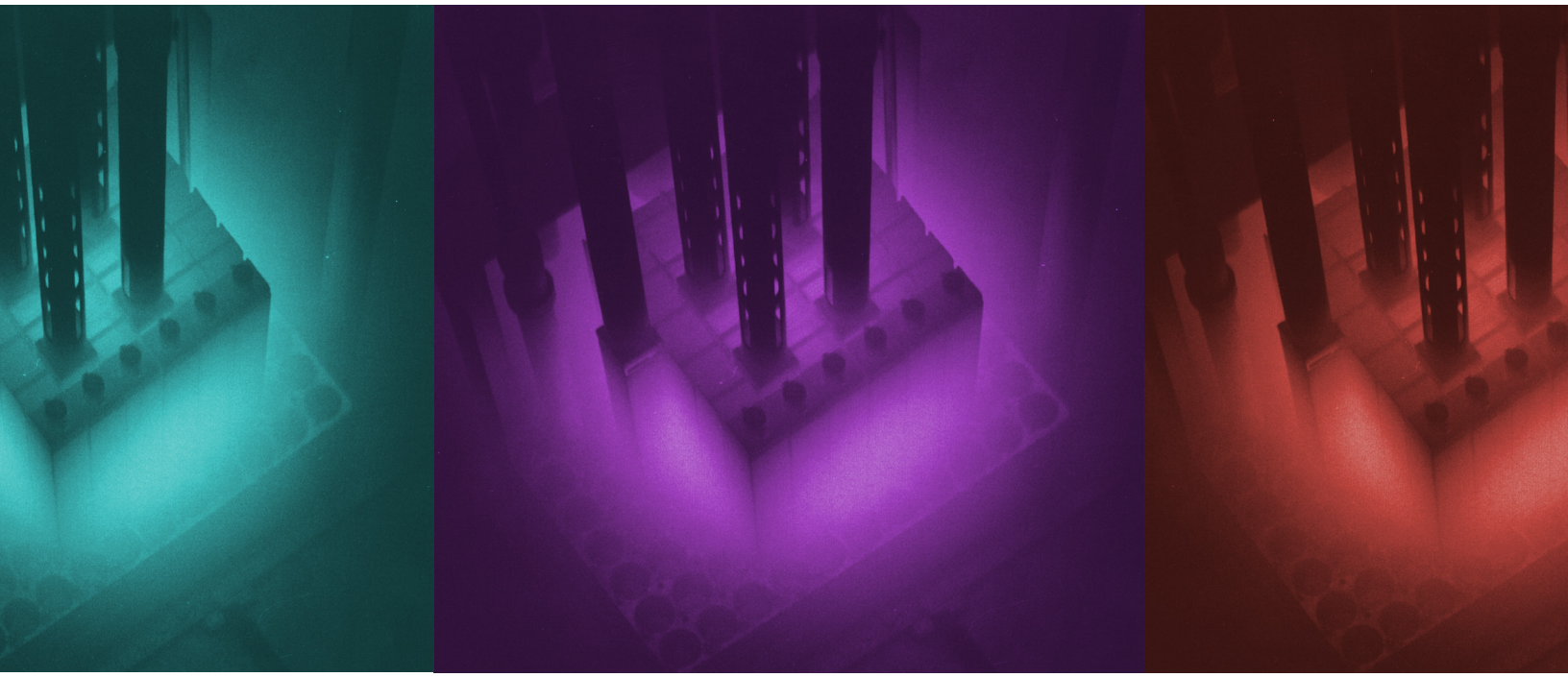
TRTR



Q3 19

Newsletter

IN THIS EDITION

Cover page: PUR-1 at Purdue University, West Lafeyette, IN. Want your photo featured in a future edition? Send high-resolution photos to TRTRnewsletter@isotopictopics.com.

Sean O'Kelly, Executive Committee Chair

Amber Johnson, Editor

Luke Gilde, Content Editor

MESSAGE FROM THE CHAIR

At the time I was writing this, the final Non-Power Production or Utilization Facility or NPUF final rule has been sent to the Commission for vote and approval. The final rule document is SECY-19-0062 if you want to find it to read for yourself. You probably should if you have been too busy or just came to be involved with TRTR recently as it will require some changes in how you manage your facility.

When many of us started working around research and test reactors we were called Non-power Reactors to differentiate us from Nuclear Power Plants. Then we had an identity crisis and started getting called Research and Test Reactors or RTR. Sadly, that left off our training reactor peers, but don't we all do a little training now and then with our reactors? Besides, the very catchy and internationally recognized "TRTR" was already taken by a very respected organization. I suppose TTRR or RTTR could have been used but I'm getting confused just writing that here.

Now we have accelerator driven sub-critical reactors for either research or the production of radioactive isotopes which use special nuclear materials and particle accelerator produced neutrons. Non-power production or utilization facility is a definition that hopefully covers just about

anything in the future utilizing special nuclear material in a critical or sub-critical systems that doesn't produce electricity. The Office of Nuclear Reactor Regulation (NRR) and the Office of New Reactors (NRO) will merge in October of this year. Within the new NRR will be a new Division called Advanced Reactors and Non-Power Production or Utilization Facilities. It's a mouthful but it's good to see the NRC clearly recognizing that not all future power reactors will use light water. The Idaho National Laboratory has been working with NRC staff to prepare for licensing advanced nuclear reactors such as the various small modular reactor concepts or even smaller power reactors that can be transported by truck or plane. I'm sure we will hear more about this reorganization at the upcoming TRTR meeting in September.

If you've read this far then I want to remind you that the name change to NPUF is the least significant change in the new rule and the changes in the regulations will have a significant impact on how your facility uses the 10CFR50.59 process and maintains its Safety Analysis Report. Some of this will be discussed at the TRTR meeting by the NRC staff attending so bring plenty of questions. We are all looking forward to seeing you at the meeting.

Sean O'Kelly
Associate Laboratory Director,
Advanced Test Reactor Complex
Idaho National Laboratory

MESSAGE FROM THE EDITOR

In this issue, we bring you the usual coverage of NRC inspection reports, news stories, and events. We are excited to feature on the cover Purdue's PUR 1, the first reactor to be licensed with all digital nuclear instrumentation and control console. We are also pleased to offer a travel report from MIT's Sarah Don, a profile of the 2019 Tawfik Raby Scholarship winner, and an article on UC Davis's relicensing. Let us know if you have been on an adventure that we can feature.

We have had a great time preparing the TRTR newsletter and we hope you have enjoyed our efforts. We have prepared a short survey that will provide us with the information we need to meet the needs of the community. If you would prefer to speak with us in person, Luke and I will be at the annual TRTR conference. We hope everyone is having a great summer and we look forward to seeing you in the fall! If you have suggestions for topics to be covered, sections you would like to see, or articles that you would like shared, please send an email to TRTRnewsletter@isotopictopics.com.

Amber Johnson, Editor
Director,
University of Maryland Radiation Facilities

Luke Gilde, Content Editor
Reactor Operations Manager,
University of Maryland Radiation Facilities

NEWS

Dragons for Peace

The Bulletin of the Atomic Scientists compares the usage of dragons in Game of Thrones to the theory of nuclear weapons deterrence. [More]

Medical Isotope Production

Coquí Radio Pharmaceuticals Corp. was transferred 206 acres of land near the DOE's Oak Ridge National Laboratory to begin building it's Mo-99 production facility. Coquí is using a reactor based method for production and, when operational, will be the first full scale Mo-99 producer in the US. [More]

Neutron Lifetime Measurements

A discrepancy in the lifetime of neutrons has been an ongoing mystery for the last 15 years. When lifetime measurements are performed by 2 different methods, different results are obtained; one nearly 1% greater than the other. As the methods used differ in that one directly counts the neutrons remaining after some period of time, while the other records the neutron decay products, one possible explanation is that the neutrons are decaying into dark matter some of the time. Work to more accurately measure the neutron lifetime is currently ongoing at the NIST Center for Neutron Research. [More]

Residents Return to Town Near Fukushima

Residents are being allowed to return to Okuma, a town located next to the Fukushima Daiich power plant. About 40% of the town has been declared safe following 8 years of remediation efforts; however, relatively few residents have been willing to return so far. [More]

Removal of Fuel from Fukushima Spent Fuel Pool

Work has begun on removing spent fuel from the spent fuel pools at the Fukushima Daiich nuclear plant. The fuel in these pools was not damaged during the earthquake and tsunami that struck the plant in 2011 and work to remove them is expected to take about 2 years. [More]

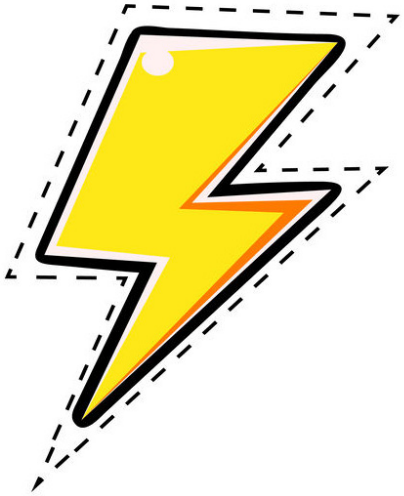
VTR Cost Estimates Higher than Expected

New information obtained in a Freedom of Information Act request by the Union of Concerned Scientists revealed the cost estimates for the Versatile Test Reactor are from $3.9 to $6 billion, approximately 40% higher than previously reported. [More]

Southwest Experimental Reactor Zeroed Out of 2020 DOE Budget

The decommissioning of the Southwest Experimental Reactor is nearing completion and the project has been zeroed out in the 2020 DOE Budget. The 20 MW, sodium

cooled, reactor operated in Arkansas from 1969 to 1972. Remediation efforts at the site have been completed, however, contractors are still awaiting final approval from the state and federal authorities. [More]



Neutrons Used to Track Lithium Ions in Batteries

Researchers at the University of Virginia are using neutron imaging at the High Flux Isotopes Reactor (HFIR) to learn more about the charging and discharging process of lithium-ion batteries. Their research was published in the Journal of Power Sources. [More]

NPUF Final Rule Issued

The final NPUF rule has been sent to the commission for a vote. This rule would eliminate the license terms for research reactors, but require the submittal of an updated FSAR every 5 years, revise various definitions, and make several other minor changes to rules for NPUFs. A number of other rules will also take effect at that time. More information on this can be found in the slides from the NRC public teleconference on April 25th, to discuss the implementation of the new rules. The NPUF rule is expected to take effect in late 2020 and at that time Regulatory Guide 2.7 will be issued to aid licensees in compliance. Licensees will be required to submit an updated FSAR within 3-5 years of the ruling, the exact deadline is based on how recently their operating license was issued. [More]

NuScale Signs MOU with Doosan

NuScale power has signed a Memorandum of Understanding with South Korea's Doosan Heavy Industries & Construction in order to help manufacture it's new small modular reactors. [More]

Rwanda to get Nuclear Research Center

Rwanda is collaborating with Russia to develop Centre for Nuclear Science and Technology (CNST) within the next five years. The center will serve to educate Rwandans about nuclear energy and help Rwanda build its nuclear industry. [More]

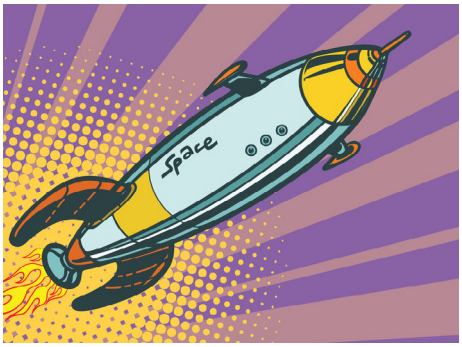
Improved Heat Transfer Models

Researchers at MIT have developed an improved model of heat transfer within reactors. This could allow for operating reactors at higher power levels as the boundaries of Critical Heat Flux will be better understood. [More]

Saudi Arabia Builds Research Reactor

Saudi Arabia is building a new research reactor outside of Riyadh, the capital city. The reactor will be the country's first although it also has plans

to build several larger reactors for electricity and water desalination. Saudi Arabia states the reactor's purpose is "strictly peaceful"; however, given the country's rivalry with Iran, concerns exist about nuclear weapons proliferation. [More]



Electricity from Americium

Scientists in the UK generated electricity from the decay of americium-241 in what they believe to be a first of a kind experiment. This means that relatively plentiful Am-241 could replace rare and difficult to produce Pu-238 as a power source for spacecraft, greatly increasing the possible number of missions. [More]

C-14 From Nuclear Bombs Found in Deep Ocean Trenches

A new study in Geophysical Research Letters reports finding evidence of C-14 produced during atmospheric nuclear weapons testing in deep ocean organisms. This demonstrates that these deep ocean organisms feed primarily on food produced near the ocean's surface rather than local sediments. [More]

New Documentary About NRU Reactor Premiers

A new documentary about the recently shut down National Research Universal (NRU) research reactor in Chalk River, Ontario has been released on Youtube. The documentary "contains the stories and reflections of both past and present staff, and is an emotional perspective not only of the research reactor but of the impact it has had on those who worked within it. Notably, this film provides a rare opportunity to view footage of an operating research reactor, and includes the final moments of operation filmed in the control room as the NRU was permanently shut down on March 31, 2018." [More]

MURR Plays a Critical Role in Production of Medical Isotopes

MURR has become the only US Domestic Supplier of Lutetium-177 and Iodine-131. [More]

TMI Unit 1 to Shutdown

Three Mile Island Unit 1 will be shut down in September after 45 years of safe operation. This decision comes in the wake of Pennsylvania failing to approve a new green energy subsidy that would include nuclear energy. [More]

JEEP-II Research Reactor in Norway to Be Decommissioned

Norway's JEEP-II Reactor will be shutdown after the discovery of corrosion in "reactor components important to safety." The reactor, commissioned in 1967 was the only neutron scattering facility in the Nordic countries. [More]

Plant Communication Studied at HFIR

The neutron imaging facility at HFIR was used to study chemical communication between plants. [More]

NOAA Explains Why Nuclear Weapons are Not Used to Stop Hurricanes

Apparently this is a frequently asked question!! [More]

Ohio School Closed after Traces of Uranium, Plutonium, and Neptunium Found Inside

Zahn's Corner Middle School in Ohio has been closed for the remainder of the school year after traces of enriched Uranium, Plutonium, and Neptunium were found inside. These may be from the nearby Portsmouth Gaseous Diffusion Plant that closed in 2001. [More]

C-14 from Nuclear Bombs Used to Identify Art Forgeries

Atmospheric Carbon 14 from nuclear weapons testing has been making the use of carbon dating to identify art forgeries easier. However, with the decline of C-14 levels following the conclusion of atmospheric weapons testing it may no longer be possible to use carbon dating to identify the age of an object as testing will find two possible dates of origin. [More]

HFIR Profiled by DOE's Office of Nuclear Energy

The DOE wrote 7 fun facts about HFIR including that it was used to prove that former president Zachary Taylor was not poisoned. [More]

Shine Medical Breaks Ground on Production Facility

Shine Medical Isotopes has broken ground on their isotope production facility. Once competed, their accelerator based Mo-99 production facility should be able to supply approximately 1/3 of global demand. [More]

The First All Digital Console!

The U.S. NRC has licensed Purdue University Reactor Number 1 (PUR 1) with the first all digital instrumentation and control console in the U.S. [More]

REACTORS UNKNOWN

READER TRIP

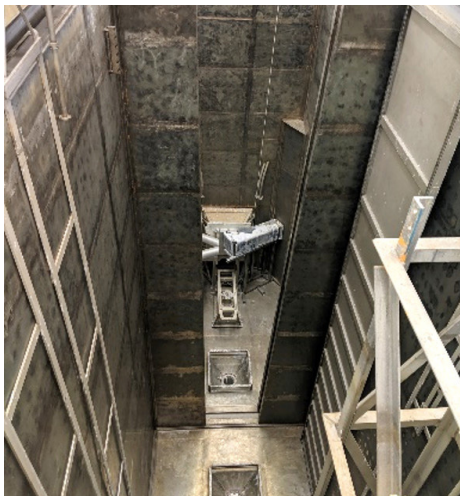
***Sarah Don, Superintendent of the MIT Nuclear Reactor Laboratory**, visited two European research reactors while on vacation in June. Here she shares her adventures!*

Whenever I travel somewhere new I always check to see if there's a research reactor I can visit there. On my recent vacation travels to Europe I was fortunate to visit two - the Demokritos National Center for Science Research reactor in Athens, and the Atominstitut reactor in Vienna. Both facilities are somewhat isolated from the global nuclear industry – neither country has any other research or power reactors, and their regulatory environment is quite different. The staff at both

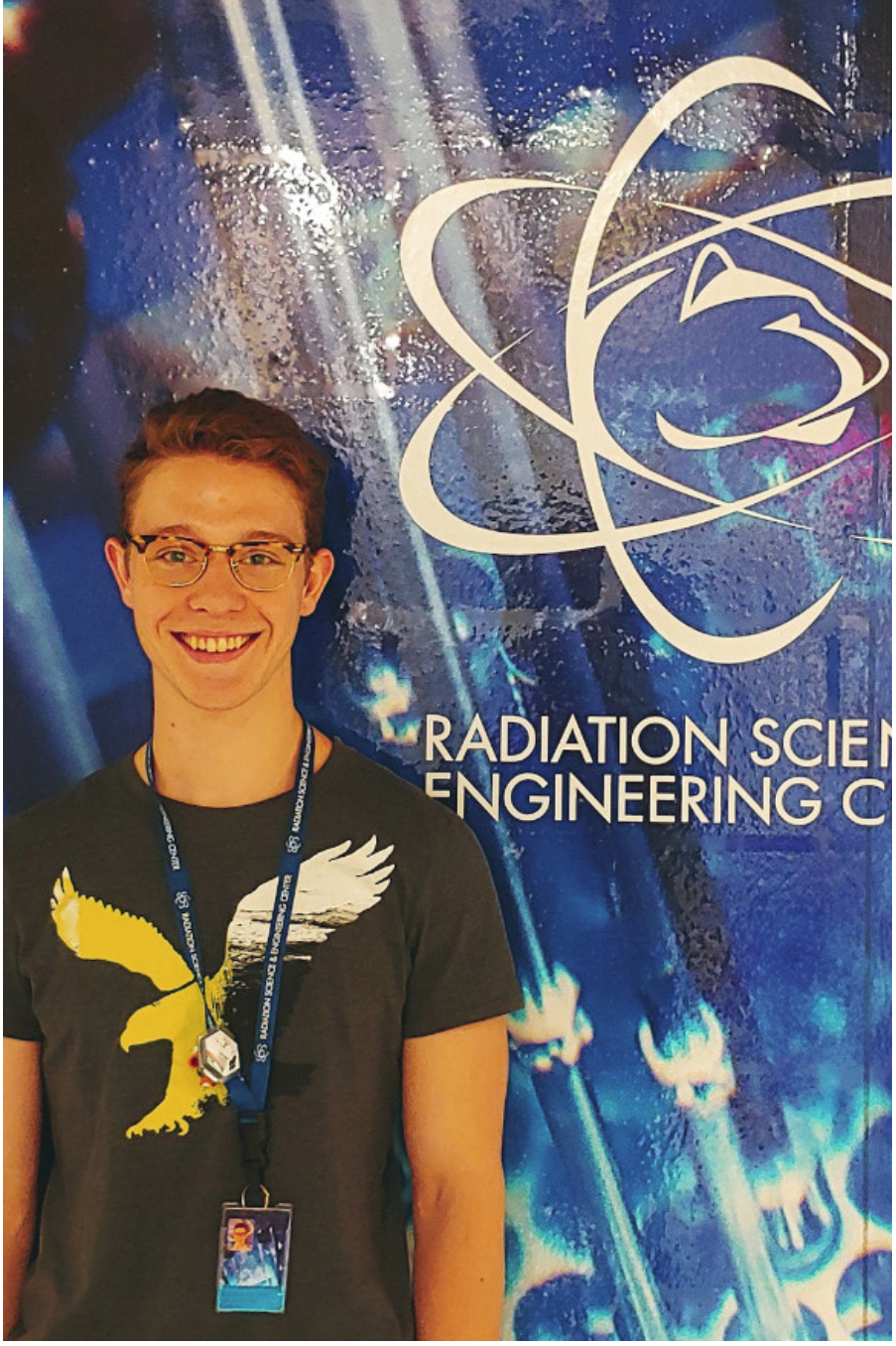
facilities were so welcoming and it was wonderful to be able to visit and learn from them.

The GRR-1 at the National Centre for Scientific Research Demokritos is a 5 MW pool-type reactor. They are in an extended shut-down since 2004. In 2008 a significant renovation program for all reactor systems was initiated, however this was never completed due to the financial crisis. At this moment there are no plans to restart the reactor and the used fuel was repatriated to the US before the May 2019 deadline. On the right is Mr. George Katsoulas (reactor superintendent) and Dr. Konstantina Mergia (research director) in the control room.

The reactor at the Vienna University of Technology Atominstitut is a 250 kW TRIGA Mark-II reactor just 4 mi from the IAEA campus. The facility underwent a comprehensive renovation in 2015 and the reactor is mostly operated at steady-state for training, though they have 4 beamports in use and occasionally pulse. The control room feels very modern with glass panel walls and an all-digital console. While I was there some students were doing training startups and the reactor manager let me do a startup too!



From top-left: GRR-1 Reactor, Sarah Don in GRR-1 Control Room with Mr. George Katsoulas (reactor superintendent) and Dr. Konstantina Mergia (research director), GGRR-1 Reactor Hall, Sarah Don in front of Vienna University of Technology Atominstitut Reactor, Control Room at the University of Technology Atominstitut.



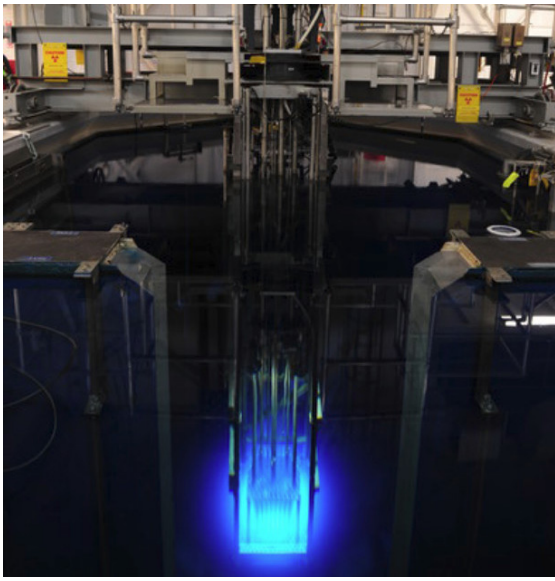
Left: Garret Wendel
Bottom: Penn State Breazeale Reactor core

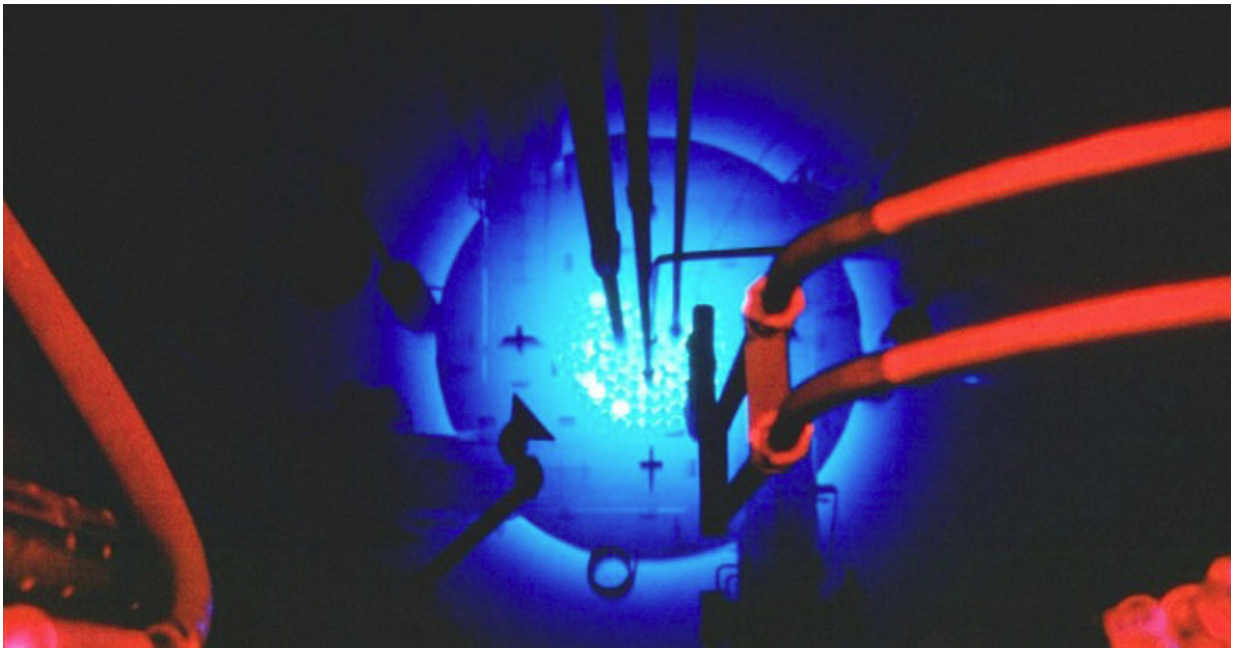
OPERATOR PROFILE

Garrett Wendel was selected as the 2019 Tawfik Raby Memorial Scholarship winner. Garrett is a Reactor Operator Penn State's Breazeale Reactor where he is also studying for degrees in Nuclear Engineering, Physics, and Mathematics (Class of 2019).

Garrett first became interested in nuclear engineering while in high school. The opportunity to become involved with Penn State's Radiation Science and Engineering Center (RSEC) was a large part of his decision to attend school there. While at the RSEC he has worked on data archiving and processing of reactor parameters for a fission-product poison calculator. He also worked on real-time website plotting of reactor conditions and redesigning an experimental apparatus for testing the areal density of wafers of neutron absorbing material used for radiation shielding applications.

Garrett is studying to become a senior reactor operator. Following graduation he intends to attend graduate school.





LIFETIME EXTENSION

UC Davis looks to expand its operational lifetime with a request to reduce the licensed power to 1.0 MW and remove pulsing capabilities.

In their license renewal application the UC Davis McClellan Nuclear Research Center has requested a reduction in licensed power from 2.0 MW to 1.0 MW, the removal of pulsing capabilities, and the removal of the ability to irradiate explosives. Dr. Wesley Frey, the director of the McClellan Nuclear Research Center explains that these were rarely used capabilities and that removing them will not affect the uses of the reactor while significantly reducing the relicensing burden and extending operational lifetime.

Frey states, "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 the economics and the need to keep operating long term that was the dominant force."

He continues that power may be administratively limited to 750 kW to ensure the fuel is sufficient to last the entirety of the 20 year license term and concludes "The downgrades in capability will have no negative impact on our work and mission. It is just more of a hit to the ego to no longer operate the "highest power TRIGA in the country."

Review: The Children

Left: Set of The Children. Notice CDV-717 on end table.

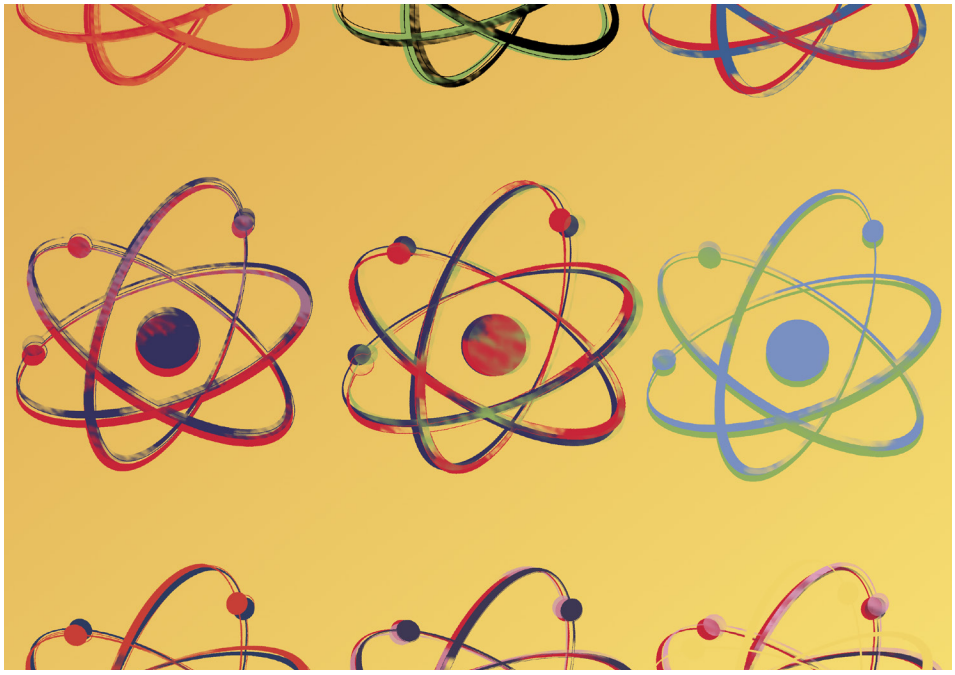
Lucy Kirkwood's play, The Children, is set in coastal Britain just weeks after a nuclear power plant disaster that resembles the Fukushima disaster.

The story centers on a pair of retired engineers from the plant who are mysteriously visited by an old friend they have not seen for over 30 years. Over the course of one night in their cottage, the play explores topics including social responsibility, aging, and the worthwhileness of nuclear energy while the characters debate the lives they must lead in the post-disaster world.

While the action of the play is never fast-paced it stays interesting with a mix of raunchy jokes and deep questions. It also displays commendable scientific accuracy, with the largest issue identified in the performance we saw being an ion chamber (CDV-717) clicked like a geiger counter. The Children leaves the audience with a great deal to consider when the play is over; it's certainly not pro-nuclear, but the accident sets the stage for a discussion of broader topics.

We saw The Children at Studio Theatre in Washington DC where it will be until July 9th.

NRC INSPECTIONS



University of Wisconsin Nuclear Reactor Laboratory

An inspection of the University of Wisconsin Nuclear Reactor Laboratory was carried out from March 18 - 20, 2019. The inspection included a review of organization and staffing, operations logs and records, procedures, re-qualification training, surveillance and limiting conditions for operation (LCO), experiments, design changes, committees, audits, and reviews, emergency planning, maintenance logs and records, and fuel handling logs. No violations were found. The complete inspection report is ML19094A449.

MIT Nuclear Reactor Laboratory

An inspection of the Massachusetts Institute of Technology Reactor (MITR-II) was carried out from April 16-19, 2019. The inspection included a review of operator licenses, re-qualification and medical examinations, experiments, organization and operations and maintenance activities, procedures, fuel movement, and surveillances. No violations were found. The complete inspection report is ML19128A011.

Armed Forces Radiobiology Research Institute

A follow-up inspection of the Armed Forces Radiobiology Research Institute TRIGA Reactor was carried out from April 9-10, 2019 to review the unresolved item (URI) pertaining to the AFRRI reactor console replacement, which was documented in NRC Inspection Report No. 05000170/2018201, dated July 5, 2018. AFRRI was issued a Severity Level IV violation for failure to properly complete a 50.59 review before testing their new digital console. The complete inspection report is ML19114A479.

Breazeale Research Reactor

An inspection of the Breazeale Research Reactor at Penn State University was carried out from April 29 – May 1, 2019. The inspection included a review of procedures, experiments, health physics, design changes, committees, audits, and reviews, and transportation No violations were found. The complete inspection report is ML19130A101.

University of Texas at Austin Nuclear Engineering Teaching Laboratory

An inspection of the University of Texas at Austin Nuclear Engineering Teaching Laboratory was conducted on November 6-8, 2018. The inspection included a review of organization and staffing, operating logs and records, procedures, re-qualification training, surveillance and limiting conditions for operation, experiments, health physics, design changes, committees, audits and reviews, emergency planning, maintenance logs and records, fuel handling logs and records, and transportation of radioactive materials. No violations were found. The complete inspection report is ML19078A146.

Idaho State University AGN-201M Research Reactor

From May 13-15, 2019 a security inspection was performed at the Idaho State University AGN-201M Research Reactor facility. There were no significant security concerns or findings of non-compliance. The complete report is withheld from the public.

EVENTS 2019

JULY 28-31, 2019

U.S. WOMEN IN NUCLEAR
Chicago, IL

AUGUST 4-7, 2019

UTILITY WORKING CONFERENCE AND VENDOR TECHNOLOGY EXPO
Amelia Island, FL

AUGUST 19-30, 2019

NUCLEAR INNOVATION BOOT CAMP
Paris, France

AUGUST 18-23, 2019

18TH INTERNATIONAL TOPICAL MEETING ON NUCLEAR REACTOR THERMAL HYDRAULICS - NURETH
Portland, OR

SEPTEMBER 3-5, 2019

ATOMS FOR HUMANITY
West Lafayette, IN

SEPTEMBER 4-6, 2019

WORLD NUCLEAR ASSOCIATION SYMPOSIUM
London, UK

SEPTEMBER 17-19, 2019

DESIGN AND ENGINEERING OF NEUTRON INSTRUMENTS MEETING
North Bethesda, MD

SEPTEMBER 22-26, 2019

TRTR ANNUAL MEETING
Idaho Falls, ID

OCTOBER 6-10, 2019

INAUGURAL MATERIALS IN NUCLEAR ENERGY SYSTEMS CONFERENCE
Baltimore, MD

NOVEMBER 17-21, 2019

ANS WINTER MEETING
Washington D.C.

NOVEMBER 25-29, 2019

INTERNATIONAL CONFERENCE ON RESEARCH REACTORS
Buenos Aires, Argentina

JUNE 23-25, 2020

WORLD NUCLEAR EXHIBITION
Paris, France

KNOW MORE NUKES!

Senior Reactor Operator Jeff Burmeister at the NCNR reactor controls

NIST Center for Neutron Research *located at the National Institute of Standards and Technology in Gaithersburg, MD is our featured facility in this edition of Know More Nukes. Tom Newton, Deputy Director and Chief of Reactor Operations and Engineering at NIST has provided the responses to our questions.*

What year did your reactor first go critical? 1967.

What is the reactor license number? Power level? TR-5, 20 MW (the nation's only operating "testing facility" as defined by NRC)

What is your position at the reactor? How long have you held that position? Deputy Director and Chief of Reactor Operations and Engineering. Started at NCNR in 2015.

Have any major changes/ modifications, such as conversion, power upgrade, etc., been done? Power upgrade from 10 to 20 MW in 1984. There have been many improvements throughout the years. We are currently working on our fourth cold source upgrade to be installed in about 4 years.

What is a unique feature of your reactor? We have two liquid hydrogen cold sources, delivering neutrons at a temperature of 17 K (neutron energy average of about 4 meV) to 20 cold neutron scattering instruments.

What is a fun fact about your reactor? Some might argue that this is not "fun" at all, but because our reactor is cooled and moderated by D2O, refueling – moving all 30 elements every 50 days -- has to be done blind, as you cannot risk degradation by mixing D2O with the H2O in the air. This is accomplished by tools specifically designed to lift and rotate the elements to any given position.

What is the biggest challenge facing your reactor? As we have well over 2500 experimental users every year coming from all over the world, reactor reliability is crucial. Despite an enormously dedicated operations staff, keeping the reliability of a 50+ year old reactor at close to 100%

Want your facility featured in a future edition of Know More Nukes? Tell us more via our on-line form!

Left: NCNR Cold Neutron Guide Hall
Right: Refueling the NBSR by "feel"

is always a challenge.

What is the most unusual request someone has had to use your reactor? We've had samples ranging from pre-Colombian pottery to state-of-the-art magnetic storage compounds, so picking one that's unusual from our usual unusualness is difficult.

What drew you to your current position? Being a part of one of the world's premier neutron science centers was an offer I couldn't refuse.

What has been your favorite project? We are currently designing and building a liquid deuterium cold source to replace the current hydrogen cold source. This will almost double the available cold flux to neutron instruments.

Before working at your reactor, what was the most unusual or interesting job you've ever had? I was at the MIT Reactor for 25 years. There were many cool things I was involved in there, including building and operating an epithermal neutron beam for human clinical trials of boron neutron capture therapy.

What do you find the most challenging at your reactor? Negotiating the bureaucracy of the federal government is always a frustrating challenge, but, fortunately, NIST has a lot of folks very adept at it.

What advice would you give to new reactor operators? Few people get the opportunity to run a reactor. Simply operating a reactor is not that difficult, but being good at it takes initiative, hard work, and attention to detail.

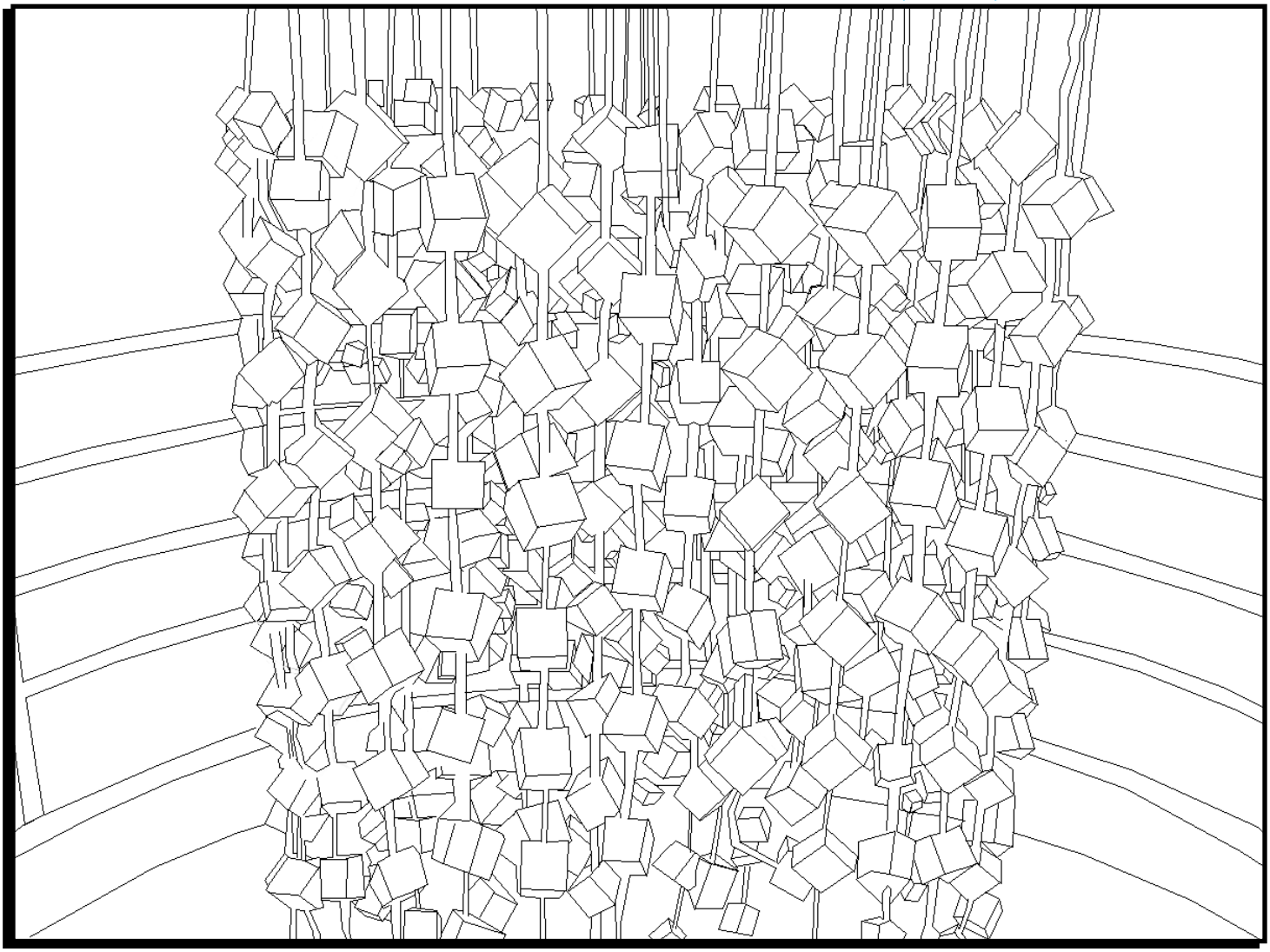
What are three career lessons you've learned thus far? One, you can learn a lot from your peers. Two, very few people in life want you to fail. That's up to you. Three, it's OK to be the dumbest person in the room as long as all the smarter people work for you.

Anything else??? One of my favorite parts of my job is to take a walk around NCNR and see all that is going on, with the buzz of operations in the control room, to the engineers working on figuring out the latest reactor issues, to the scientists intently studying the display of their results as the neutrons scatter off of their samples. It makes the NCNR a truly marvelous place to work!

ATOMIC ART

You can win!
Color the image below and submit to trtr-art@isotopictopics.com.

Learn more about the failed German attempt to build a nuclear reactor during WWII and the quest to uncover the cubes, https://physicstoday.scitation.org/doi/10.1063/PT.3.4202



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Website

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Isotopic Topics

TRTR