument at a US University in 2023.

[NRC to Review ACU Molten Salt Reactor Application:](#) The US Nuclear Regulatory Commission has accepted and will begin reviewing Abilene Christian University's (ACU) construction permit application to build a 1 MW molten salt research reactor.

[IAEA Completes Review Mission in South Africa:](#) The IAEA has completed a review mission in South Africa to make recommendations about the country's plan to develop a new multipurpose research reactor.

[New Book on Brookhaven High Flux Reactor:](#) The Leak by Robert P. Crease and Peter D. Bond explores the events leading to the shutdown of the Brookhaven High Flux Reactor.

Idaho State University

Reactor Supervisor,
Jonathan Scott,
provides insight into the
AGN-201M.



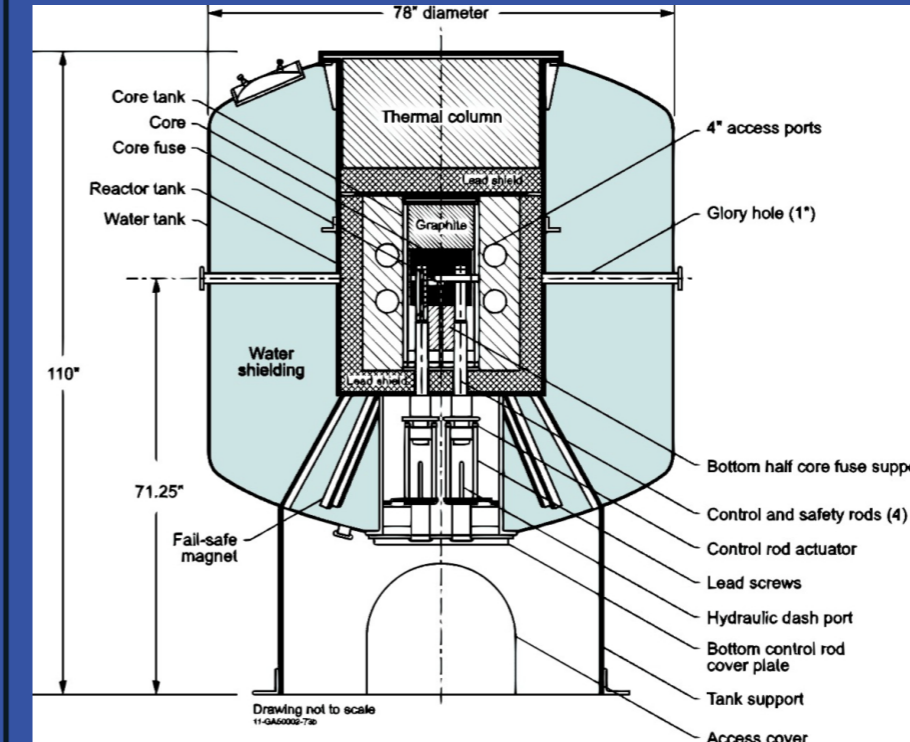
The AGN-201m, license R-110, at Idaho State University first went critical in 1965. The AGN-201 has a few unique design features. The control rods come up from the bottom of the core. This is because the control rods are made of the same polyethylene fuel that comprises the core; inserting the rods from the bottom adds reactivity as opposed to removing rods from the top which subtracts reactivity. Another unique feature of the AGN-201 design is the inclusion of a thermal fuse. This is a small bit of fuel that is made of polystyrene with double the fuel density; so it gets hotter faster than the rest of the core. When it melts the bottom half of the core that, drops about 5 cm.

There have been many modifications to this reactor since its initial criticality. The name of the reactor shows one major change. AGN is the name of the manufacturer (Aerojet General Nucleonics) and 201 is the model number. The "m" after 201 means it's been modified. For ours specifically, it



was modified to increase the maximum power level from 100mW to 5W. This was completed before the reactor was transferred to ISU. More recently, we have upgraded our control console from vacuum tube circuits to solid state circuits using the 50.59 process. We went critical with the new console in June of 2020 during the height of the pandemic.

One of my favorite things about attending Missouri University of Science and Technology (A.K.A. UMR,



MST, MSM) was hanging out at the reactor while training to be a reactor operator. So when I saw the job opening at Idaho State University I jumped at the chance to apply. The university reactor setting provides an excellent opportunity to help the next generation learn to become reactor operators and experimenters.

I give the new operator trainees two bits of general advice early in their training:

1. There is a ton of new information to learn and it's going to feel overwhelming but you will get through it.
2. Use the diagrams of the reactor console in the Safety Analysis Report to make a pseudo console at home. Use this to practice going through the startup procedure outside your scheduled operation times.

The biggest challenge facing our reactor at the moment is the lack of BF3 ion chambers. We are working on upgrading our aging log and linear power channel detectors, but finding detectors that have the same operating characteristics as BF3 is extremely difficult.

Though from a personal standpoint, even though it's difficult to find new detectors, it's been one of the most interesting parts of the job over the last few years. I've gotten to work with a bunch of interesting people and learn a ton about detector design and analog circuits.

Another challenge, outside of the technical aspects of keeping the reactor operational, is our failure to market ourselves. I can't count the number of students and faculty not associated with the Nuclear Engineering department who have no idea there is a reactor on campus.

One of the most useful things about the AGN-201 design is the sensitivity of the detectors and the console circuits. Our log power channel has a low power set point of 3E-13 amps and our full power set point is around 1E-7 amps, which is where most other reactors start. This means we can measure extremely small reactivity changes. This allows us to measure hyper accurate material properties like neutron absorption cross section.



Opposite page: Upgraded control console in 2020
Current page, Top: Elevation diagram showing reactor and shielding
Bottom: Dr. Jay Kunze standing in front of the reactor



MASTER OF PROTONS