Nuclear News

July 2020

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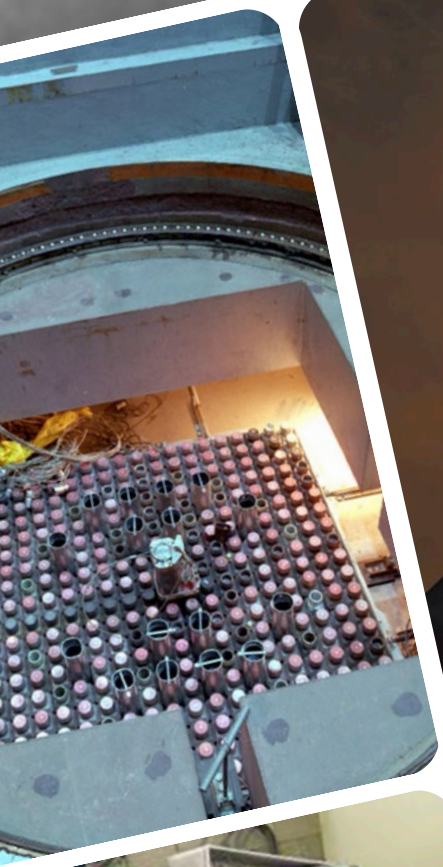
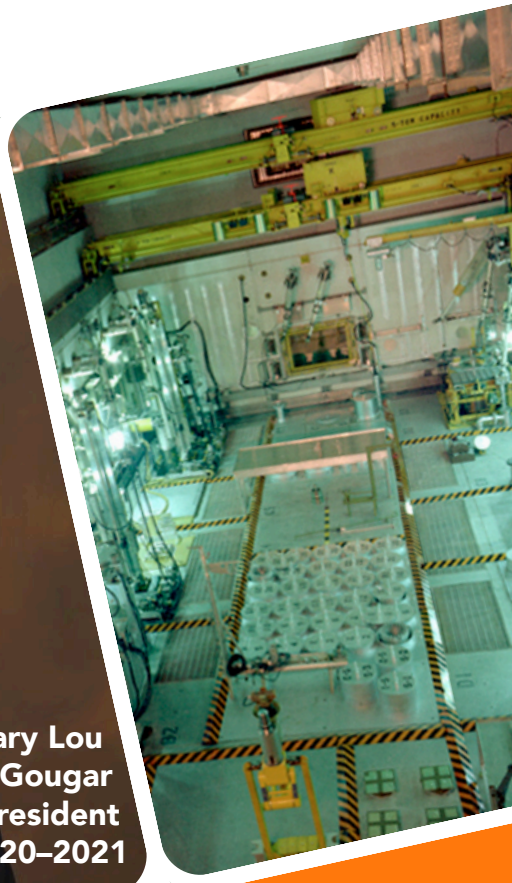
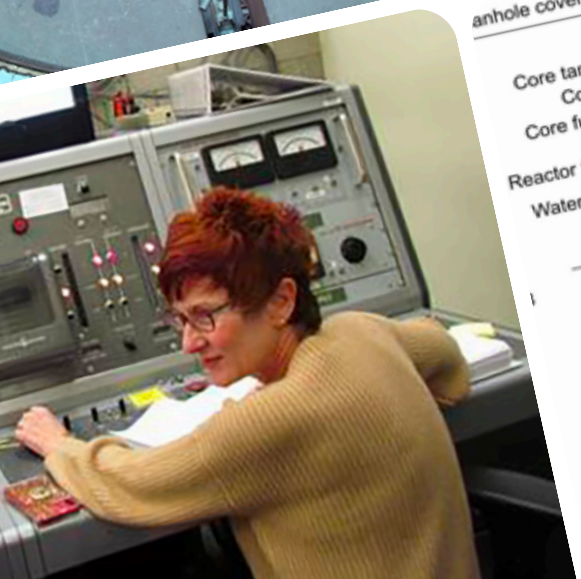
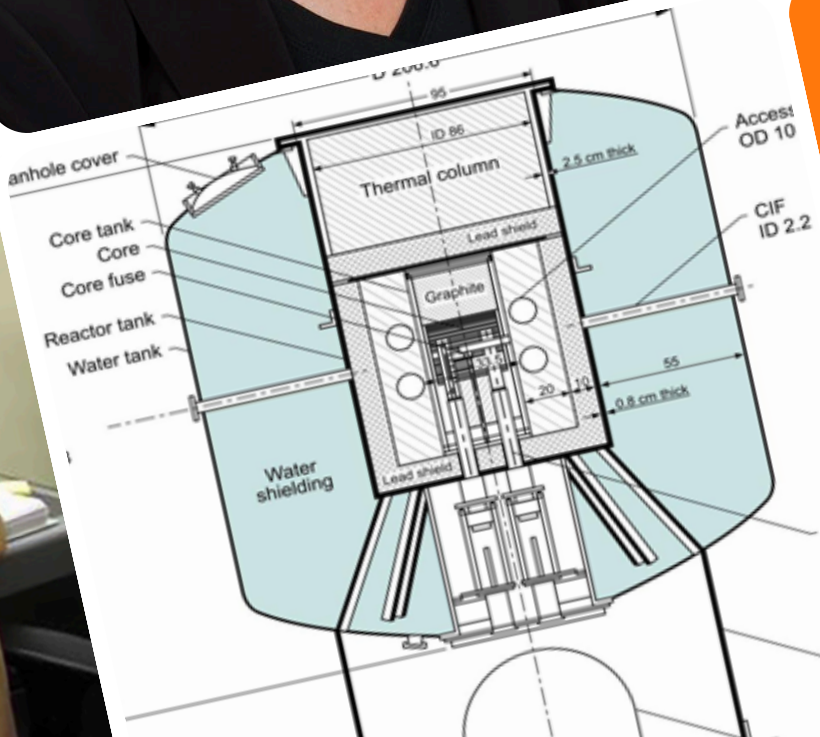
Dunzik-Gougar



Mary Lou
Dunzik-Gougar
ANS President
2020–2021







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On the Cover
Scenes from Dunzik-Gougar's life: (clockwise from top left) TRISO fuel particles; the hot fuel examination facility at Idaho National Laboratory; an Idaho State University (ISU) logo; cutaway of the ISU AGN-201m reactor; Dunzik-Gougar at the ISU AGN-201m reactor's control console; the TREAT reactor at Idaho National Laboratory.

Features

Every Issue

Electrostatic disinfecting and foggers were used during Limerick's successful refueling outage amid the COVID-19 pandemic. See page 28 for the full story.

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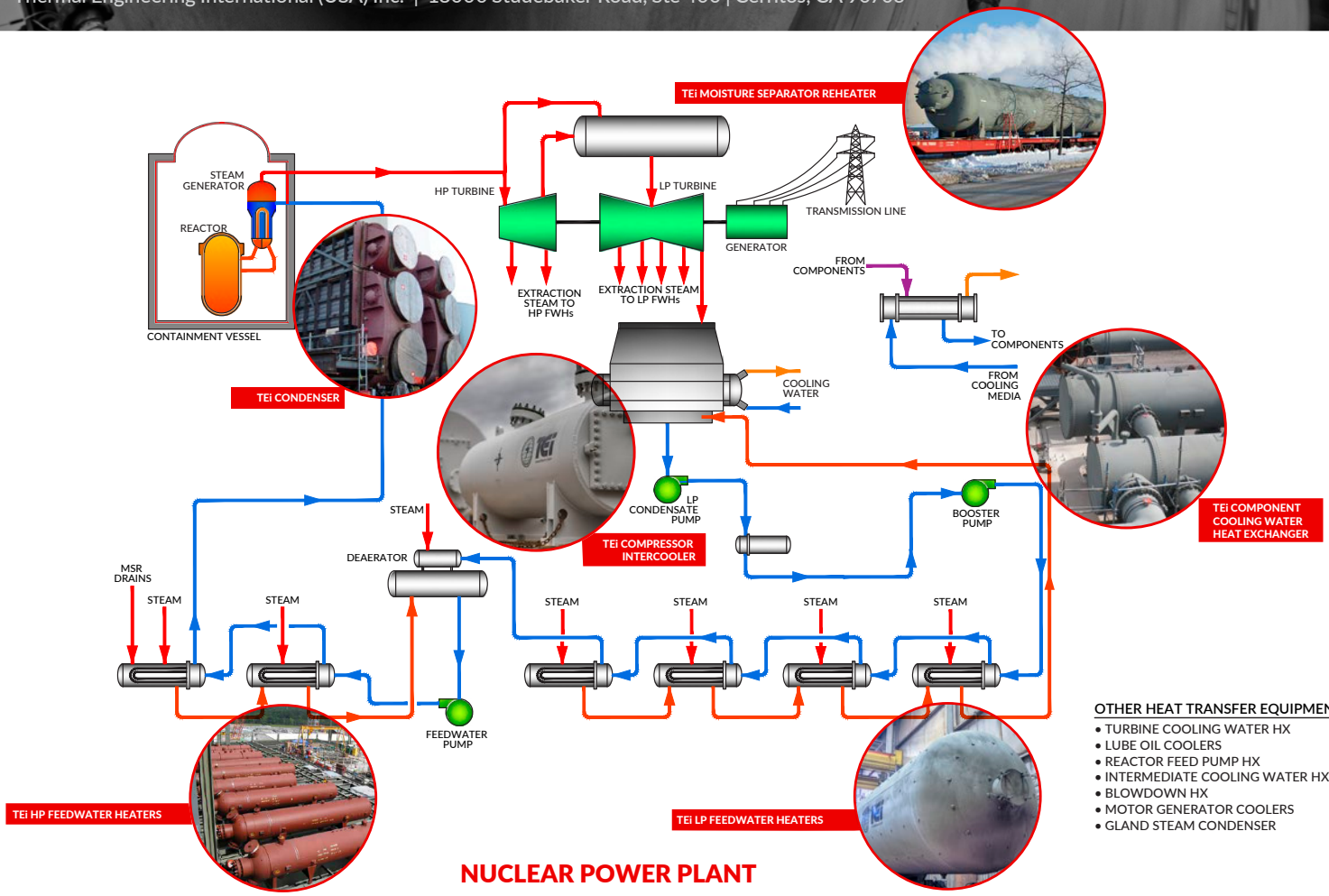

OTHER HEAT TRANSFER EQUIPMENT BY TEi

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The new *Nuclear News*

The American Nuclear Society and *Nuclear News* are proud to introduce the first issue of the "new" *Nuclear News*. The updated *NN* is one part of the improved ANS that also includes our online news site Newswire (ans.org/news), which is updated daily through the work week with nuclear-related news and feature articles. If you haven't yet checked out Newswire, please do so.

As for *NN* itself, we have refreshed the page designs, upgraded to a higher-quality paper stock, and added sections that we hope will draw you in and make you look forward to each issue. We have also retained the magazine's principal content, such as hard news for and about the nuclear community and feature stories that cover a variety of topics, such as nuclear plant outages, health physics, and robotics and remote systems.

Following are descriptions of our new sections:

Nuclear Trending—Positive news about nuclear science and technology and ANS's leading role in it. This section will include regular columns from the ANS president and the ANS executive director/chief executive officer; ANS successes on the national stage (such as callouts by lawmakers, collaborations with other organizations, ANS's setting the bar on nuclear policy discussions on topics such as low-dose radiation, and ANS's breaking records for virtual meetings, webinar attendance, and social media engagement); prominent industry successes, such as a new reactor order or record nuclear generation; policy updates; text/graphics pointing to featured issue contents and explaining why it's important and timely; announcements of new ANS position statements; and interesting quotes, facts, and historical notes.

Atoms—Quick takes on a current topic, capturing essential facts, data, and quotes and presenting them visually. Each month, something new will be presented that will catch the eye and spark insight.

Spotlight On—A focus on ANS professional divisions, committees, local and student sections, federal agency and national laboratory programs, and university programs.

Leaders—Comments from nuclear influencers, including those who lead national laboratory programs, government agencies and programs, universities, utilities, vendor/contractors, and ANS constituent groups.

A Critical Look—Setting the record straight on movies, TV shows, and other entertainment media—such as Amazon Prime's *Bosch* series and the Netflix *History 101* episode in which nuclear science and technology is inaccurately portrayed.

***Nuclear News* Asks**—Replaces the long-running Backscatter column on the last page of the magazine, where each month a single question is posed to an ANS member whose response gives the reader a chance to reflect on common experiences and the diversity of the nuclear community.

In addition, *ANS News* is no longer a separate publication and is now a part of *NN*. We hope you enjoy the new *NN* and look forward to it each month. Your feedback is important to us so that we can keep improving the product. If you have comments about *NN*, please email them to nucnews@ans.org. We look forward to continuing to serve the ANS membership.—*Rick Michal, Editor-in-Chief.*

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Cuba and the nuclear plant

I am trying to find information about an item of history from President Eisenhower's "Atoms for Peace" era of the 1950s. At the time, I was 15 or 16 years old. My father was a lawyer and frustrated engineer, and he encouraged me to become a nuclear engineer.

The information I am trying to find is in regard to a nuclear power plant that was proposed for Cuba, in the eastern part of the island at the port of Santa Lucia.

The Matahambre copper mine was located in the area, and it used large amounts of electricity, which was supplied by a fossil fuel plant. This is why a small nuclear reactor was proposed for the area.

The mine was taken away from its owners soon after Fidel Castro came into power, and the plans for a nuclear plant faded away. I left Cuba for the United States in 1961 and became an electrical engineer. (I switched my goal from nuclear engineering after hearing a college professor's lecture that nuclear power had no future!)

I have done as thorough a search as I could to find information about the proposed nuclear plant for Cuba, but I have come up empty. I ask *Nuclear News* readers if they remember details of that era and to share that information.

Adolfo Ponce de Leon
Atlanta, Ga.

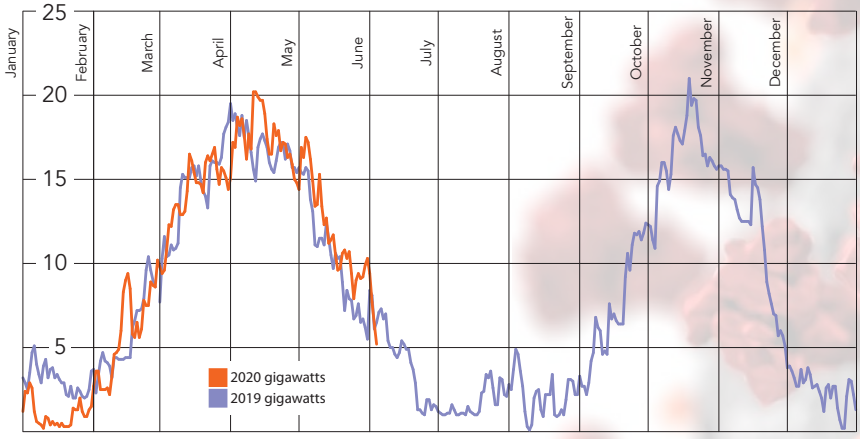
Editor's reply: We wish you luck on your endeavor. We too have done a search, both online and in our *NN* archives, but have found nothing related to a nuclear plant proposed for eastern Cuba. (The nuclear plant in question is not the Juragua nuclear plant, which was under construction on the western side of Cuba but was halted in the early 1990s.) Perhaps our readers have some information. If so, please contact nucnews@ans.org, and we will publish the info in *NN*.

Outage Management

The truth is, nuclear workers have always been essential. So are nuclear refueling outages, pandemic or no pandemic. As one reactor after another was safely refueled in recent months, keeping lights on across the country, attention focused on outage management. Here we offer a few quick takes and stats. Turn to page 28 for this month's Outage Management feature articles.

Daily U.S. nuclear capacity outage

Total fleet capacity outage trended slightly higher in spring 2020



Source: U.S. Energy Information Administration, based on the Nuclear Regulatory Commission's Power Reactor Status Report and Forms EIA-860 Annual Electric Generator Report and Form EIA-860M Monthly Update to the Annual Electric Generator Report. Note: Outage data reflect only nuclear units that have operated or were intended to operate in the past year.

"Not only did they perform the required outage work **SAFELY** and **EFFECTIVELY**, but they did it in **RECORD TIME** while preventing the spread of COVID-19."

Bryan Hanson, Exelon Generation president and chief nuclear officer, on spring 2020 refueling outage performance at four Illinois plants: Braidwood, Byron, LaSalle, and Quad Cities.

NRC fields COVID-19 relief requests

The Nuclear Regulatory Commission recorded

66

COVID-related power reactor licensing requests

FROM

31

plants by June 3.

Most requests came from plants conducting a spring 2020 refueling outage.

34

Exemption Requests

9

License Amendment Requests

23

Relief Requests

Source: www.nrc.gov/about-nrc/covid-19/reactors/licensing-actions.html. Image: Alissa Eckert, MS, Dan Higgins, MAMS

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Finding inspiration from the challenges we overcome

By Alan Icenhour

Alan Icenhour is an ANS Fellow and Associate Laboratory Director for Nuclear Science and Engineering at Oak Ridge National Laboratory.

In the past several months, the COVID-19 pandemic has dramatically changed the world. It required a quick adjustment to executing important missions from home, instead of the campus of Oak Ridge National Laboratory—a place I've gotten to know well in nearly three decades of service.

The experience has caused me to ponder what we can learn and apply to ongoing efforts in the broader nuclear community. If the first part of 2020 has reminded us of anything, it's that we are adaptable and resilient, which are qualities needed to make advanced reactors a reality.

Recently, the Department of Energy launched the Advanced Reactor Demonstration Program with the aggressive goal to build two nuclear reactors in five to seven years. This timely and necessary effort will require the nuclear muscle from industry and the exceptional scientific capabilities of our national laboratories.

For ORNL, that means bringing foundational science and technology advancements to bear for industry use—capabilities that will enable accelerated, cost-competitive deployment. We have the know-how to do that:

■ Earlier this year, the Consortium for Advanced Simulation of Light Water Reactors, based at ORNL, started commercially licensing its Virtual Environment for Reactor Applications modeling suite, which provides unprecedented high-fidelity insights into reactor operations.

■ The ORNL-designed IronClad, an iron-chromium-aluminum cladding, was developed in six years and handed over to industry for testing in the Hatch nuclear power plant in 2018, greatly reducing the traditional timeline for deployment of reactor materials.

■ ORNL is leading the Transformational Challenge Reactor (TCR) program, an additively manufactured nuclear reactor that is expected to start up in 2023. The goal is for this forward-thinking concept to lay the groundwork for industry to take the technology advances of TCR and apply them to their own reactors.

Our research and development activities are focused on building, and transitioning to industry, the various capabilities—optimal designs, novel materials and manufacturing methods, integrated sensors combined with the ability to handle massive amounts of data, and digital twins to drive toward autonomous operations—that will facilitate economical nuclear energy deployment this decade.

As a reader of *Nuclear News*, you likely know the early history of ORNL. The Army Corps of Engineers established the Manhattan Project as a response to World War II. This included building the X-10 site, which is now ORNL, to demonstrate plutonium production and separation. The Graphite Reactor broke ground on February 2, 1943, and went critical only nine months later!

I'm a history buff, and I always get chills when touring the Graphite Reactor Museum, seeing the logbook entry for the first criticality of the world's first continuously operating reactor, and reflecting

on how yesterday's nuclear giants paved the way for today's nuclear scientists and engineers. They were resilient and resourceful, and they responded when the nation called.

In 2019, ORNL hosted Sam Beall Jr., whose career included work on the Manhattan Project and the Graphite Reactor. Later, he worked on the Low Intensity Test Reactor and the Homogeneous Reactor Experiment before leading ORNL's Reactor Division.

Just a few weeks before his 100th birthday, Beall wanted to see how the laboratory had changed since his retirement in the 1970s. At lunch, Beall looked around the table and said to us, "I started up four reactors on this site. What are you doing?" Challenge accepted!

As all of us look to the nation's future of nuclear energy, I challenge you, and myself, to prepare as our nuclear predecessors would have. Use their innovation as inspiration. Use Beall's question as a call to action. Use the last few months as an ever-present reminder of how quickly we may need to—and can—adapt.

We have brought together a diverse set of scientists and engineers, who have various backgrounds, experiences, and cultures, for this moment. We are stronger, more resourceful, and more versatile. Let's work as a community to deliver the next nuclear era and pave a new path for future generations of scientists and engineers—that is our obligation.

Oak Ridge National Laboratory's history started with the Graphite Reactor (top images), the world's first continuously operating nuclear reactor, in 1943. In the 77 years since, the lab has operated 13 reactors and is using those experiences to develop a quicker, more affordable path for advanced reactor technologies. This includes the Transformational Challenge Reactor, an additively manufactured nuclear reactor, expected to start up in 2023.

Spotlight On . . .

The ANS Accelerator Applications Division

By William Horak

The Accelerator Applications Division (AAD) is a relatively young ANS professional division. It was originally organized to promote the advancement of knowledge in the use of particle accelerator technologies for nuclear and other applications. The division focuses on the production of neutrons and other particles and the utilization of these particles for scientific or industrial purposes, such as the production or destruction of radionuclides significant to energy, medicine, and defense, as well as imaging and diagnostics.

AAD members come from national laboratories, universities, and the private sector. Like many of the professional divisions, many of its members are from outside the United States. The division grew out of the design and operation of large research accelerator facilities, including the Spallation Neutron Source, the Relativistic Heavy Ion Collider, the Los Alamos Neutron Science Center, the Large Hadron Collider, and the Facility for Rare Isotope Beams at Michigan State University. These facilities have opened up new areas in the understanding of the structure of matter and its response to extreme environments and have contributed to the production and use of isotopes for a variety of scientific and medical applications.

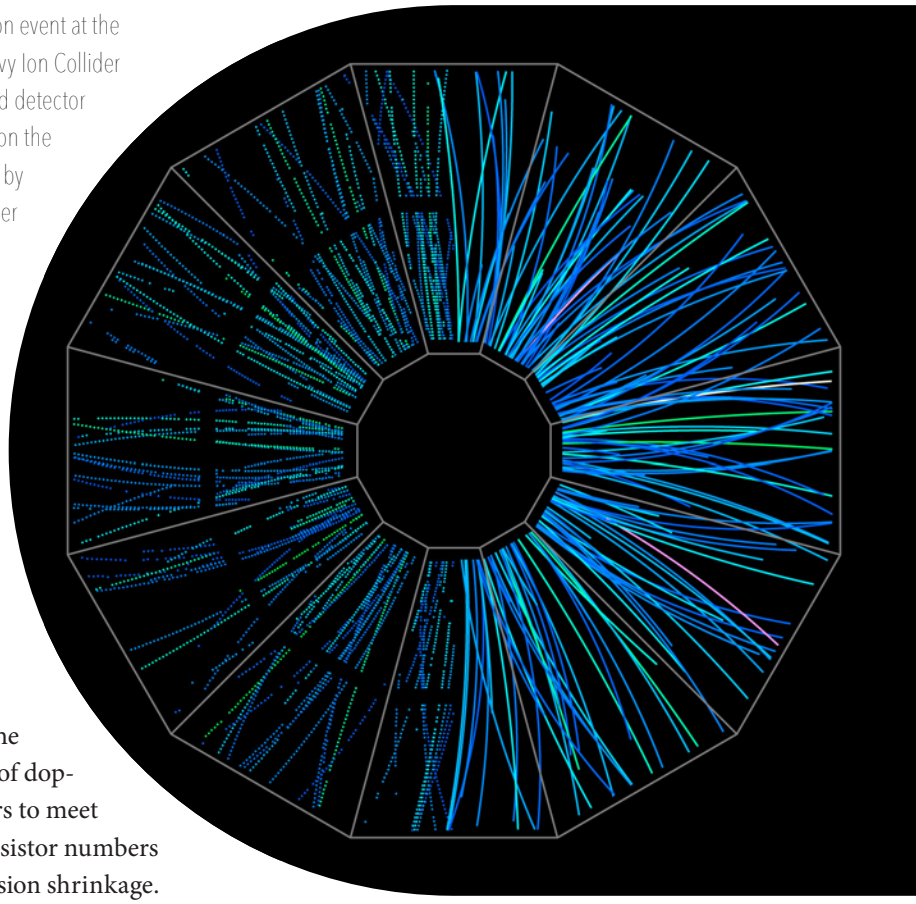
About every two years, the division organizes a topical meeting, which typically alternates between a U.S. and a non-U.S. location. AccApp'20, organized in cooperation with the International Atomic Energy Agency, had over 300 papers from more than 50 countries accepted for presentation. Unfortunately, the meeting was canceled because of the COVID-19 crisis.

William Horak, AAD Chair

The division was founded when programs such as Accelerator Production of Tritium and Accelerator Transmutation of Waste, along with Rubbia Energy Amplifier for thorium utilization, were being developed at low technology readiness levels. Although none of these concepts were developed further, research facilities based on their concepts are being developed and deployed.

Currently, accelerator-driven research facilities have been built or are under development in India, China, Switzerland, Sweden, Ukraine, Japan, and Belgium.

Historically, accelerator developments have significantly been driven by the semiconductor industry for device doping. The ever-increasing needs of device shrinkage require precise control of doping regions, which was beyond the capability of the thermal diffusion approach in the late



This end view of a low-energy collision event at the STAR detector at the Relativistic Heavy Ion Collider shows particle tracks on the right and detector "hits" from which tracks are derived on the left. The abundance of hits recorded by the detector's recently upgraded inner sectors greatly enhances scientists' ability to reconstruct tracks to make precision measurements. Image: Brookhaven National Laboratory

1970s. Accelerators cannot only precisely control the number of dopants introduced, but also the depth of dopants, which makes it possible to fabricate transistors to meet the road map from Moore's Law, which is that transistor numbers would double every two years due to device dimension shrinkage.

More than 100 steps are typically required to make a silicon-based chip. About 20 to 30 ion implantation steps are typically needed in fabrication. The semiconductor industry has stimulated the specific designs of different types of accelerators. For example, high-energy ion accelerators are required for isolation to reduce leakage current, and middle-energy ion accelerators are needed for gate, source, and drain implantation. Ultra-low energy, high-current accelerators are required for shallow junctions, which has been a bottleneck for device shrinkage. Today, accelerators are still evolving to meet the industry's needs.

Accelerator applications are being used for advanced materials research, which includes ion beam analysis and ion beam testing. Ion beam analysis includes a large group of techniques, such as Rutherford backscattering spectrometry, particle-induced X-ray emission, forward recoil detection, ion beam induced current, nuclear reaction analysis, and second ion mass spectrometry. These methods have had a significant impact on materials science. Ion beam testing is a very important subfield in nuclear materials studies due to the fact that current testing reactors cannot create the damage rates demanded by materials development. Commercial accelerators at the energy of megavolts can introduce heavy damage with a rate of more than three orders of magnitude higher than typical rates inside a reactor. This makes it possible to use one day of ion irradiation to emulate neutron damage accumulated over 10 years in a reactor environment.

It is feasible to control ion irradiation under specific conditions to decouple parameter dependence (i.e., temperatures and damage rates). It is feasible to not only simulate the damage processes but to observe them *in situ* using imaging techniques such as electron microscopy and synchrotron light sources (e.g., IVEM-Tandem at Argonne National Laboratory and I3M at Sandia National Laboratories).

Spotlight On continues

Above: A production component going up and over a bunker wall into a SHINE structure. Photo: Phoenix LLC
Left: Presenting flux calculations of Niowave's subcritical uranium target assembly to the National Nuclear Security Administration. Photo: Niowave

Low-energy electron accelerators are also commonly used in applied radiation technologies, such as sterilization of medical devices, polymer modification, and food irradiation. For example, the Department of Energy's National Nuclear Security Administration is currently funding a project implemented by Pacific Northwest National Laboratory, Texas A&M University (TAMU), and several industrial players to perform radiation effects testing on different medical devices representing 17 polymers in order to determine any differences in the effects of irradiation with cobalt-60 and sub-10 MeV electron beam and X-rays. RadiaBeam, a California-based company, is developing a compact, inexpensive, low-energy linear accelerator (LINAC)–based self-contained irradiator for sterilization and phytosanitary applications. Finally, the Electron Beam Research Facility at TAMU investigates and

applies irradiation to eradicate food-borne infectious diseases and to ensure global food supplies.

Radioisotope production has been a main area of accelerator applications for many years. Accelerators have been used to produce a wide range of radioisotopes for medical and industrial purposes. Accelerators not only enable these isotopes to be produced at the hospital and other points of use, but enable their mass production without the use of reactors.

Superconducting magnets at the Facility for Rare Isotope Beams. Photo: FRIB

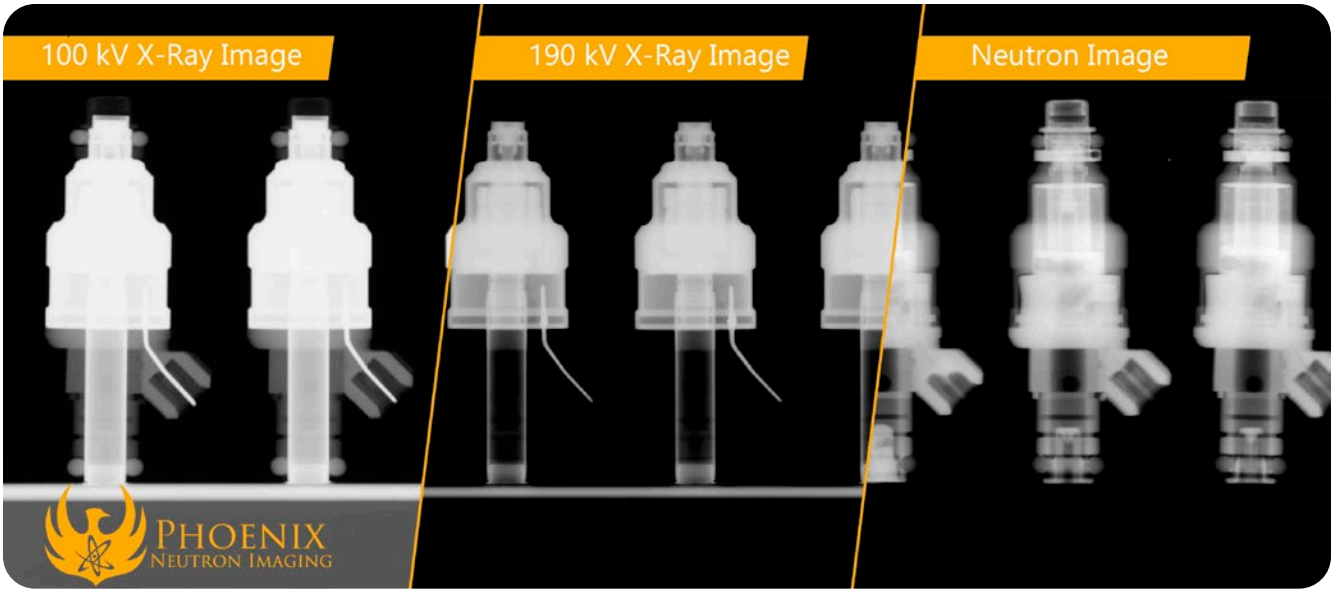
Recently, the NNSA funded a program to produce molybdenum-99, a crucial treatment for cancer, which was being produced using high-enriched uranium in research reactors outside of the United States. Four companies were selected for cooperative development agreements. Three of these companies proposed producing Mo-99 using accelerator-driven systems: NorthStar Medical Isotopes, Niowave Inc., and SHINE Medical Technologies. SHINE is using a high-flux accelerator-based neutron source to produce comparable neutron yields to a fission reactor and low-enriched uranium instead of HEU. SHINE plans to produce one-third of the world's demand for Mo-99 at its production facility in Janesville, Wisc. NorthStar will use electron accelerators to generate Mo-99 from the (n,γ) reaction in Mo-100 targets at its facility in Beloit, Wisc. Lansing, Mich.–based Niowave is developing superconducting electron linear accelerators for medical radioisotope production.

As is the case with advanced reactors, private firms, in partnership with national laboratories, are developing and deploying new applications for accelerators. Accelerator-based neutron sources stand to benefit industries such as aerospace manufacturing and health care, as these two industries, in particular, already use neutron sources for quality assurance. In the aerospace industry, manufacturers of turbine blades and other critical components, such as ejection and payload faring separation mechanisms, require the extensive use of neutron radiography to ensure product quality and safety.

Neutron radiography has been used as a nondestructive testing method for industrial parts since the 1950s. Since the neutron cross section of materials does not correlate linearly with density, as the

Accelerators not only enable these isotopes to be produced at the hospital and other points of use, but enable their mass production without the use of reactors.

Spotlight On continues



Radiographs of fuel injectors using X-rays from two energy levels and neutrons. Image: Phoenix LLC

X-ray cross section of the same materials does, neutron radiography acts as a powerful complementary inspection method to X-ray radiography.

These industries currently rely heavily on reactor sources, but recent advances in accelerators relying on deuterium-deuterium or deuterium-tritium fusion reactions to produce neutrons can offer an alternative. Wisconsin nuclear technology company Phoenix LLC has developed an accelerator-based neutron generator capable of producing a high enough neutron output to produce radiographic images of the highest quality. Phoenix intends for its first-of-its-kind neutron imaging center in Fitchburg, Wisc., to be the first of many.

Another company, Muons Inc., was founded to develop new accelerator technologies for the DOE. As its name suggests, its original focus was to enable technologies for a muon collider, potentially the next atom-smasher to follow CERN's Large Hadron Collider. Many of Muons's projects support ANS objectives over a wide range of technologies. Normal and superconducting radio frequency components now under development range from magnetron power sources to provide low-cost, highly efficient alternatives to klystrons to alternating phase focusing drift tube linear particle accelerators to create ion beams for the production of radioisotopes used for medical diagnostics and therapy. Muons is currently working to advance superconducting accelerator-driven subcritical reactor technology to address global nuclear waste issues and carbon-free energy needs.

This article is an overview of the work being done by national laboratories, universities, and private industry on accelerator applications. The most important activities of AAD, however, are those that support the next generation of acceleration application researchers. Each year, the division sponsors a best paper award at the ANS Student Conference and provides travel grants to students for ANS national meetings. AAD believes that it is this support that will ensure the development and deployment of accelerators in the future in new and innovative ways.

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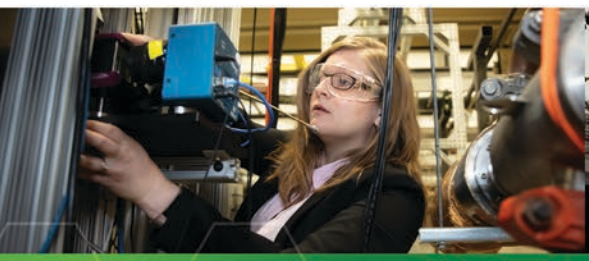
"There are few places in the world like Oak Ridge National Laboratory. Since coming to the lab in 2014 as a postdoctoral fellow, I've found colleagues willing to collaborate, leadership who listens, and facilities that are hard to beat. It's an environment that has helped my career flourish."

- Elijah Martin, *Plasma Physicist*



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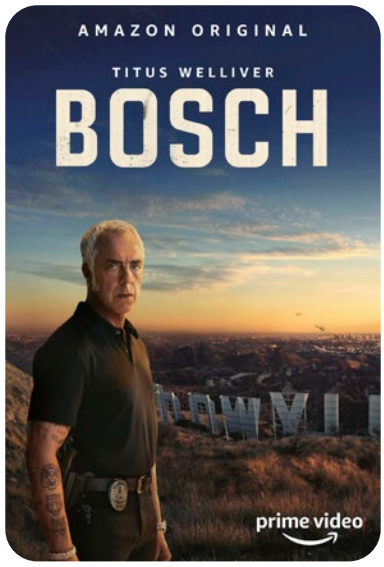
Fact-checking Amazon's new season of *Bosch*

The latest season of Amazon's detective series *Bosch* premiered recently on its streaming service, Prime. The season opens with the murder of a medical physicist and the theft of radioactive cesium, with plenty of drama following as the protagonist tries to solve the murder and end the "catastrophic threat to Los Angeles." The show is a work of fiction, but let's take a closer look at the depiction of radiation to sort out the scientific facts.

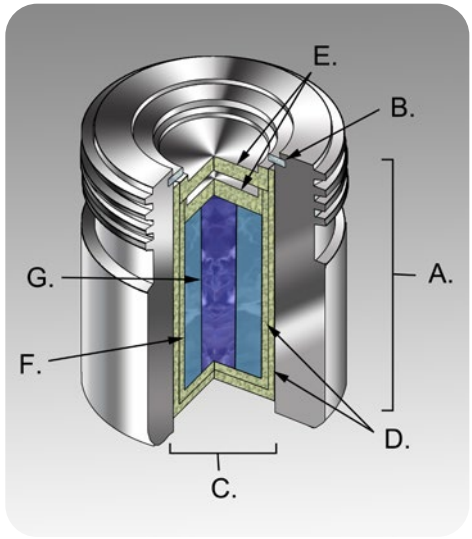


The series stars Titus Welliver as Los Angeles Police Department detective Harry Bosch and Jamie Hector as his partner, Jerry Edgar. The first episode of the sixth and latest season begins late in the evening at a Los Angeles hospital. We are shown a nervous-looking medical physicist as he walks into a laboratory, the camera dramatically focusing on the radiation sign on the door. No one else is around as the medical physicist clears out the lab's inventory of what we find out later is cesium. The physicist then walks the material out of the hospital without anyone giving him a second look.

The medical physicist drives to a secluded meeting spot, where a masked individual demands the cesium. The medical physicist says that he stashed it nearby and will gladly give it up, but only after the safety of his wife—whom, it is implied, has been kidnapped by the masked man—is guaranteed. The scene cuts away to a new one: Bosch and Edgar arriving at the crime scene, where they learn of the murder and eventually discover the theft of the medical material.

To help understand the science and practices portrayed in *Bosch*, *Nuclear News* asked some questions of ANS members Steve Biegalski, chair of the Nuclear and Radiological Engineering and Medical Physics Program at Georgia Tech, and Sam Glover, chief of the Chemical and Biological Monitoring Branch of the National Institute for Occupational Safety and Health.

The radioactive forms of cesium most commonly used in hospitals (Cs -131 and Cs-137) are produced by neutron irradiation of barium and by the fission of uranium, respectively. Cesium is problematic, because it moves easily through the air; binds strongly to soil, concrete, and metal; and, in the case of Cs-137, has a half-life of around 30 years (Cs-131 has a half-life of only about 9 days). The long half-life of Cs-137 means that hospitals can store the material for extended periods of time, unlike other isotopes that have half-lives of only a couple of days. The radioactive cesium isotopes found in hospitals are used most often in blood irradiators or other sterilization systems. Both Cs-131 and Cs-137 seeds can also be used for brachytherapy



An example of a teletherapy radiation capsule like the one at the center of the Goiania incident in Brazil. The Goiania capsule was 1.8 inches long with a diameter of 2 inches. The depicted components are A.) an international standard source holder (usually lead), B.) a retaining ring, and C.) a teletherapy "source" composed of D.) two nested stainless steel canisters welded to two E.) stainless steel lids surrounding an F.) internal shield (usually uranium metal or a tungsten alloy) that protects a G.) cylinder of radioactive source material, often but not always cobalt-60. The diameter of the "source" is 30mm. Image: Wikimedia/KDS444

treatment, where small cesium seeds are inserted directly into a cancerous tumor. Biegalski said, "The problem with high-activity, long-lived isotopes is that they pose a radiation risk for the duration of their use, and they must be properly disposed at the end of use." Other uses of radioactive isotopes in medicine can be found on ANS's About Nuclear page at ans.org/nuclear.

Before we dig further into the *Bosch* series, it is interesting to note a real-life incident that happened in Goiania, Brazil. Glover explains that in 1987, a radiation therapy machine was removed from an abandoned hospital. That machine used a lead-and-steel capsule that contained 93 grams of cesium instead of small pins as shown in *Bosch*. The Goiania incident resulted in four people dying and dozens of homes being demolished due to contamination from the cesium. It's not an apples-to-apples comparison to what is depicted in *Bosch*, but it does provide an example of what could happen when radioactive material is released.

Bosch never specifies what isotope was stolen, but the most likely explanation is that the rods being removed by the medical physicist in the first episode could contain cesium seeds used for brachytherapy or cesium chloride used for sterilization systems. Biegalski explained that radiation contamination would not occur unless the steel case containing the material was broken or damaged, which was noted by the FBI agents in the show. Biegalski said, "If Cs-137 was used by domestic terrorists in a dirty bomb, it would wreak havoc on a major city like Los Angeles because of the panic it would induce and not from radiation."

There are times when the show discusses radiation dose, like when Bosch and Edgar find the cesium. Edgar's radiation detector does not go off until they are right next to the cesium. "If the source had high activity," Biegalski said, "the detector should have been alarming much farther away" than portrayed in the show. Bosch does say, after a quick checkup at the hospital, that the doctors told him he would get more radiation on a flight from Los Angeles to New York—which is very true.

Screenshot of when the cesium pins were discovered by Bosch and Edgar. Image: Amazon Prime Video

Any exposure to radioactive material is not to be taken lightly, but it takes prolonged exposure to high-activity sources found in hospitals to receive enough dose to get radiation sickness or die. The only casualty from radiation in *Bosch* was a homeless man who found the canister of cesium. It was discovered that the man was sleep-

A Critical Look continues

A screenshot showing one of the cesium pins being removed by the medical physicist in the first episode of *Bosch*. Image: Amazon Prime Video

ing in his van with the cesium only a few feet away for the handful of days after it went missing from the hospital. Biegalski agreed that the scenario depicted "could theoretically give him a lethal dose without any medical attention."

The opening scene of the first episode sets the tone here. Biegalski confirmed that there is no way a medical physicist would be able to simply walk into a hospital's lab and remove a source like this. "Any radiation source with high enough activity to cause public risk is protected by multiple layers of security," Biegalski explained. "There are physical barriers for removal along with alarm systems and video surveillance. It is not possible for someone to just walk out of a facility with such a source without alerting others to this removal."

Then there are the obligatory comments from FBI agents in the show saying things like any radiation contamination would be "catastrophic" with "mass casualties" and the land would be "unusable for 300 years." If a radioactive source was dispersed over a city by a terrorist organization, Biegalski said, "the concentrations would be reduced significantly and would not be lethal to the city." We are never told how much cesium is in the stolen pins, but referring back to the Goiania incident, 93 grams of cesium chloride was spread around the Brazilian city, and four people died. Any deaths are a tragedy, but "mass casualties" is not a realistic statement.

Biegalski added, "The main impact would be denial of use of the contaminated area"—not very different from what we are dealing with now with the COVID-19 pandemic. Economic activity has been halted since mid-March around most of the United States, and the economic impacts have been devastating for many around the country and the world. This is similar to what would happen if a radioactive source were to be dispersed in a major city—though the effects of a dirty bomb would be less widespread than the current COVID-19 pandemic.

While the FBI agents in the show say that the land wouldn't be habitable for 300 years, in reality the land would instead be decontaminated, as it was in real life in Brazil. During the remediation process, the contaminated area would not be usable. The decontamination would take a considerable amount of time and would be very expensive. Even after the cleanup, the general public would likely still be afraid to return to the area because radiation is undetectable without a sensitive radiation detector. Fear would have much more impact than the radioactive material itself.

Overall, the *Bosch* series was fun to watch and has received a lot of positive reviews from fans and critics. Its take on radiation, however, has to be taken with a grain of sodium chloride.

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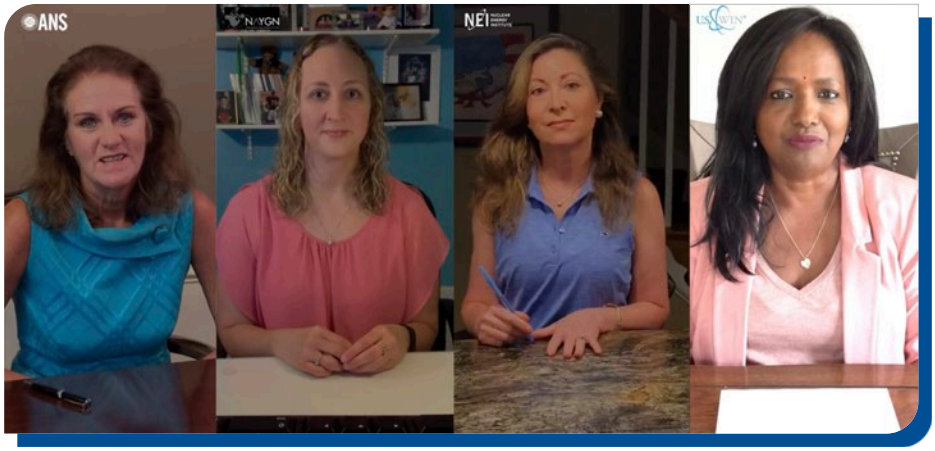
ANS strengthens collaboration with nuclear organization partners

In the final week of her term as ANS president, Marilyn Kray announced the signing of a memorandum of understanding with other key nuclear organizations on June 9 during the President's Special Session of the Virtual Annual Meeting. A short video of the virtual signing of the MOU is available online at www.ans.org/file/1620/mou-720.mp4.



Marilyn Kray (ANS), Amber Von Ruden (NAYGN), Maria Korsnick (NEI), and Jhansi Kandasamy (WIN) signed the MOU.

Kray signed the MOU along with Amber Von Ruden, president of North American Young Generation in Nuclear; Maria Korsnick, president and chief executive officer of the Nuclear Energy Institute; and Jhansi Kandasamy, chair for U.S. Women in Nuclear. The organizations have agreed to strengthen their collaboration in advancing nuclear energy and science, professional development, and member networking to support industry priorities and benefit their individual members.

"NAYGN, NEI, WIN, and ANS have worked together in the past," Kray said as she signed the document. "Each organization is unique, but we share many common goals. This MOU provides us the framework to collaborate even more in the future. It also signals our cooperation to the external stakeholders."

The MOU calls for the organizations to:

- Maintain regular and ongoing communication about opportunities for collaboration and support for members in the commercial, academic, and laboratory areas.
- Support collaboration by encouraging the creation of inter-organization objectives at the local and university level, sharing communication strategies, and developing programs to promote networking and professional development for members.
- Facilitate opportunities for cross-organizational mentoring and knowledge transfer to enhance technical, professional, and leadership skills.
- Support one another's events, including but not limited to national conferences, webinars, mentoring initiatives, leadership programs, and technical sessions.
- From time to time, develop a joint membership communication to keep each organization's members informed.
- Advocate for initiatives that support science, technology, engineering, and math and the promotion of nuclear science, energy, and technology.
- Share lessons learned on public outreach, communicating with stakeholders, and keeping members informed and engaged.
- Create and foster a policy environment to advance the nuclear industry.
- Jointly recognize achievements and award outstanding service to benefit nuclear science, energy, and technology.

ANS PRESIDENT'S COLUMN

400 words?!?

It's my first column as ANS president and I'm limited to 400 words? Well, it turns out you can say a lot with a little. Take, for example, "Shelter in place," and "Say their names." These phrases have been at the forefront of our consciousness in recent months, and each invokes a host of emotions and mental images. What should the ANS catchphrase be? "Into the Nuclear Future"? "Just Nuke It"? "Nuclear, it keeps going . . . and going . . . and going . . . "? How about, "Nuclear: The choice of a new generation"?

Don't worry, I don't plan to quit my day job to become a marketing guru! And like most engineers and scientists, I'm a person of action, rather than words. If you've been watching ANS happenings in recent months, you will have seen the results of a lot of action. We have a new executive director/CEO, Craig Piercy, who has undertaken a complete operational review and reorganization of ANS staff; staff have created a Member Service Center (reached at askanything@ans.org) and an updated ANS website; and then there is this reimagined edition of *Nuclear News*! All of these actions have been guided by ANS Change Plan 2020, approved by the Board of Directors in November 2019 with the goal of creating a more sustainable Society that better serves you and me. It may not be the snappiest catchphrase, but Change Plan 2020 is resulting in real, strategic changes. We find more evidence of the value of organization and leadership changes in the overwhelming success of the first-ever completely virtual ANS meeting: the 2020 ANS Annual Meeting. In a matter of weeks, our staff and members organized and conducted a high-quality technical meeting for which a record 2,346 people registered.

I consider myself fortunate to be part of the dynamic team of members and staff who will continue to implement Change Plan 2020 and keep ANS on course. I invite you to hop on board and help steer our Society into the future. Who needs a catchphrase!?!

That's a wrap, at only 351 words ;)—*Mary Lou Dunzik-Gougar (president@ans.org)*

Nuclear Notables—July

Power to the grid
65 years ago in Arco, Idaho, BORAX-III sent the first nuclear-generated electricity to the grid

Golden anniversary
Ginna, sited on Lake Ontario, entered commercial operation in July 1970

Nuclear for Mississippi
Grand Gulf, boasting the U.S. fleet's greatest licensed MWt, entered commercial operation in July 1985

1950 1960 1970 1980

60 years ago
The first multinational nuclear association was founded in Belgium on July 12

45 years ago
FitzPatrick, a BWR, began commercial operation in upstate New York

Nuclear Trending continues

Piercy joins Gender Champions in Nuclear Policy

ANS Executive Director/CEO Craig Piercy has joined Gender Champions in Nuclear Policy (GCNP), making a commitment, along with over 50 other leaders in the GCNP network, to break down gender barriers in the field of nuclear policy.

"Fighting for gender equality within the nuclear profession is a vital part of making our community more inclusive and dynamic," said Piercy. "ANS is committed to not only recognizing the contributions of women in nuclear but amplifying their voices as well."

GCNP is uniting leaders of nuclear policy organizations who have committed to work toward gender equality within their spheres of influence. Immediate Past President Marilyn Kray joined GCNP in 2019 on the recommendation of the Diversity and Inclusion in ANS Committee. Kray's term as ANS president ended on June 11, and Piercy will now represent ANS as a Gender Champion.

Like all GCNP signatories, Piercy has adopted a personal "panel parity pledge" to avoid whenever possible appearing on single-gender panels. In addition, Piercy has made three "SMART" commitments—pledges that are Specific, Measurable, Attainable, Relevant, and Timely.

Piercy has pledged to:

- Finalize an overview of the roles and responsibilities of ANS session organizers and chairs to encourage balanced participation in panels and Q&A sessions, with consideration for virtual events.
- Revise enforcement procedures for the ANS Respectful Behavior Policy.
- Review historical data of ANS Honors and Awards to analyze for representativeness of the Society membership across the sectors of utility, vendor/consultant, academia, and government/national laboratory.

Progress on the pledges will be reported to GCNP annually. As pledges are accomplished they can be replaced with new commitments that strengthen and expand continuing progress toward gender equality.

Visit www.gcnuclearpolicy.org for more information about GCNP, and explore the many resources of the Diversity and Inclusion in ANS program at www.ans.org/communities/diversity/, including the ANS position statement on Diversity in Inclusion in the Nuclear Profession and a curated list of educational resources on diversity, equity, and inclusion.

Your toolkit of diversity, equity, and inclusion resources

The Diversity and Inclusion in ANS (DIA) Committee guides the Diversity and Inclusion in ANS program to promote diversity and inclusion in nuclear science, technology, and engineering and to promote and support the participation of underrepresented or marginalized groups within the Society, including—but not limited to—women, persons of color, members of the LGBTQ+ community, and persons with disabilities.

A curated list of over 75 educational resources on diversity, equity, and inclusion is available to all on the ANS website at www.ans.org/

Our flagship moves forward

Dear reader:

Welcome to the inaugural edition of the new *Nuclear News*! What you are seeing is truly the product of a team effort, led by our Director of Publications John Fabian and veteran Editor-in-Chief Rick Michal, to fundamentally reimagine the way we bring you news and insights from the wide world of nuclear science and technology. *Nuclear News* has always been the flagship publication of the American Nuclear Society, but in recent decades our visual format has gotten a little, well . . . long in the tooth.

So we set out to re-create the magazine, maintaining the quality content our readers have come to expect, housed in a format that is more modern and visually impactful. It is part of a larger strategy to keep you informed and engaged in the global nuclear science and technology community through a vibrant mix of traditional periodical and digital content. In addition to reading this magazine from cover to cover, I encourage you to make a daily visit to ANS Newswire, our companion digital news outlet (ans.org/news). There you will find a mix of daily stories and *Nuclear News* content that is a substantial leap forward from the poorly named "Late News" of the *NN* of yore. We have also discontinued publication of *ANS News* in PDF form, but rest assured that its content will continue to feature both in the new magazine and on Newswire.

Redesigning a magazine is hard. It is an exercise that requires acceptance upfront that not everyone will like all parts of the final product. However, I think our team of volunteer leaders and staff has done an excellent job of setting the direction forward. Do you like what you see? Let us know! We love feedback and are committed to refining the content and format of *Nuclear News* over the next 12 months.

The 2020s will be a pivotal time for nuclear science and technology, and the new *Nuclear News* is built for the journey. See you next month.—*Craig Piercy, Executive Director/CEO (cpiercy@ans.org)*

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communities/diversity/resources/.

It includes general information; links to networking and support resources for numerous ANS communities; anti-racism educational materials; tips for being an ally to underrepresented or marginalized groups; steps to reducing biases in workplaces and academia; and even resources tagged for families, children, and teens.

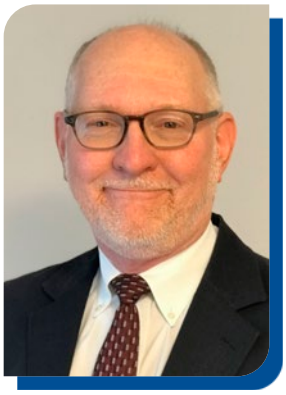
The list will be continually updated with new resources, so bookmark www.ans.org/communities/diversity/resources/ and return often.

The ANS DIA program also provides networking events, organizes diversity-related sessions at meetings, provides travel scholarships for meetings, bestows awards, and offers leadership opportunities. ANS programs are shaped by a position statement on Diversity in Inclusion in the Nuclear Profession and the ANS Statement on Diversity.

Visit www.ans.org/communities/diversity/ for more information.

Nuclear Trending continues

ANS backs NRC rulemaking on spent fuel reprocessing



Nesbit

ANS Executive Director/CEO Craig Piercy sent a letter to the Nuclear Regulatory Commission on May 28 urging the agency to resume work on a proposed rulemaking to allow spent fuel reprocessing in the United States. As the letter explains, "the lack of an efficient, technically robust, and technology-inclusive regulatory foundation for reprocessing and recycling is a barrier to innovation."

Steve Nesbit, who was recently elected ANS's next vice president/president-elect, chairs the ANS Nuclear Waste Policy Task Force and helped develop the letter. *Nuclear News* staff talked with Nesbit about the development and goals of ANS's participation in the NRC's rulemaking process.

Spent fuel reprocessing (also referred to as used fuel recycling) could lead to more efficient use of uranium resources while reducing the amount and types of waste that require geologic disposal. "Everything comes at a cost, and at the present time the cost of embarking on a reprocessing program for the current fleet of light-water reactors would be very high," Nesbit stated. "With that being said, a closed fuel cycle could be an attractive option for advanced reactors, particularly those that operate with a fast neutron spectrum and are able to efficiently utilize recycled nuclear material."

As Piercy's letter states, efforts by the NRC to address regulatory gaps, particularly regarding costs and nonproliferation, "would tangibly reduce the regulatory uncertainty associated with deploying reprocessing technologies, thereby lowering the costs and risks of deployment. . . . While no new reprocessing facilities are planned in the United States at this time, this in itself should not be the rationale for suspending rulemaking."

Reprocessing has gotten a lot of attention within the nuclear community lately, especially after Rita Baranwal, assistant secretary for nuclear energy at the Department of Energy, suggested the United States could send fuel overseas for recycling during a May 14 webinar hosted by the Organization for Economic Cooperation and Development's Nuclear Energy Agency. ANS's work on the issue pre-dated those remarks.

"The ANS Fuel Cycle and Waste Management Division raised the issue in April," Nesbit said. "Incoming chair Sven Bader, current chair Jared Johnson, and others in FC&WMD did a great job drafting a comment letter and working with the Nuclear Waste Policy Task Force and the ANS staff to get it issued."


American Nuclear Society

ISSUE BRIEF

A Proposal for Progress on Nuclear Waste Management

Nesbit explained ANS's goal in this way: "We would like the NRC to carry out the proposed rulemaking to establish a technology-inclusive, risk-informed, and performance-based rulemaking framework for nuclear fuel reprocessing facilities," he said. Recognizing that rulemakings typically take a long time to come to fruition, Nesbit added that "my hope is that the agency will streamline its processes and accomplish the job in a time frame of approximately five years."

The Nuclear Waste Policy Task Force will continue to encourage policymakers to address the current logjam on high-level waste management. The events of 2020—including the COVID-19 pandemic and a presidential election—may forestall major breakthroughs on nuclear waste policy, Nesbit acknowledged. Nonetheless, the task force has recommended simple actions the government can take now to set the stage for real progress. Those recommendations can be found in an issue brief—"A Proposal for Progress on Nuclear Waste Management"—available on the ANS website at www.ans.org/policy/.

The full letter is posted on the ANS website at www.ans.org/policy/letters/. Visit www.ans.org/policy for more information about ANS's participation in U.S. and international public policy discussions.

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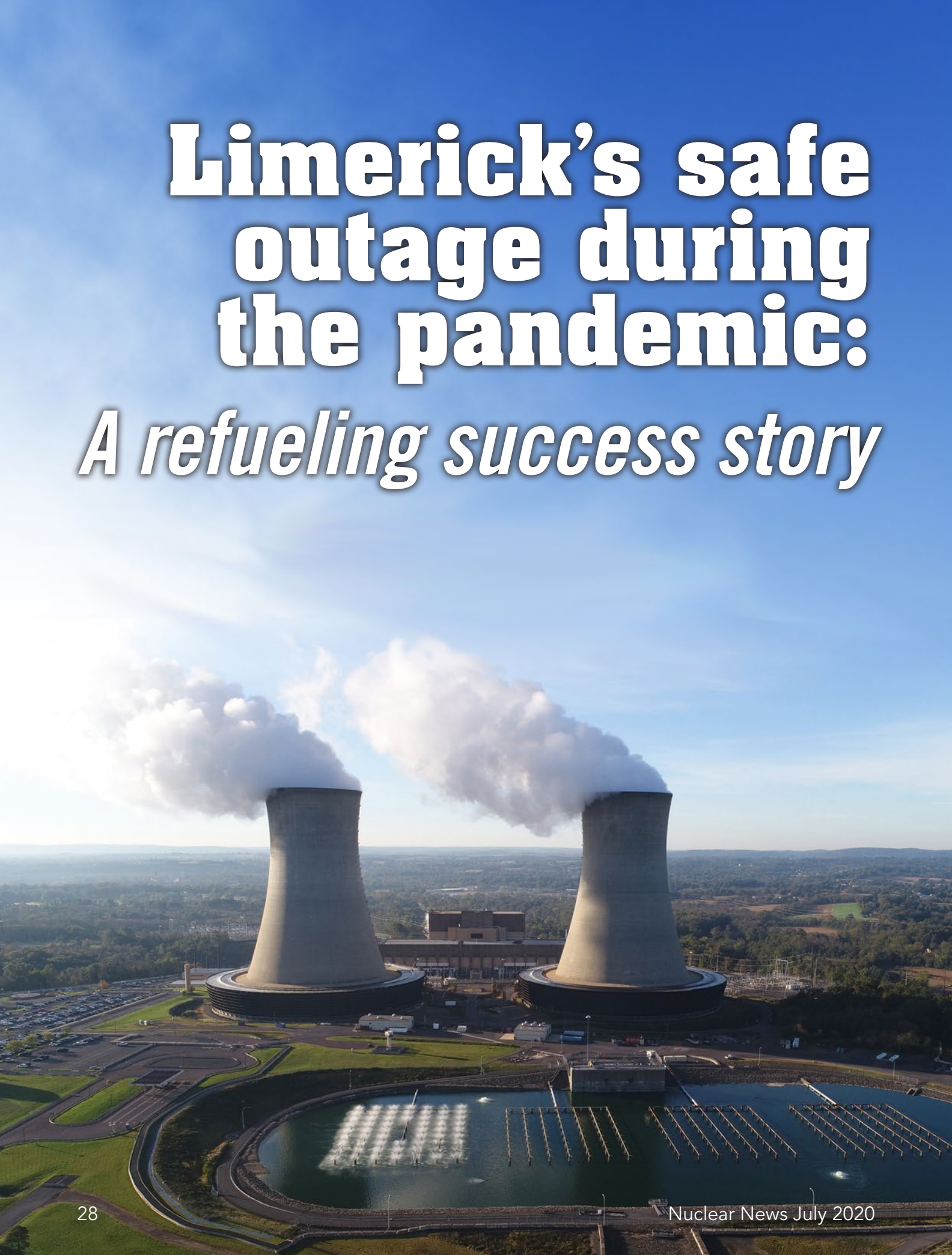
Limerick's safe outage during the pandemic:

A refueling success story



Before the spring outage at Limerick-1 began, Exelon Generation implemented rigorous procedures to keep its employees and contractors—and the public—safe.

By Bryan Hanson

Bryan Hanson is president and chief nuclear officer of Exelon Generation. This article first appeared in the April 26, 2020, issue of the *Times Herald*, of Montgomery County, Pa.

Refueling a nuclear reactor under normal circumstances can be a challenging endeavor, with hundreds of maintenance activities and inspections to perform in a short window of time, and more than a thousand supplemental workers on-site to complete the work safely and effectively. But these are anything but normal circumstances.

In late March, while the number of confirmed COVID-19 cases continued to rise in Montgomery County, Pa., we were making final preparations to execute Exelon Generation's fifth spring refueling outage at Limerick Generating Station's Unit 1, in Pottstown, Pa. Limerick-1 is a 1,158-MWe (net) boiling water reactor.

While most of our local stakeholders were very supportive of the outage and our planned precautions, some understandably expressed concern over its potential impact on our workers and the community.

We explained why the refueling outage needed to proceed on time, primarily because Limerick's clean and reliable energy was critical to the region's response to COVID-19, powering hospitals,

Continued

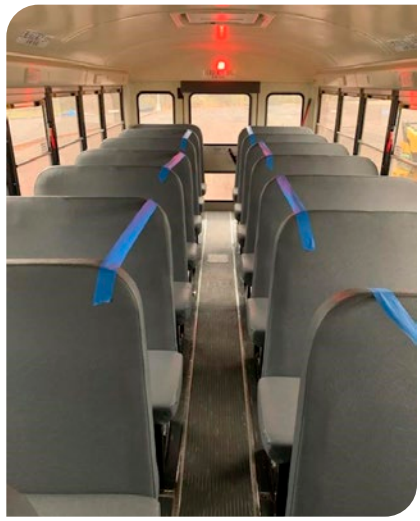
Every worker received a symptom and body temperature screening before entering the plant. Those with 100.4° temp or symptoms consistent with CDC guidelines (cough, body aches, prolonged headache) were not allowed inside the plant. Photos: Exelon Generation

essential businesses, and more than two million area homes. A spring refueling outage was also vital to ensure that both units at Limerick could run at peak performance this summer as electricity demand increases. These factors were made clear by Pennsylvania Gov. Tom Wolf and the U.S. Departments of Energy and Homeland Security.

Before the outage began, the station implemented rigorous procedures to keep the public, our employees, and contractors safe. We postponed all nonessential work to limit the number of individuals onsite and followed CDC guidelines, including social distancing, use of personal protective equipment, and more frequent cleaning and disinfecting of work areas. Lastly, we required all outage workers to be aware of state and local travel, shelter, and gathering restrictions to minimize any potential spread in the community.

We also committed to execute the outage as transparently as possible, working closely to update local, county, and state officials, sharing daily information, and updating our website, social media, and the press with current cases and numbers of employees in quarantine. Operating safely, ethically, and transparently is part of our culture.

From the Limerick refuel floor, reactor engineers sat six feet apart and conducted virtual fuel rod inspections.



Buses that transported outage workers were required to social distance by taking every other seat in a checkerboard fashion. Workers were told at the end of each shift to obey all stay-at-home orders and to social distance off-shift.

Sixteen days later, a full two weeks faster than the U.S. average and a station record, Limerick-1 was back online, ready to generate carbon-free electricity for another two-year operating cycle. Our employees and highly skilled contractors performed all the required work safely and effectively. More importantly, we recorded only two confirmed cases of COVID-19 during the outage. I'm pleased to report that both workers are resting at home and are expected to make a full recovery.

In the end, we met our commitments to local elected officials, to our workers, and to the residents of Montgomery, Chester, and Berks Counties. We were open, honest, and transparent with our stakeholders and neighbors every step of the way, and we appreciate their support.

We could not have done it alone. We want to thank the hundreds of local businesses and contractors, as well as national vendors and suppliers, that supported the outage. We appreciate the help from our local union halls too, and the hundreds of skilled craft workers that answered the call and performed the work safely.

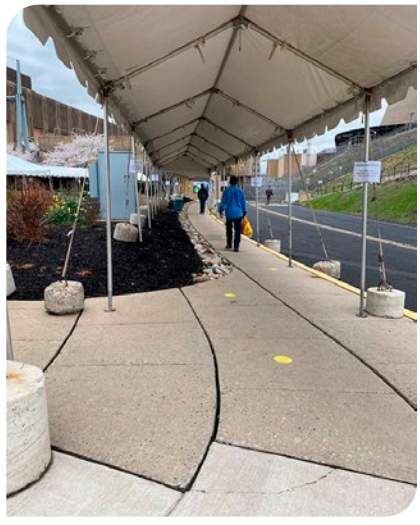
COVID-19 brought some significant challenges to this year's spring outage at Limerick Generating Station, but I'm pleased to say that we met the challenge together. While our outage may be over, our commitment to health and safety never ends. Limerick employees are proud and active members of the community, and we will continue to work hard to prevent any further spread of COVID-19. That includes adhering to CDC guidelines, practicing social distancing, and doing everything possible to protect our employees and the community, every task, every shift, every day.

Limerick's on-site dining services were open 24 hours a day so workers could be fed on-site to limit community interaction. Tables and chairs were removed from the cafeteria as only grab-and-go meals were offered.

Electrostatic disinfecting and foggers were used throughout the plant, including bins in the Main Access Facility.

Updates from the field were done in large areas where there was a lot of space to maintain distance.

Portable handwashing stations were placed throughout the plant, along with hand sanitizer at entries and elevators.



Workers stood on yellow dots spaced six feet apart leading up to the Main Access Facility.

Penfield and Enos: Outage planning in the COVID-19 era

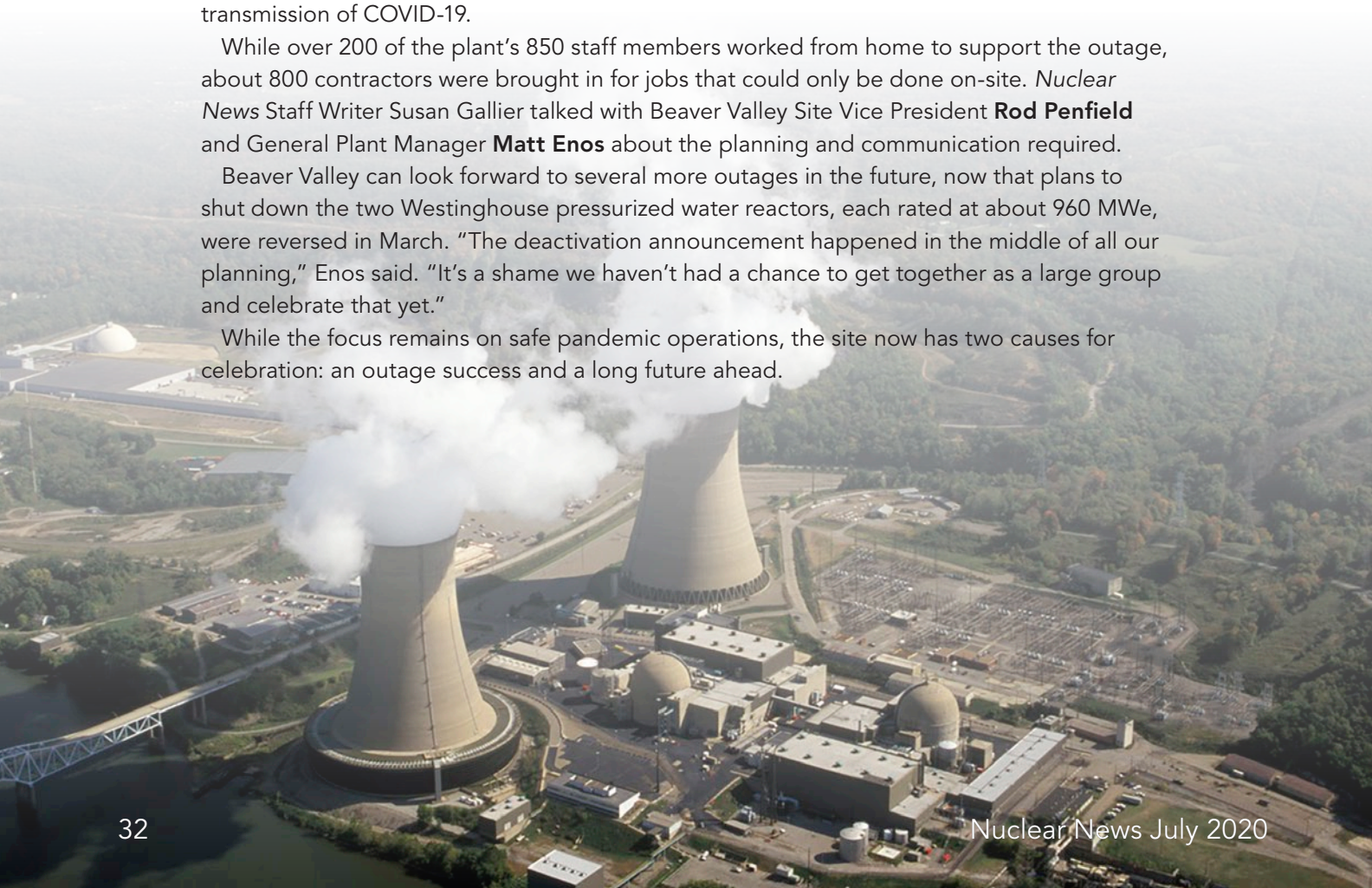
Regulatory relief, remote working, sanitation, and communication were key factors in the success of the spring refueling outage at Beaver Valley-2.

Energy Harbor's Beaver Valley plant, located about 34 miles northwest of Pittsburgh, Pa., was one of many nuclear sites preparing for a scheduled outage as the coronavirus pandemic intensified in March. The baseline objective of any planned outage—to complete refueling on time and get back to producing power—was complicated by the need to prevent the transmission of COVID-19.

While over 200 of the plant's 850 staff members worked from home to support the outage, about 800 contractors were brought in for jobs that could only be done on-site. *Nuclear News* Staff Writer Susan Gallier talked with Beaver Valley Site Vice President **Rod Penfield** and General Plant Manager **Matt Enos** about the planning and communication required.

Beaver Valley can look forward to several more outages in the future, now that plans to shut down the two Westinghouse pressurized water reactors, each rated at about 960 MWe, were reversed in March. "The deactivation announcement happened in the middle of all our planning," Enos said. "It's a shame we haven't had a chance to get together as a large group and celebrate that yet."

While the focus remains on safe pandemic operations, the site now has two causes for celebration: an outage success and a long future ahead.



When did outage work at Unit 2 begin and end, and what work was planned?

Rod Penfield

Enos: The outage began on April 12, one minute after midnight, and ended on May 6 at 16:33 hours [4:33 p.m.], for a duration of 24 days, 16 hours, and 32 minutes. We hit our target of 24 days.

This was a standard refueling outage that included refueling the reactor, steam generator and primary and secondary side inspections, and reactor vessel head nondestructive testing. We also had various upgrade projects, such as cooling tower work, that are typical of a refueling outage.

Penfield: I would add that we reduced our scope for this outage two weeks prior to the outage, based on the potential impacts of the COVID-19 pandemic. We got relief from the Nuclear Regulatory Commission in several inspection areas. We also deferred some repair work for a future outage. We did all the work required to make sure the plant would operate safely and effectively for an 18-month cycle.

How long did it take to get that approval from the NRC?

Penfield: All those approvals were essentially put together, submitted, and approved by the NRC inside of two weeks. We did some legwork ahead of time on those programs that we thought would be eligible as we were monitoring the COVID situation. We also looked at what other sites were doing. The formal submittal and approval process was very efficient. Our engineering department provided the technical basis for solid submittals that we can share with other utilities that have upcoming outages.

Matt Enos

All commercial nuclear plants in the United States were required to develop pandemic plans in the mid-2000s. Leading up to the outage, were both Beaver Valley units operating under the guidelines in that plan?

Penfield: Both units were operating under a pandemic plan that we had recently updated. I would like to recognize Steve Sawtschenko, our site's designated pandemic response manager. He was very instrumental in tracking and identifying things to do. He helped coordinate everything about our execution of that plan, and he did a great job.

Enos: Our updates to the plan were based on the Centers for Disease Control and Prevention recommendations specific to this particular pandemic and also making sure that we met the requirements of two states. The nuclear side of Energy Harbor's business has two plants in Ohio and one in Pennsylvania. We had to make sure that the plan would satisfy the requirements of both states. Especially in the early stages, it seemed that each state was changing or adding a new requirement every day. Our corporate team and our site representatives made sure that we had the best plan to protect our employees.

continued

The entryway into the Primary Access Facility was lengthened to allow for social distancing, using a tent to protect people from the elements.

As Unit 2 was shut down at the beginning of the outage, operations employees in the control room were socially distanced and wearing masks.

How did your pandemic plan address outage work, which brings hundreds of additional people on-site?

Enos: In several ways. Social distancing would be the first example. We altered how workers entered and exited the sites, making sure that they didn't cross in close proximity. Critical groups were spread throughout the sites, including in some buildings that had not been used for a while. We remodeled or revamped those buildings to make them habitable, and we brought in additional trailers. We didn't have any meetings with more than 10 people in attendance.

Also, we brought in temporary employees for sanitization of public areas and sanitization of some tools or processes that a lot of people might use. For example, we had dedicated people to wipe down the hand geometry reader at the security access point after each use. After measuring and testing equipment and hand tools such as wrenches were returned, they were wiped down before they were issued again.

We began daily screening questions and temperature monitoring. We also began wearing masks on-site. That was mandatory.

Penfield: Those are all things that are still in place. The pandemic plan allowed us the operational flexibility, if you will, to keep more people on-site during outages. It didn't mandate certain staffing requirements. This allowed us to make sure we had the right people on-site during the outage.

Given that you had to bring in temporary staff for sanitation duties, did this outage have a higher level of staffing than a normal outage?

Penfield: No. Not even close. In fact, the outage scope changes I talked about earlier resulted in over a 200-person reduction in our contractor workforce. While we did bring in some extra people for cleaning activities, it was no more than 10 or 15 people to allow us to do all of those things.

I would say the scope reduction was done for two reasons. One was to reduce the number of personnel on-site, thus reducing worker exposure. Any time you have extra people on-site, as you alluded to, you have increased exposure. And the second was to ensure that we could get through the outage in case there was an outbreak on-site.

Was there any doubt about whether state or local authorities would allow the outage to go ahead?

Enos: Not all utilities had the cooperation of local authorities that we had. Our Regulatory Compliance Department here on-site was in constant contact with the Allegheny and Beaver County commissioners. Local politicians understood our outage; they understood what we were doing. They had no concerns, and I think that's a real testament to being forthright with our community and their understanding of their role in supporting us, too.

A plant electrician performs preventive maintenance on an inverter.

continued

Portable, hands-free sinks were constructed and placed throughout the plant.

Davis-Besse, an Energy Harbor plant in Ohio, completed an outage in March during the pandemic. Were you able to gather some lessons learned from Davis-Besse?

Enos: Yes, we did learn things from Davis-Besse, including the psychological impact of the pandemic. When Davis-Besse's outage began, it was in the early stages for the Ohio and Pennsylvania area. At that time, even the CDC was still trying to understand COVID-19. Everyone wanted *the* answer, and even the experts didn't have *the* answer. One of the lessons we learned from Davis-Besse was to have a lot of communication with your folks, keeping people aware of what's going on. The underlying mission never changed. Our first and foremost priority was the safety of our workforce. I think we conveyed that well at Davis-Besse and Beaver Valley. And that led to the success of both outages.

Did you have any difficulty getting masks and sanitation supplies ahead of the outage?

Enos: Our Procurement Department reached out with the relationships we have with our vendors to get the required masks, to get the hand sanitizers. We were having some difficulty getting sanitizers early on, so our groups

Radiation protection dosimetry programming stations were extended into the plant to allow for social distancing.

got together and started building portable sinks that if need be we could stage around the site so people could wash their hands at just about any location. It's a story of our workforce finding innovative solutions to problems.

How did you coordinate outage preparations with contractors and vendors?

Enos: This was by no means a single-utility task. This is really a good story with our contractors and vendors such as Westinghouse, Day & Zimmermann, Siemens, and others. We still had to bring contractor staff on-site. Our vendors and contractors were huge in our success, ensuring that workers were screened and tracked prior to coming to our site. It's not just what Beaver Valley did, it's what everyone who worked at Beaver Valley did to ensure our success in the outage.

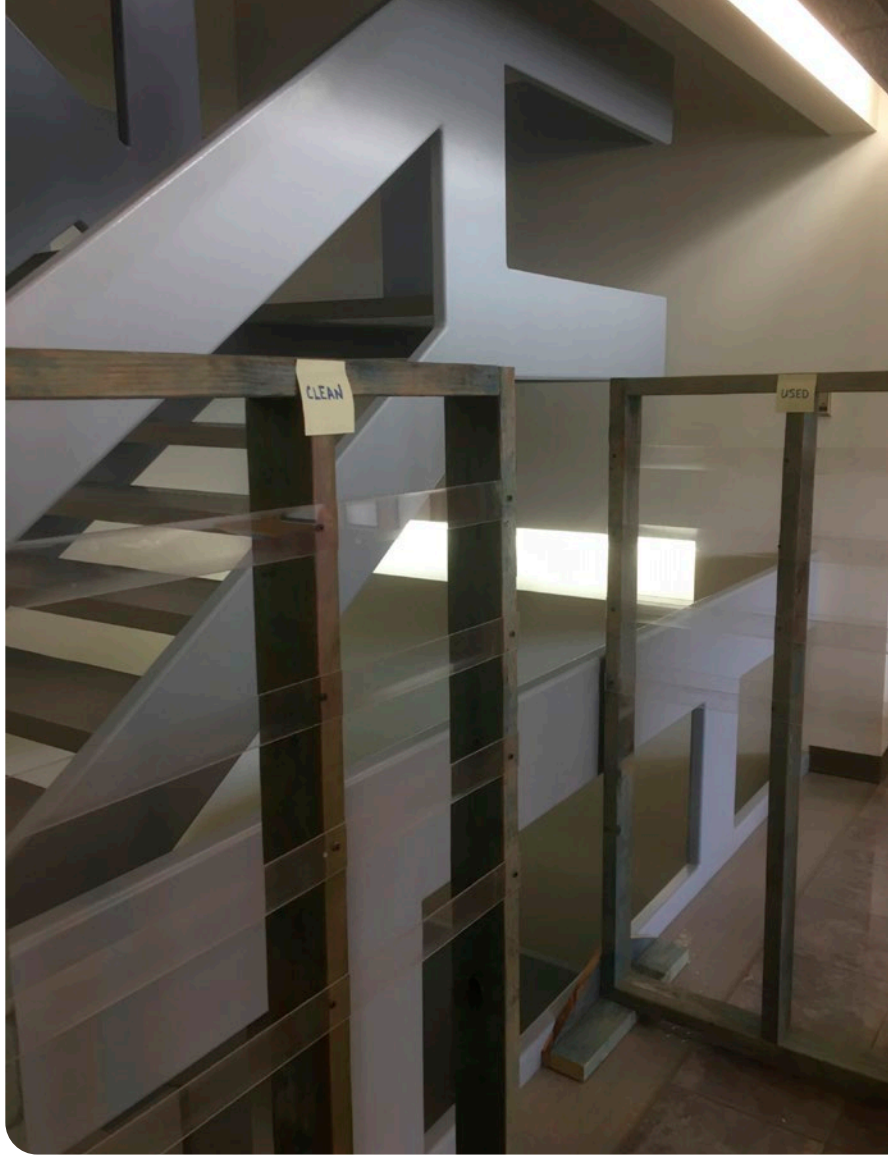
Penfield: Matt alluded to screening. I want to reiterate that. Our contractors were pre-screening people that they brought to the site. We had a screening checklist that they had to answer prior to coming to the site. I think it was very instrumental in our success.

How did outage training change?

Penfield: We did change how we trained people coming on site. We changed how they went through in-processing by ensuring that they maintained social distancing, and we set up classrooms to maintain that social distancing. D&Z would normally have three or four "Welcome to the Site" meetings for all the people coming in. For this outage, they had eight or nine meetings, because they needed to maintain social distance.

Enos: Normally, the week before an outage we hold an "Outage Expo." Think of it as a fair with different booths, each with a different topic that might be "Clearance and Tagging Program" or "Fall Protection Program." It gives us a chance to interact with every single employee with some demonstrations and practical hands-on. Obviously, with this pandemic, we could not do the expo in person, so our team got together and developed a virtual expo. They found an innovative way to get the information in the hands of those employees who might be new to nuclear so they could still be successful.

One last piece is the challenge of communication when you cannot all be in the same room. I think we've all become experts at Microsoft Teams [a unified communication and collaboration platform that combines workplace chat, video meetings, file storage, and application integration] over the last month. We have to come up with many different ways to get communications out when we all can't congregate together. There's a lot of technology out there, and that's helped us quite a bit.



Dosimeter racks were added to allow for sanitation of shared instruments between uses.

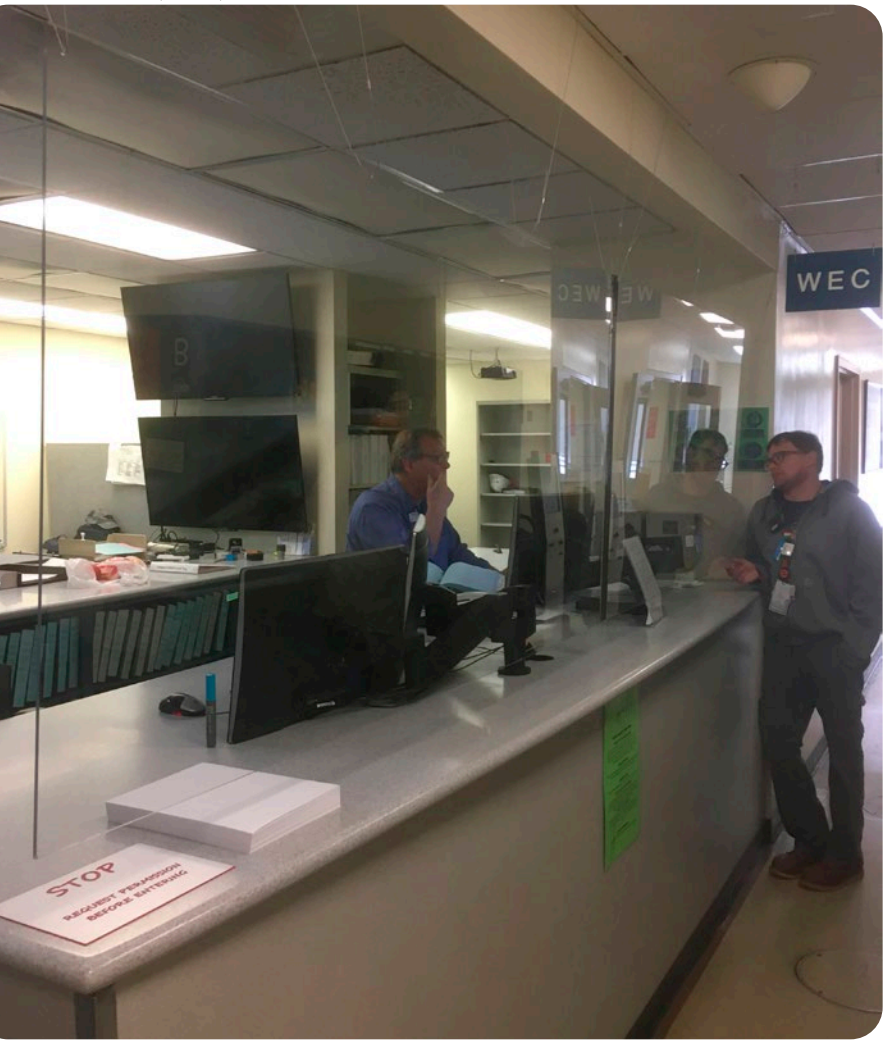
continued

Could social distancing be maintained at all times? Wouldn't some tasks require working in close proximity?

Penfield: You can't completely socially distance during work if it requires two people to move something or work on a component. In those circumstances, we identified what needed to be done to keep each other safe, whether that was a face mask, a face shield, or a more robust type of ventilation device. We maintained social distancing whenever it was possible to do so. At times when it wasn't possible, we would put other measures in place to keep people safe.

Enos: I'll give another example. In the Instrument and Controls Shop, normally you might be paired up with someone new every day. Instead, we kept teams intact and socially distanced the teams from each other. That way you would minimize exposure if it were to happen.

Plexiglass shields were installed to help separate personnel.



Deciding how to implement social distancing and other pandemic measures must have added a lot of work to your outage prep. Can you describe those demands on your time?

Enos: It obviously was more demanding, but I can speak personally to the fact that Rod set the right vision for the station as we were watching the pandemic unfold. Everything we're doing here supports critical infrastructure. Doctors and hospitals need electricity, and that is what we're providing. Rod set that vision.

Our goal was to not have any COVID-related spread on-site. We asked the question of our employees: "What does it take to make that happen?" The response from the organization—not just from the management team but from those on the front lines—was to offer simple solutions that were game-changers. It started with corporate helping to develop the plan, Rod's vision for the station, and then everyone rallying around to get it right and do it.

Penfield: It was the entire station that helped us to be successful, including our partnership with the bargaining units. We had multiple meetings to discuss "what if" scenarios. "What if this happens? What about this? How can we do that?" Ultimately, we had daily meetings, and we still have daily meetings to discuss where we are with the pandemic. We wouldn't be successful without all the people here.

Your goal has been to avoid the spread of infection on-site. Have you had any COVID-19 infections on-site?

Penfield: We had one individual during the outage who did test positive for COVID-19. We were quick to isolate that individual, quarantine him at home, and clean the area where he worked. We identified all personnel who had indirect or direct contact with him. Following our plan, we quarantined people who had direct contact with that individual and monitored those who had indirect contact. That was the only individual we've had on-site that had COVID-19 to date in mid-May. We continue monitoring that and continue screening people

before they come to work to make sure we stay on top of it.

Unit 1 was operating at full power during the Unit 2 refueling outage. Did the Unit 2 outage and all the movement on-site impact Unit 1 operations in any way?

Enos: We made changes that did impact it, but they were not negative impacts. For example, we share a common control room, so we put up physical barriers. When people would go to work on Unit 2, they would not go through Unit 1 areas, even if it meant taking the long way around. We basically "quarantined" Unit 1, including key critical groups such as operations, radiological protection, and chemistry. They were the only ones who could access certain areas in Unit 1. Our job was to divide the site in two—the outage unit and the online unit—and quarantine Unit 1 so it would not be impacted.

Now that the outage is over, do you still have separation between Unit 1 and Unit 2 staff?

Enos: There is some separation that normally occurs, and we are minimizing interaction. Only critical access to the control room is permitted. Right now, the number of people on-site is pretty limited. One of the things we did post-outage is divide the union staff and supervisors into split shifts. Normally, we would be pretty heavy on daylight work. Now we're working on daylight and afternoon shifts to minimize the number of people on-site at any given time.

How have operations changed because of the pandemic?

Penfield: I'd like to point out that we haven't changed any standards, and we haven't adjusted any execution requirements. We are maximizing our social distancing behaviors, wearing of masks, and hygiene. But if a standard requires two operators to be in one location, then we are following the standard. We still have training requirements for the operating staff, and they are practicing social distancing in the training simulator. We're doing that in the control room to the maximum extent possible as well.

Cleaning stations, including this one in the tool room, were set up throughout the plant to sanitize shared items.

Have unforeseen challenges required Beaver Valley to alter its pandemic plan?

Penfield: There weren't any unforeseen challenges that would cause us to say, "Oh man, we didn't even think about this. We have to put something in place in short order." That hasn't occurred. The pandemic plan we had was well thought out. But there have been some tweaks based on the situation. For instance, when an individual tested positive, we entered a different stage of the pandemic plan, and that was a conservative approach. Going forward, if we had another case, we would probably wait for evidence that the virus had been transmitted on-site before we would change stages. Some nuances like that are being clarified in the plan. Also, we have adjusted our plan to be in com-

continued

First and foremost, we are still operating a nuclear power plant. We share lessons learned to make sure that behaviors that have made the nuclear industry successful over the years are not undone by COVID-19.

pliance with changing CDC and state guidance. Outside of that, there hasn't been anything we've experienced that required us to say, "Hey, we've got to update our plan."

Now that the outage is over, are you sharing lessons learned with other Energy Harbor plants and with the broader nuclear community?

Penfield: We have weekly calls with the other plants. Every Monday, the site vice president has a call with the Institute of Nuclear Power Operations, along with our executive vice president, who is responsible for the pandemic plan. We share with INPO all the actions we're taking and what's working well. The chief nuclear officer also has a weekly call with other CNOs on what is going on with the industry regarding the pandemic, what different sites are experiencing, and what help or ideas they can offer. It's a wide-open information exchange on several different fronts.

Enos: First and foremost, we are still operating a nuclear power plant. We share lessons learned to make sure that behaviors that have made the nuclear industry successful over the years are not undone by COVID-19.

Unit 1 is licensed to operate until 2036 and Unit 2 until 2047. Beaver Valley no longer has the threat of closure in 2021. Are you and the plant staff looking ahead to decades of continued operations?

Penfield: Yes, we are. The company is positioned very well to continue operation of the plants. Here at Beaver Valley, we'll be putting together our five-year strategic plan. Once that is done, we will make it a little bigger—we'll make a 10-year strategic plan. We're definitely operating as though we're going to be here long term.

For Unit 1, would the five- or 10-year plan include possibly seeking subsequent license renewal?

Penfield: Yes, our plan could possibly include subsequent license renewal.

As we speak, in mid-May, are staff who have been working remotely beginning to return to the site?

Penfield: That process hasn't begun yet. We do have a "return to work" plan put together. We'll follow the state's guidance and execute our plan when the state allows it.

Our focus on preventing the spread of the virus has actually heightened since the end of the outage. As the states open, I think our risk goes up, so we're continuing to make sure folks are aware of that, and we are redoubling our efforts. I'm very pleased with everyone that was here in Beaver Valley and what they've done. I am very happy that the employees here worked through all these issues and we came out of this, so far, fairly unscathed.

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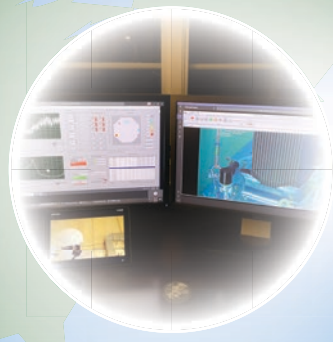
Remote fuel cleaning



In the midst of the COVID-19 pandemic, U.S.-based experts from Dominion Engineering led European workers remotely in the execution of ultrasonic fuel cleaning.

By Rick Michal

Around the world in the mid-March time frame, conditions were changing rapidly due to the COVID-19 pandemic, as was everyone's understanding of it. For nuclear power plants, the pandemic meant dealing with new government regulations and restrictions that were put in place. "U.S.-based support of international clients was especially challenging," said Mike Little, president and principal officer of Reston, Va.–based Dominion Engineering Inc. (DEI). "With border closures going into effect, we were not only focusing on the health and safety of our workers abroad, but also making sure they would be able to return home. Providing remote subject matter expertise from the U.S. through our international service partners was critical to successful job execution during this time."

DEI has two prime focuses: engineering consulting and specialized equipment/field services, with work done primarily for the Electric Power Research Institute, U.S. and non-U.S. commercial nuclear utilities, and Department of Energy sites. The company's areas of expertise include materials degradation management, water chemistry, fuel reliability, cleaning and decontamination, radiation protection, filtration, and waste management.

The company provided on-site services for 20 nuclear

from across the ocean

plant refueling outages during the COVID-19 pandemic this spring, with five of them happening overseas. A main task for the company during these outages was the delivery of specialized ultrasonic cleaning, decontamination, and filtration equipment and services. Ultrasonic cleaning is an area of particular expertise for the company, and since the late 1990s, DEI has developed ultrasonic cleaning and filtration equipment for a range of nuclear plant components, including fuel, heat exchangers, piping, tanks, and vessels.

During one of the spring outages, a team of DEI experts was on-site at a nuclear plant in Europe to perform ultrasonic fuel cleaning. The process removes activated corrosion products (crud) and debris from irradiated fuel bundles during refueling activities and before the bundles are reinserted into the reactor core. The process is effective in mitigating crud-related performance issues such as crud-induced power shift, also known as axial offset anomaly, at pressurized water reactors. It is also effective in preventing and arresting debris-related fuel failures and improving radiological conditions at PWRs and boiling water reactors by effectively removing activated corrosion products and debris from the fuel and reactor system.

As outage activities progressed at this European plant, the rate of COVID-19 infections began increasing exponentially in Europe. As a result, the United States and European countries implemented border closures, at which point DEI made the decision to bring its team of experts back home. "It was a situation where the virus was clearly dictating to us what was going to be possible, and it was unclear whether continued in-person work by our technicians was going to be possible in Europe at that time," Little said. "We made the decision to bring our team back to the U.S. to avoid the possibility that they would be required to stay overseas for an indefinite period."

The challenge, then, was to take the in-person work and determine the best way to execute it remotely, from across the Atlantic Ocean. Working together with a European service partner that was also on-site supporting the activity, DEI proposed a remote work-support arrangement in which remote networking tools and computer screen sharing would allow its subject matter experts, located in the United States, to guide the ultrasonic fuel cleaning process remotely, with on-site activities performed by European workers at the plant. "Having been applied more than 200 times in six countries, ultrasonic fuel cleaning is recognized as a safe and effective maintenance activity," Little

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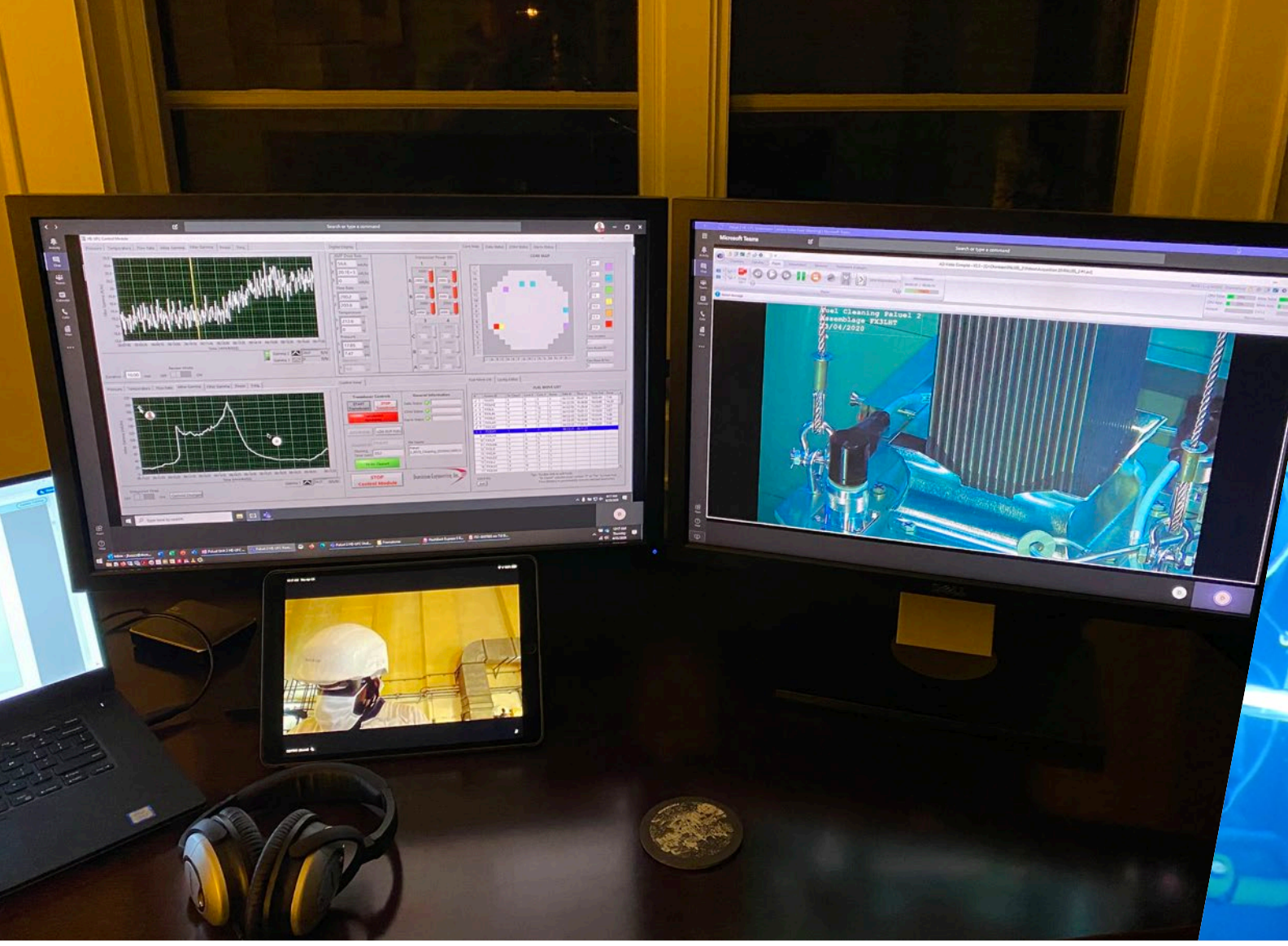
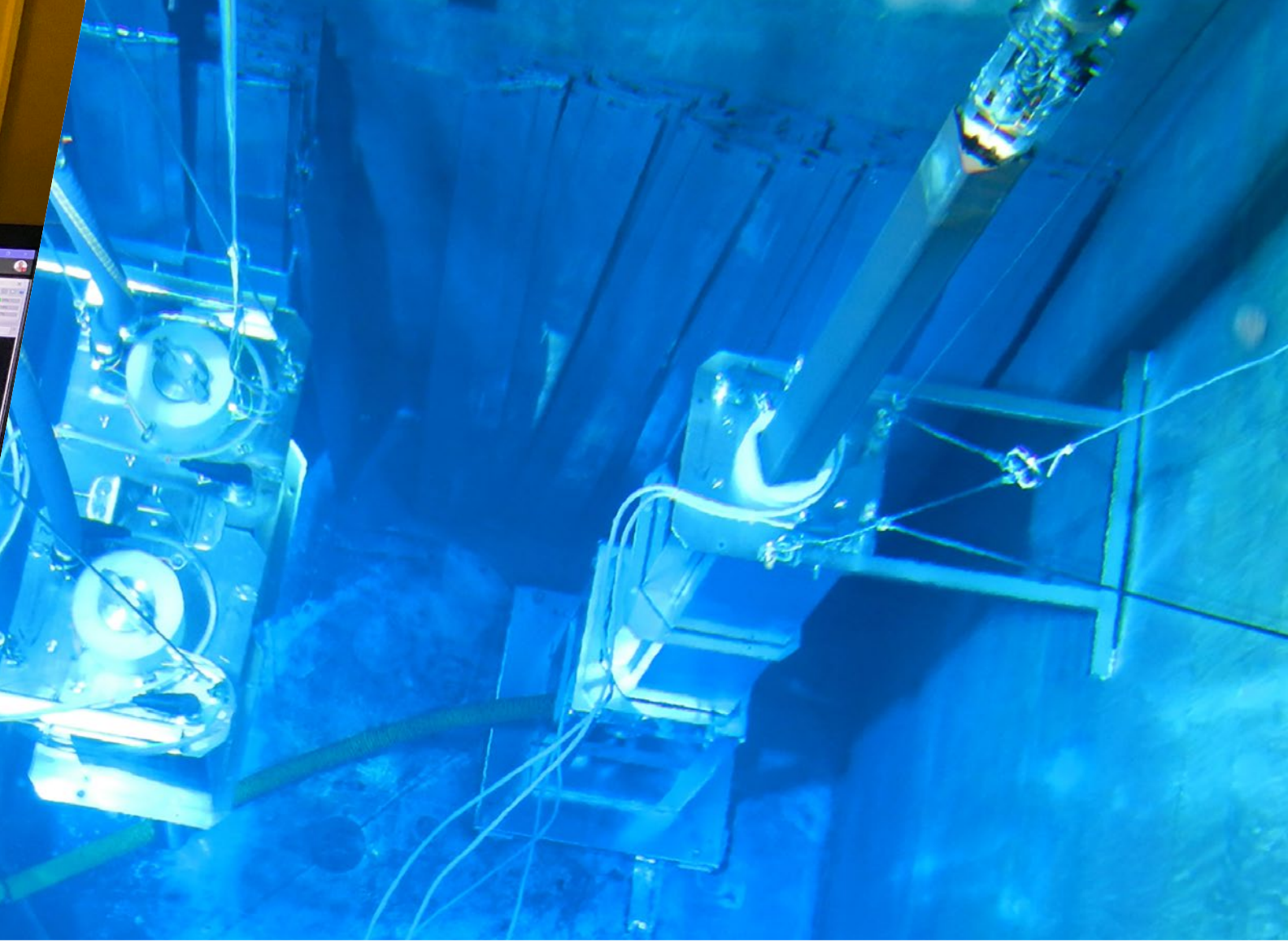


DEI's remote control station, including screen-sharing from on-site computers.

said. "That said, it is not necessarily a routine activity, and initially the plant owner did have some reservations about the DEI team coordinating the activity remotely, especially given that this was a first-of-a-kind activity at this particular plant."

Ultimately, however, the fuel cleaning activity was deemed critical to safely restarting the plant. Given the uncertainty as to when the COVID-19 pandemic would allow the DEI team to return to the European site, it was agreed that remote support by U.S. subject matter experts was the best approach.

Despite initial concerns over performing such a specialized activity remotely, once the WiFi and networking infrastructure were put in place in the work location (in the fuel building near the spent fuel pool), coordination with the European workers on-site and the execution of the work was seamless. "We used a combination of screen sharing and augmented-reality glasses, which allowed our subject matter experts to guide the on-site operators, both when they were sitting at the equipment's control computer and also when more physical interaction with the equipment hardware was required," Little said. "It worked very well. So well, in fact, that we subsequently used this remote support arrangement in three additional outages during the spring outage season, two in the U.S. and one internationally. In all cases, we were successful in remotely guiding on-site operational teams from our headquarters office in Virginia. Having fewer staff



The high-efficiency ultrasonic fuel cleaning equipment in operation.

members on-site reduced our outage service costs and made it easier for personnel to adhere to new physical distancing protocols being adopted at the plants."

As for many industries, the COVID-19 pandemic is forcing the nuclear industry to adapt and conduct activities differently. It is possible, however, that many of these changes will provide improved safety and economics in the future. "Certainly, for specialized outage activities, on-site support remains preferable," Little said. "Nevertheless, this example demonstrates that remote support is a viable way to reduce the number of workers required on-site during outages. In some cases, plant owners may not have installed WiFi or networking infrastructure in work locations had it not been for COVID-19, but once put it place, it could allow plants to reduce the cost of outage services and radiation exposure to workers by minimizing the number of experts and technicians that need to be physically on-site for future outage activities."

Little, who is in his 40s, has been in the nuclear industry for 20 years and finds himself near the center of the industry's relatively wide workforce demographic, which he sees as both a potential barrier and an opportunity for progress in regard to the integration of new technologies and approaches such as the example discussed above. "On one hand, you have seasoned professionals who are very familiar with, and experienced in, the work to be done, but who are generally less comfortable with the use of technology to improve workflow," Little said.

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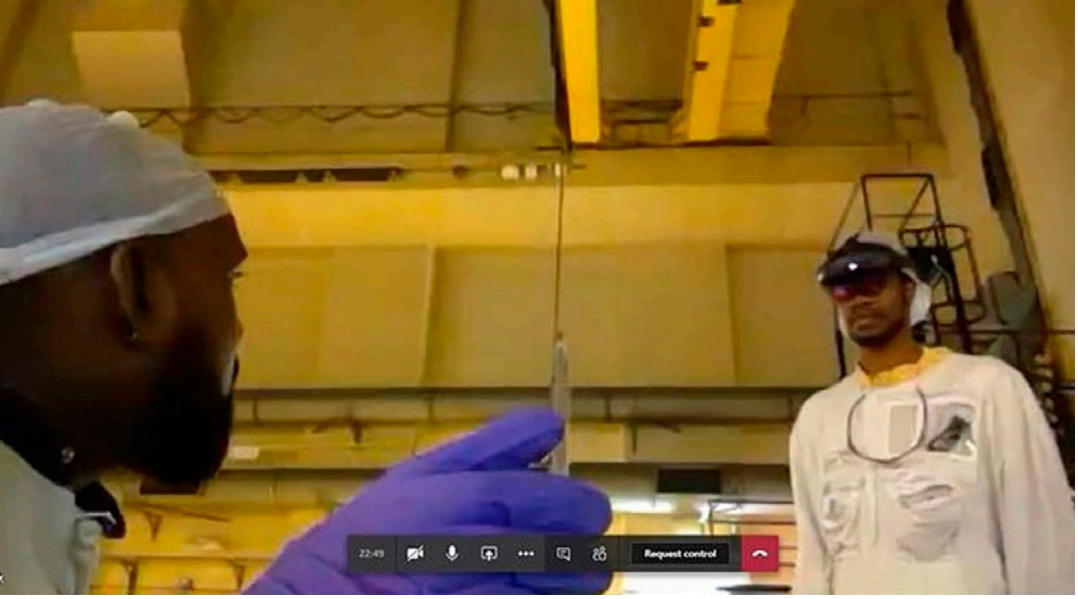

As seen through a meeting app, outage workers discuss tactics, with one of them wearing augmented reality glasses that are used to guide intricate on-site tasks remotely.

"On the other hand, we have a growing number of younger nuclear industry professionals who are enthusiastic about the use of technology to improve nuclear plant safety and economics. Blending these demographics together provides great opportunities to teach, learn, and make progress in our industry."

As Little watched the spring outage season unfold, from February, when the pandemic wasn't a primary consideration for many countries, to May, when it was a major concern around the world, he made a number of observations. "It was interesting for me to watch the perspective of people change over that four-month period," he said. "The human mind tends to want to hold on to its current vision of how it wants things to play out, and it resists change as long as possible. Many people, including those in the nuclear industry, were generally in denial that the virus was going to change their planned projects or approaches, until the last possible moment when those changes became inevitable. It was interesting to watch that same pathos sequentially unfold in Asia, and then in Europe, and then in the United States. Once people were forced to change their approach, however, most realized that there were alternative and, in some cases, more efficient ways to get things accomplished."

One of the biggest generic lessons learned from the COVID-19 pandemic and from the events of 2020 generally, Little said, is to be prepared for anything, which is something that nuclear industry professionals have always done well. "Within the nuclear industry, we have always trained ourselves to consider unplanned scenarios and to have contingencies in place," he said. "I think that culture has really allowed the nuclear industry to navigate the COVID-19 pandemic effectively, and perhaps better than some other industries. Nevertheless, the current circumstances highlight that we need to be open to continuing to adopt new contingency measures that we may not have considered before, such as installing networking infrastructure in outage work locations to accommodate remote technical support, if needed, even if the 'Plan A' is to have all technicians and experts on-site to perform the services directly."

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The U.S. Department of Energy's Light Water Reactor Sustainability Program, led by Idaho National Laboratory, works closely with utilities to improve outage efficiencies and enable nuclear to go "toe-to-toe economically" with other energy sources.

The Race for Outage Efficiency

By Eric Williams

There are numerous similarities between auto racing pit crews and the people in the nuclear power industry who get us through outages: Pace. Efficiency. Diagnostics. Teamwork. Skill. And safety above all else.

To Paul Hunton, a research scientist at Idaho National Laboratory, the keys to successfully navigating a nuclear plant outage are planning and preparation. "When you go into an outage, you are ready," Hunton said. "You need to manage outage time. You want to avoid adding delays to the scheduled outage work because if you do, it can add a couple million dollars to the cost."

Hunton was the principal investigator for the September 2019 report *Addressing Nuclear Instrumentation and Control (I&C) Modernization Through Application of Techniques Employed in Other Industries*, produced for the U.S. Department of Energy's Light Water Reactor Sustainability (LWRS) Program, led by INL. Hunton drew on his experience outside the nuclear industry, including a decade at Newport News Shipbuilding.

The LWRS Program is but one initiative by the DOE, its national laboratories, trade associations, and of course, the commercial nuclear power industry, aimed at modernizing nuclear power generation stations. For example, one group of nuclear utilities, the Utilities Service Alliance (USA), is working with the LWRS Program on a project on remote monitoring (more below), which was awarded through the DOE's U.S. Industry Opportunities for Advanced Nuclear Technology Development funding opportunity.

USA is a Kansas-based nonprofit co-op that facilitates collaboration between its eight member utilities representing 14 reactors and 15,000 MWe of generation. Its work is broader than addressing outages, explained John Christensen, president and chief executive officer. But downtime is always a major consideration.

"When you staff up for an outage, you bring in a whole bunch of fire watch personnel" to ensure work such as grinding metal doesn't spark a blaze, Christensen said. "Individuals conduct fire watches 24-7 during an outage." USA is working to automate that process by using advanced fire-detection sensors and automated methods to replace or augment manual fire watch activities—a project led by Talen Energy's Susquehanna Steam Electric Station.

Conducting fire watches is, of course, a task grounded in safety. Another core aspect of improving reactor operations is reducing costs, and INL's Bruce Hallbert believes making outages more efficient while maintaining safety is an important key to success.

While it's not exactly news, Hallbert, national technical director of the LWRS Program, said the fact remains that "We've got to be able to go toe-to-toe economically" with other energy generation technologies. The DOE is an equal-opportunity deployer, as evidenced by the agency's research on fracking playing a role in plentiful and inexpensive natural gas as well as its work on next-generation wind and solar technologies.

Of the multiple ongoing DOE-sponsored projects, two in the LWRS Program plant modernization area, Hallbert said, are particularly geared to address outage-related issues:

- **Advanced Remote Monitoring for Operations Readiness (ARMOR)** research is developing automated monitoring systems that gather data and detect process anomalies before something goes awry, in order to avoid forced outages. In one project, LWRS Program researchers collaborated with Cooper Nuclear Station (operated by USA member Nebraska Public Power District) to develop machine learning methods capable of detecting anomalies before they occur. The research showed that it is possible to use process data from components, coupled with machine learning, to detect deviations in fan-coil units days ahead of an actual failure.
- **Instrumentation and Control (I&C)** architecture modernization research provides specific ways to reduce operation and maintenance costs, improve operational performance, and maximize worker productivity through digitization of plant control systems. With collaborators Duke Energy and Honeywell Process Solutions, DOE researchers are developing effective techniques—including updating digital control system hardware while the plant continues operating—to reduce outage times for equipment modernization.


Cooper nuclear power plant

The need for technology transition

"Obsolescence" is a word nobody likes to use to describe their industry, and at the same time it describes an issue that nuclear must wrestle with to be cost-competitive.

"Many nuclear plants have focused on sustaining older technology to control costs and produce power," said INL's Hunton. "While this has worked in the past, legacy I&C system obsolescence costs and the lack of advanced labor-saving features are now threatening economic viability."

The DOE released its Addressing Nuclear I&C Modernization report in 2019. It notes that attempting to sustain the existing fleet by doing the same things with the same equipment "has created an institutional inertia within the nuclear industry I&C community that has constrained efficient application of non-nuclear OT [operational technology] in a way that hinders nuclear from realizing the benefits of these technologies as demonstrated in non-nuclear applications."

continued

Consider stopwatches, for example. USA's Christensen pointed to scenarios in which stopwatches have long been used, such as during LOOP (loss of off-site power)/LOCA (loss-of-coolant accident) testing.

"You announce 3-2-1 mark, and the switch is flipped to start the test," he said. People stationed throughout the plant to time critical elements of the test click their stopwatches on this mark. "Yet you don't realize how easy it is to double-click a stopwatch, and in some cases, if certain data are missed, you have to completely redo the test," Christensen said. "It sounds archaic because it is."

The work of USA and others takes on hurdles as basic as stopwatches and simultaneously grapples with broader changes needed to transform the industry.

"We're working from a more labor-intensive business model, based on older technology," Hallbert said. "We're unique in this way today, as other power generation sectors have made more complete technology transitions from analog to digital systems."

Making the transition from that business model and older technologies will equip the workforce to become more efficient and less reliant on manual efforts to accomplish work. This will enable plants to become more cost-competitive and sustainable in current and future energy markets.

Everyone involved, Hallbert said, is working toward sustainability with modern technology using the skills of a highly trained and tech-savvy workforce.

The quest for nuclear sustainability

For Clint Carter, the multifaceted drive for improvement is in concert with "Delivering the Nuclear Promise." The initiative—led by the Nuclear Energy Institute and launched in 2014—was designed, according to NEI, to "strengthen the industry's commitment to excellence in safety and reliability, assure future viability through efficiency improvements, and drive regulatory and market changes so that nuclear energy facilities are fully recognized for their value."

Carter, who ran Luminant's groundbreaking Power Optimization Center and is now a loaned executive to USA in charge of fleet modernization, said sustainability is achieved by people deploying technology, not yielding to it. "Computers only do what humans program them to do," Carter said. "With that in mind, there is the opportunity to apply algorithms, computer code, and machine learning to allow us to see things, to see anomalous behavior we don't see now."

Broadly, that's the approach that flags deviations in fan-coil units at the Cooper Nuclear Station days ahead of failure.

"When we identify some anomalous behavior, we apply human expertise to figure out what that was. We then take that learning and fold it into the algorithm," Carter explained. "Over time, the intelligence and capabilities of that machine learning advance, and we improve operational efficiency while maintaining safety."

Hallbert said that much like a high-performance auto racing pit crew, various sectors of the nuclear community working cooperatively to achieve competitiveness—always toward the same goal—will ensure success.

Eric Williams (haukcc@yahoo.com) is a contract science writer for INL.

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INL Idaho National Laboratory

Mary Lou Dunzik-Gougar

A PASSION FOR TEACHING

By Tim Gregoire

The 66th president of the American Nuclear Society takes the helm at a time of great change, both internally and externally.

Mary Lou Dunzik-Gougar said she feels very fortunate to be taking on the role of president of the American Nuclear Society at this moment in history. "By that, I don't mean at the time of the COVID-19 pandemic," she quickly clarified. "I mean at a time when we are making exciting and transformational changes to the Society."

These changes are described in the aptly named Change Plan 2020, which was developed by a group that included ANS past presidents Andy Klein, Gene Grecheck, and Bob Coward, with input from members, including Dunzik-Gougar, and was approved by the ANS Board of Directors at the November 2019 ANS Winter Meeting in Washington, D.C. Already, Change Plan 2020 has reshaped the way the Society interacts with its members, including a new, greatly improved website and an updated, more vibrant and informative *Nuclear News* magazine. The plan has also reorganized the Society to create, in the words of ANS's new executive director and chief executive officer, Craig Piercy, a "more streamlined, less siloed organization that is better equipped to meet our members' needs going forward."

Dunzik-Gougar agrees, saying, "I think this plan will move us toward a more sustainable Society that better serves its members," adding that the plan will promote continuity across the annually rotating position of ANS president. "I feel privileged to come in at a time when these good changes are happening, and I can help keep the momentum going and promote continuity in leadership," she said.

Beginning as an ANS student member in 1994, Dunzik-Gougar has been active in shaping the Society, particularly in support of its outreach and education programs. As a graduate student, she was appointed to sit on the ANS Board of Directors, during which time she helped write the bylaws that allowed the student board member to have a vote and to be elected by the student membership.

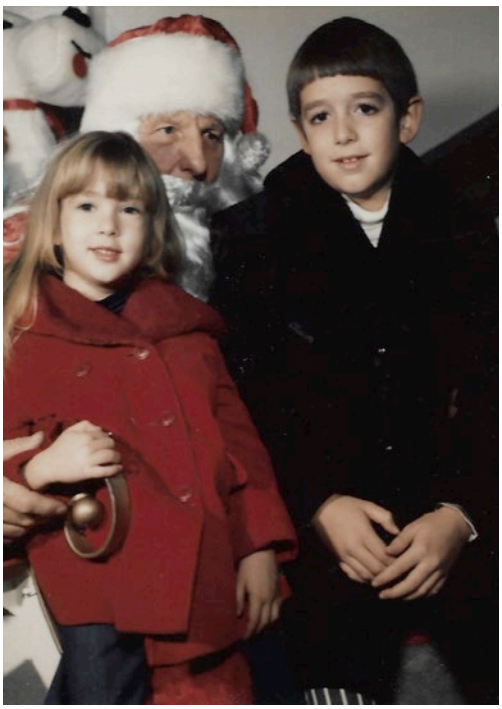
Passionate about education, Dunzik-Gougar has been heavily involved in ANS teacher workshops, which provide educators with lessons in nuclear principles and serve as a vehicle for dispelling some of the myths about the technology. "Spending a Saturday with a group of K–12 teachers who want to know and understand nuclear has been, on my part, some of the most valuable time I have spent," she said, adding that such outreach is very

continued

gratifying. "Some of those teachers have another 30 or so years ahead of them in their careers. Just think how many students and parents they are going to interact with. The eight hours I invest in a teacher is going to give exponential returns. I'm also very excited about the Navigating Nuclear K–12 educational materials that ANS has developed through Discovery Education, with support from the Department of Energy. We will reach even more teachers and students through this project."

Childhood

Born on January 21, 1965, Mary Lou Dunzik grew up in the small, idyllic town of Millersburg, Pa., home of the last operating ferry on the Susquehanna River. It could be argued that much of Dunzik-Gougar's drive and independence came from her mother, Pat Dunzik, who raised Mary Lou and her older brother, Scott, as a single mother after their father, Charles ("Chuck"), died of natural causes when Mary Lou was just two years old.



Mary Lou and her older brother, Scott, sit with Santa in 1969.

"My mother was a real trooper," Dunzik-Gougar said. "She instilled in me the importance of education. There was never a question that my brother and I would go to college." Scott Dunzik eventually went to medical school, becoming a clinical psychiatrist.

To support herself and her two children, Pat Dunzik held a number of jobs, including working in the school cafeteria, cleaning houses, and eventually doing data entry work for the Pennsylvania Department of Transportation. "At one point, she was a sort of nanny to a family who lived just outside of town," Dunzik-Gougar said. While the parents, who were both lawyers, were at work in Harrisburg, Pa., Pat Dunzik would tend to the children at their rural Pennsylvania home. "She loves kids, and for her this was a really fun job," Dunzik-Gougar added.

Dunzik-Gougar noted that growing up in a small town with one elementary school, one middle school, and one high school allowed her the freedom to grow and explore the world. "I can say I had a really good experience in school, because it was a relatively small town, and when you're in a small school, you have more opportunities to do things; there isn't so much competition," she explained.

In addition to classroom work, Dunzik-Gougar was involved in a number of extracurricular activities, including student government, marching band, editing the school newspaper and yearbook, and, having caught the theater bug, participating in the high school's annual spring musical.

It was at Millersburg Area High School that Dunzik-Gougar was introduced to chemistry and physics teacher Terry Boyer, who would make a lasting impression on her. "He was a really unassuming man, but he was such a good teacher," she said. "He made those subjects come alive, and it was his influence that led me to eventually major in chemistry when I went to college."

Dunzik-Gougar, however, didn't initially set out to study chemistry when she enrolled at Cedar Crest College in Allentown, Pa. ("I learned the first semester that Cedar Crest is not a 'girls' school,' it is a 'women's college,'" she said.) Growing up about 40 miles from Three Mile Island, the TMI-2 accident in March 1979 had a profound effect on her, as it did on many of her generation. While the accident elicited worry from her mother, who was unsure about nuclear power, for Dunzik-Gougar it had the opposite effect, sparking her curiosity and interest. TMI-2 convinced Mary Lou, who was in middle school at the time of the accident, that she just had to do something nuclear-related. She decided she would become a nuclear medical technician, "Even though I didn't know what a nuclear medical technician did," she admitted.

That goal, however, changed soon after enrolling in Cedar Crest's nuclear medicine program in 1983, where

she quickly realized that she would be required to take numerous classes in biology. "I knew I didn't want to do that, so I changed to chemistry," she said. "I liked chemistry, and my mom had always encouraged me to be a teacher, so I thought, 'Well, maybe I'll major in chemistry, and then I'll take education classes so I can teach chemistry until I figure out what I really want to do.' So that's what I did."

In 1987, Dunzik-Gougar received a bachelor's degree in chemistry, along with certification by the state of Pennsylvania to teach the subject at the high school level. Chemistry, however, was not the only activity that kept Dunzik-Gougar busy while at Cedar Crest. Her love of theater followed through her undergraduate years, and she found herself acting in school productions. This included being cast as one of three "evil reindeer" in a musical adaptation of C. S. Lewis's *The Lion, the Witch, and the Wardrobe*.

"We were playing evil reindeer, but we were also directed to be these silly, girly characters who didn't want to work hard and who complained all the time," she said. "We got to ham it up, and we had fun buffing our hooves with emery boards and fixing our antlers." The only downside, she said, was having to act out the killing of Aslan the lion, a dark scene that she worries may have scarred her preteen cousin, who had come to see the play.

Top: Mary Lou in 1987 as an evil reindeer from Cedar Crest College's production of "Narnia," based on the book *The Lion, the Witch and the Wardrobe*, with Mary Lou's Aunt Arlene on the right and family friend Mimi on the left. **Second row, left:** Mary Lou and Hans in the Mediterranean between semesters teaching in 1991. **Second row, right:** The wedding of Mary Lou and Hans in 1992.

Teaching

After receiving her bachelor's degree, Dunzik-Gougar moved to the Washington, D.C., area to be closer to her longterm boyfriend, and she soon accepted a position teaching high school chemistry in the Charles County School District in southern Maryland. With teaching standards being somewhat less strict in Maryland, she also found herself teaching physics and mathematics. The relationship with the boyfriend, however, soon ran its course, and Dunzik-Gougar cast her eyes toward other opportunities.

"By around the second year, I still had the itch to go places and do things," she said. "And given that teachers are not highly paid, I thought that maybe what I needed to do was teach overseas." So Dunzik-Gougar applied to several private schools in Europe and was offered and accepted a position at TASIS England, a branch of The American School in Switzerland. It was a two-year teaching commitment, living and working at the school's Tudor-era campus in the quintessentially quaint English town of Thorpe, in Surrey, about 20 miles west of London.

"They didn't pay us a lot, but living on campus meant that whatever money I did make I could use to travel," Dunzik-Gougar said. "So any weekend that I didn't have duty on campus, I was going somewhere. I got to see a good bit of the U.K. and Europe during the two years I was there."

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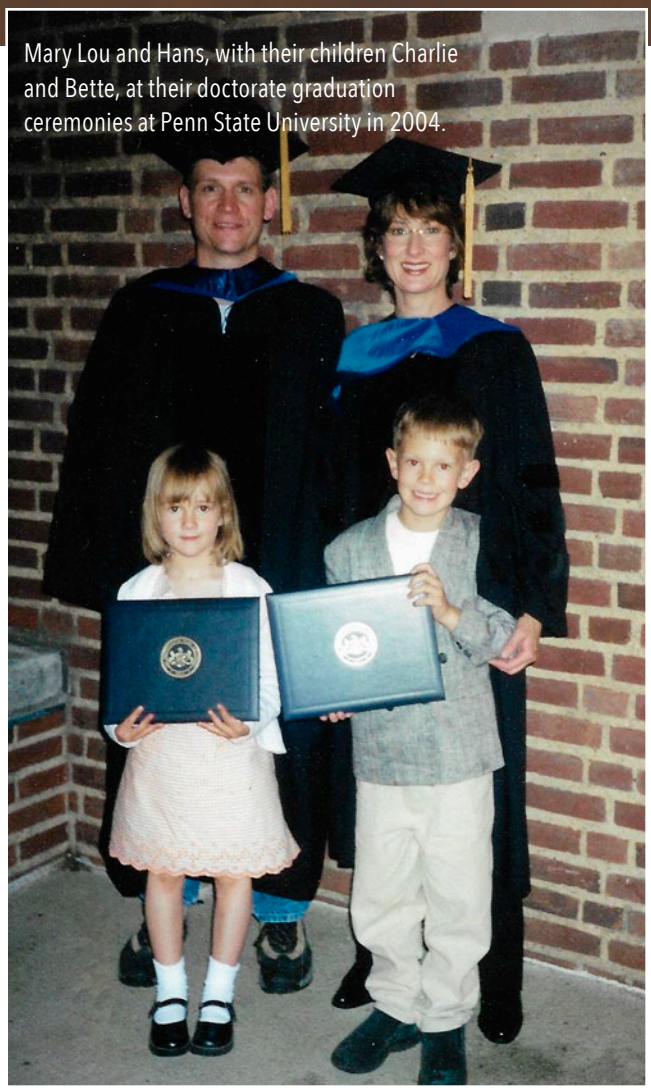


Mary Lou and Hans, with their children Charlie and Bette, at their doctorate graduation ceremonies at Penn State University in 2004.

It was also at TASIS England that Dunzik-Gougar met her husband, Hans Gougar, who was teaching physics at the school. As Dunzik-Gougar describes it, however, it was not quite love at first sight. "We jokingly say it was mutual disinterest at first sight," she said. That's because when they were first introduced in the faculty lounge early one morning before the semester had started, Dunzik-Gougar had just arrived after a long overnight flight, frazzled from a sleepless night anticipating what was in store for her more than 3,500 miles from home.

"I hadn't slept, and I looked like crap," she admitted. "Then this guy walks in, and he had been out running or biking or something, and he was all sweaty and didn't smell very good. We were both kind of gross."

As fellow science teachers, however, it wasn't long before the two were thrown together as colleagues, and a friendship grew. One night the following summer, Hans proposed to Mary Lou under the lights of the Eiffel Tower in Paris. It was the last stop the couple made during a tour of Europe between semesters. Hans had been carrying the engagement ring with him the whole trip.

Hans, a nuclear engineer, has also been a long-time active ANS member. "If you ask my husband, he will say that the reason he's a nuclear engineer is because of me," Dunzik-Gougar said. "Early on, we would talk about our future, and I would listen to him talk about what his interests were, and I said, 'You know what, I think you want to be a nuclear engineer.' And darn it, that's exactly what he wanted to be, and he loves it."

Following their years at TASIS England, the couple returned to America, both eager to pursue graduate degrees. Their university of choice was Penn State University. First, however, the couple spent two years teaching in Philadelphia-area high schools, a tactical decision that allowed them to save money while also ensuring that Hans could pay in-state tuition.

Penn State

Dunzik-Gougar started graduate studies at Penn State in 1994, setting her sights on a master's degree in environmental engineering, focusing on the study of radioactive waste management and waste form development. At the time, pursuing a doctorate degree was not part of her plan. "That was really not on my list of things to do," Dunzik-Gougar said. "At that time, my only impression of Ph.D.s was that they were over-educated eggheads who can't do anything practical." But one of her nuclear course instructors, Arthur Motta, an ANS Fellow and current Graduate Chair of Nuclear Engineering at Penn State, recognized Dunzik-Gougar's potential and encouraged her to apply for a Ph.D. fellowship. "I gave it some thought, talked to my husband about it, and ultimately it came down to, 'Dr. Motta thinks I can do this. He thinks I'm a good candidate, and if I don't at least try, I'll regret it for the rest of my life,'" she said.

Dunzik-Gougar received her master's degree from Penn State in 1997 under the supervision of Prof. Barry Scheetz, who guided her creation of a waste form for spent fuel processing calcines at Idaho National Engineering and Environmental Laboratory (INEEL). Also in 1997, and thanks to her involvement in ANS, she was recruited, along with Hans, to begin a summer internship at Argonne National Laboratory–West, which was merged with INEEL in 2005 to become Idaho National Laboratory. "That was the summer of 1997, and the way I remember that is the way a lot

of people remember when things happened in their lives, by the ages of their children," Dunzik-Gougar recounted. "That's the summer my son, Charlie, turned one.

After the summer internship, Dunzik-Gougar had an opportunity to return to Argonne-West to perform her Ph.D. research, and the family of three moved to Idaho full time in January 1998. "That's a terrible time to move to Idaho Falls, because winters here are pretty harsh," Dunzik-Gougar said.

Dunzik-Gougar's research at Argonne-West was focused on processing fuel from the sodium-cooled fast spectrum Experimental Breeder Reactor II (EBR-II) and modeling the use of zeolite to remove fission products from the molten salt used to process the fuel.

EBR-II was shut down in 1994 when the Clinton administration removed funding for the Integral Fast Reactor program, and arriving at Idaho just a few years after EBR-II closed, Dunzik-Gougar recalled the effect the program's loss had on Argonne employees. "The people who worked there were so passionate about that wonderful technology that when the program shut down, grown men cried," she said. "The technology was so beautiful, with so much potential, and to have it shut down for political reasons was a blow."

It was also during her Ph.D. work, in September 1998, that Mary Lou and Hans welcomed their daughter, Elizabeth ("Bette"), into the world. While admitting that having children while pursuing an advanced degree is not a recommended course of action, Dunzik-Gougar affectionately refers to her son Charlie as her "master's baby," and Bette as her "Ph.D. baby."

Around this time, Dunzik-Gougar took time off from her Ph.D. studies to work part time with Argonne-West's communications program, helping with tours and educational programs. "I have a tendency to do a lot of outreach and public communication," she said.

Despite all of her responsibilities, Dunzik-Gougar was able to complete her nuclear engineering Ph.D. in December 2003. Hans, who was working full time at INEEL, was also finishing his Ph.D. work. "We officially graduated together," Dunzik-Gougar said, adding that they both attended the graduation ceremonies in Pennsylvania in May 2004, along with their children and parents, 10 years after first arriving at Penn State as graduate students.

ISU

Dunzik-Gougar stayed on in Idaho Falls after graduating from Penn State, taking a joint position with Idaho State University and INEEL. "I basically had two jobs—two bosses, two offices, two phone numbers, two emails, two of everything," she said. While working on research projects with her students at the laboratory, Dunzik-Gougar was also helping ISU grow its nuclear program, traveling the state to recruit students.

As part of that recruitment effort, Dunzik-Gougar headed the DOE-funded 2+2 Scholarship Program, which allowed undergraduate students from other Idaho universities to finish their nuclear degrees at ISU on scholarship. Calling the program "marginally successful," Dunzik-Gougar explained, "It was a tough sell, because I was basically taking their students."

It was at this time that Argonne-West merged with INEEL to become Idaho National Laboratory, and Dunzik-Gougar found herself working with INL's Kamal Pasamehmetoglu on a lab-directed research and development project creating a fuel cycle model from first principles. After Pasamehmetoglu was pulled into other tasks, Dunzik-Gougar took over administration of the project, called SINEMA (Simulation Institute for Nuclear Enterprise Modeling and Analysis), and eventually many aspects of the project were built upon by ANS member Paul Wilson and his students at the University of Wisconsin–Madison.

Dunzik-Gougar would have stayed on in her dual roles at ISU and INL, but the family had a brief diversion to South Africa. In late 2007, Hans accepted a position with a company called Pebble Bed Modular Reactor (PBMR), which was established in 1999 to build and demonstrate a small-scale helium-cooled high-temperature reactor. For some time, PBMR had been wooing Hans, who had developed a pebble bed reactor neutronics code for his Ph.D., and when the company discovered that Mary Lou was also a nuclear professional, they offered her a position as well.

Hans and the children returned to Idaho in early 2009, but Mary Lou remained in South Africa for several more months to help PBMR and the University of Pretoria in setting up a lab to study irradiated graphite for PBMR's waste minimization program."That was difficult—to be without my kids for all that time," Dunzik-Gougar said. However, her work with PBMR opened the door to work

continued

Top: Mary Lou with her graphite research team at the University of Pretoria in South Africa in 2009. Bottom: Mary Lou and Hans rafting on the Zambezi River in Zimbabwe.

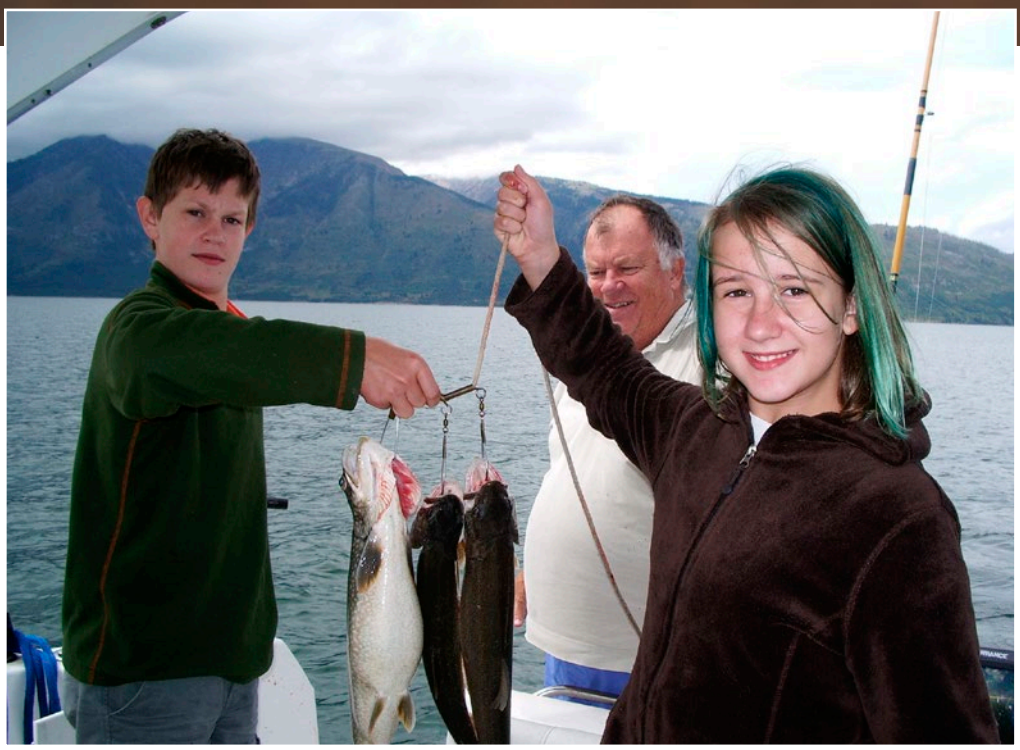
on a European Union–funded project focusing on the decontamination of radioactive graphite, as well as work on a similar project, funded by the Department of Energy's Nuclear Energy University Program (NEUP), when she returned to Idaho. Dunzik-Gougar has since also worked as a consultant to Électricité de France on irradiated graphite waste treatment.

Currently, Dunzik-Gougar is the associate dean of the College of Science and Engineering and associate professor of nuclear engineering at ISU, having previously been the acting chair of the university's Nuclear Engineering and Health Physics Department. She also serves as the reactor administrator for ISU's AGN-201 reactor, and in recent years she became an NRC-licensed reactor operator and senior reactor operator. ("You really can teach old dogs new tricks," Dunzik-Gougar jokes.) She is still doing active research, having been awarded a NEUP grant in October 2019 to develop a method of testing the tensile strength of TRISO fuel particle layers. While excited about the project, Dunzik-Gougar said that the situation caused by the COVID-19 pandemic has hampered the work. "It's been really frustrating," she said. "But I'm not the only one. Anyone who is doing experimental work now is frustrated."

Indeed, while acknowledging the unprecedented situation and the many disruptions to academics and nuclear research the pandemic is causing, Dunzik-Gougar is philosophical about the challenges. "My mantra, in general but certainly in these odd weeks, has been that I am having very first-world problems, and I'm glad to have them," she said.

There are also opportunities to learn from the pandemic, Dunzik-Gougar pointed out. In the realm of nuclear education and training, this includes better adapting new methods and technologies, such as Web-based meeting applications, to instruct students. "I think this situation has forced us to be more creative and innovative in how we teach and how we help students learn," she said.

Dunzik-Gougar also noted that the nuclear community's unique safety culture, and its adherence to risk-informed decision-making, offer the public a model lesson for navigating a world that has been shaken by an uncontrollable disease. "I think our safety culture is something that, if it could be bottled and put into the public water supply, would go a long way to controlling the spread of this virus," she pointed out.



Charlie and Bette on the family's annual fishing trip to Jackson Lake, Wyoming, with ANS member Michael Lineberry, who passed away in 2014 while serving as ANS treasurer.

Idaho Falls

When the family moved to Idaho Falls in 1998, they bought a 1930s-era house, and Dunzik-Gougar discovered a new passion outside of her professional life. "I had been living in apartments and moving around a lot," Dunzik-Gougar said. "I really didn't know much about home maintenance, and I certainly didn't know anything about gardening. But we had this big yard that needed help, and I discovered that I really love gardening. Who knew?"

> I think this situation has forced us to be more creative and innovative in how we teach and how we help students learn.

For Dunzik-Gougar, gardening and watching what she has planted and tended grow, and being able to see those results, provides a kind of therapy outside of her work at ISU. "And if my plant dies, my plant dies," she added. "At least I didn't ruin a student's life."

Living in Idaho, the Dunzik-Gougar family takes advantage of the region's natural beauty. "Where we live is among the most beautiful places, certainly in the United States," Dunzik-Gougar said. "Yellowstone National Park is only two hours away."

This fall, Dunzik-Gougar's daughter, Bette, will begin her senior year at Boise State University, where she is studying materials science and engineering. Bette also plays saxophone for Boise State's highly rated Blue Thunder Marching Band, a point of pride for her mother. "I've noticed from my own experience that kids who are involved in marching band tend to be all-around good kids," Dunzik-Gougar said. "You can't really get into too much trouble when you are showing up at 6:30 a.m. for band practice while also keeping your grades up."

Meanwhile, Charlie Gougar, who earned an associate's degree in mechanical engineering technology from ISU, recently took a position with the engineering and maintenance staff at a resort in McCall, Idaho, about six hours from Idaho Falls. "I remember that when he applied for the job, he said, 'Mom, this is my dream job,'" Dunzik-Gougar said. With the resort currently closed to the public due to COVID-19, Charlie has been busy completing maintenance projects and facility upgrades that cannot be done with guests on-site—a situation not too dissimilar from an outage at a nuclear power plant.

"We were able to visit him in late May/early June, while participating in virtual ANS governance meetings from Shore Lodge on Payette Lake," Dunzik-Gougar said. "Such a beautiful setting."

Refurbished Darlington unit returns to service


A fish-eye view of the refurbished Darlington-2. Photo: Ontario Power Generation

Ontario Power Generation's (OPG) massive project to refurbish all of its Darlington nuclear power plant reactors has reached its first major milestone with the successful completion of Unit 2's refurbishment and reconnection to Ontario's electricity grid, the utility stated in a June 4 media release.

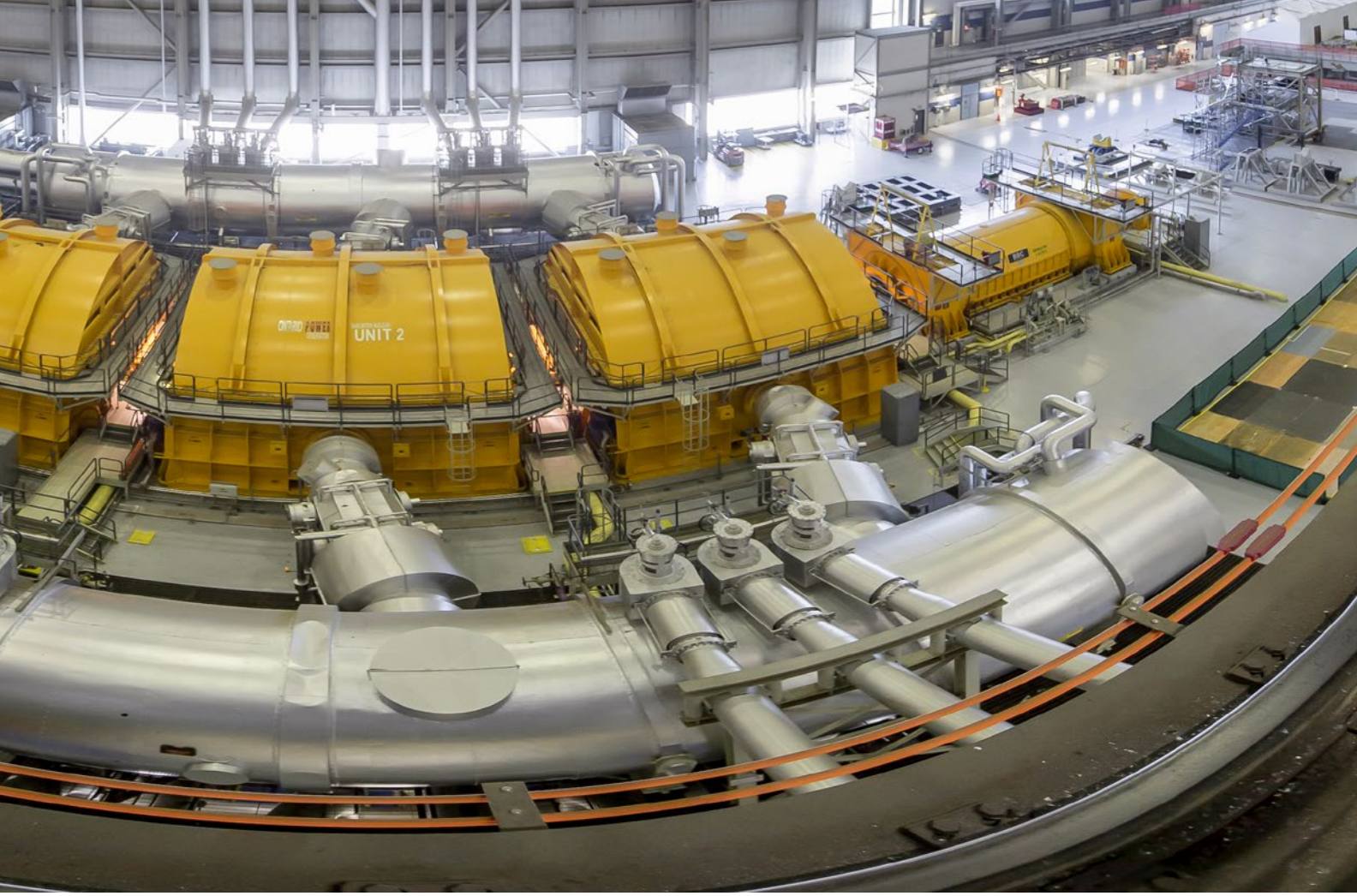
The Darlington plant, located in Clarington, Ontario, Canada, houses four 878-MWe PHWR CANDU reactors, all of which entered commercial operation in the early 1990s. The 10-year refurbishment project, which also was 10 years in the planning, began in earnest in October 2016, when Unit 2 was taken off line (*NN*, Dec. 2016, pg. 45).

"This is a truly historic moment for Ontario," said Ken Hartwick, OPG's president and chief executive officer. "I want to thank our refurbishment team, project partners, vendors, and construction building trades workers for more than 24 million hours worked safely and for returning Darlington's Unit 2 reactor to the grid at a time of unprecedented circumstances. This world-class project performance demonstrates the team's expertise and their commitment to completing the four-unit refurbishment safely, with quality, and on budget by end of 2026 as planned."

The unit's refurbishment and reconnection was also hailed by the Ontario government. "Congratulations to OPG on this incredible milestone," said Greg Rickford, the province's minister of energy, northern development, and mines, and the minister of indigenous affairs. "The Darlington nuclear refurbishment project is one of the world's largest nuclear infrastructure projects, and the timely completion of the Unit 2 reactor showcases Ontario's position as a global leader in nuclear generation. OPG's Darlington Nuclear Station is a critical part of our electricity system, producing affordable, reliable, and GHG-emissions-free electricity to over two million homes each day."

In response to the COVID-19 pandemic, OPG postponed Unit 3's refurbishment from its scheduled start in May of this year (with scheduled completion in the first quarter of 2024), allowing the unit to continue delivering electricity to the grid. In its release, OPG said that, subject to the status of the pandemic, it was preparing to resume the hiring of skilled trades workers and begin "prerequisite activities" in June to safely restart this next phase of the project.

The Darlington-1 refurbishment is scheduled to start in the first quarter of 2022 and be completed in the second quarter of 2025, while Darlington-4 is scheduled to begin refurbishment in the third quarter of 2023, with completion in the fourth quarter of 2026.



ADVANCED REACTORS

Microreactor proposed for Chalk River Laboratories

Global First Power (GFP), Ultra Safe Nuclear Corporation (USNC), and Ontario Power Generation (OPG) have announced the formation of a joint venture to construct, own, and operate USNC's Micro Modular Reactor (MMR) at Canadian Nuclear Laboratories' Chalk River Laboratories site in Ontario. The venture, known as the Global First Power Limited Partnership, is owned equally by OPG and USNC-Power, the Canadian subsidiary of USNC.

Ottawa-based GFP will act on behalf of the partnership to oversee the proposed project and provide project development, licensing, construction, and operation, according to a June 9 press release from the three companies. The project will serve as a model for potential future MMR projects across Canada to provide power and heat to industries, such as mining, and to remote communities, the companies said.

The 15-MWt, 5-MWe MMR project is currently undergoing an environmental assessment.

"The backing of OPG, combined with USNC's advanced reactor and fuel designs, will allow us to continue to lead the way in delivering a small-reactor solution in Canada," said Joe Howieson, GFP's chief executive officer. "This joint venture is a very important milestone, marking new levels of commitment by an innovator in nuclear power generation technologies and a forward-thinking, major utility."

Francesco Venneri, USNC's CEO, said, "While there are many small reactor companies boasting about the progress they're making, no other organization is closer to constructing a microreactor in Canada than we are. Through this joint venture, we're committed to proving how viable, safe, and valuable our MMR technology is to Canada and to the rest of the world."

Power & Operations continues

NUCLEAR REGULATORY COMMISSION

Hanson starts first term as commissioner, Wright begins second

Hanson

Wright

The vacant seat on the Nuclear Regulatory Commission was filled on June 8, when Christopher T. Hanson was sworn in as the agency's fifth commissioner. The vacancy was created in April 2019 with the resignation of Stephen Burns. Hanson will serve the remainder of Burns's term, which expires on June 30, 2024.

Hanson, who was nominated for the commission seat by President Trump in February and confirmed by the Senate in May, has more than two decades of government and private sector experience in nuclear energy, fuel cycle, security, and radioactive waste issues. Prior to joining the NRC, he served as a staff member on the Senate Appropriations Committee's Energy and Water Subcommittee under Sen. Dianne Feinstein (D., Calif.), and before that, as a senior advisor in the Department of Energy's Office of Nuclear Energy. Hanson also served as a consultant at Booz Allen Hamilton, where he led multiple engagements for government and industry.

Hanson received a bachelor's degree in political science from Clemson University. He earned master's degrees from the Yale Divinity School and the Yale School of Forestry and Environmental Studies, where he focused on ethics and natural resource economics.

Also on June 8, NRC Commissioner David A. Wright was sworn in for a second term. Wright was appointed to the NRC in May 2018 to serve the remainder of a five-year term ending on June 30. His second term will conclude on June 30, 2025.

Wright previously served as owner and president of Wright Directions LLC, a strategic energy and water consulting and communications business. He also served as a member and chairman of the South Carolina Public Service Commission from 2004 to 2013 and as the 2011–2012 president of the National Association of Regulatory Utility Commissioners. In addition, he has served as a council member and mayor of Irmo, S.C., and as a member of the South Carolina House of Representatives.

PUERTO RICO

Study: Advanced reactors a good fit for the island

The Nuclear Alternative Project (NAP), a nonprofit group supporting the use of advanced reactors in Puerto Rico, has released the findings of a preliminary feasibility study undertaken to explore in detail the potential for these devices on the Caribbean island. The study, sponsored by the Department of Energy, concludes that small modular reactors and microreactors could be part of Puerto Rico's energy portfolio and potentially supply a substantial part of a strong and diverse zero-emission energy mix.

Notable findings from the NAP study include the following:

- Advanced nuclear reactors provide a combination of reduced electricity costs, zero-emission baseload electricity, and minimal dependency on fuel imports that can lead to a strong degree of energy security and reliability, much needed for a robust manufacturing and industrial sector in Puerto Rico.
- Small nuclear reactors can integrate with renewable energy and the existing transmission and distribution grid, as well as with a decentralized system envisioned for the island.
- Over 90 percent of more than 3,000 Puerto Rican citizens surveyed are interested in

continuing to study the nuclear alternative for the island.

■ The design and siting regulations of advanced reactors allow this technology to sustain severe natural events, such as hurricanes and earthquakes.

■ Implementation of advanced reactors will not result in the long-term storage of nuclear waste in Puerto Rico; the waste will instead be shipped to federally approved facilities in the United States.

NAP is preparing for phase-two studies, which will focus on the viability of constructing small reactors at specific locations in Puerto Rico and on an education campaign for the Puerto Rican people.

The 288-page report, *Preliminary Feasibility Study for Small Modular Reactors and Microreactors for Puerto Rico,* can be found online at www.nuclearalternativeproject.org.

UNITED KINGDOM

EDF submits application to build Sizewell C station

Électricité de France subsidiary EDF Energy has submitted an application to the U.K. government's Planning Inspectorate for a development consent order (DCO) to build a new power station, Sizewell C, at the Sizewell nuclear site in Suffolk. The agency received the application on May 27, after it had been deferred for two months because of the COVID-19 pandemic.

The proposed station, consisting of twin EPRs, would be built next to Sizewell B, a 1,198-MWe pressurized water reactor that began operations in 1995. (The Sizewell site is also home to Sizewell A, a 290-MWe Magnox gas-cooled reactor, but that unit was permanently shuttered in 2006.) Sizewell C would be a near replica of the two-unit Hinkley Point C station, located in Somerset.

"Sizewell C is a net-zero infrastructure project ready to kick-start the economy following the coronavirus crisis," said Humphrey Cadoux-Hudson, managing director of the Sizewell C project. "It will offer thousands of high-quality job opportunities and long-term employment for people living in Suffolk, and it will strengthen the nuclear supply chain across the country. On top of the economic benefits, Sizewell C will avoid 9 million tons of CO_2 being pumped into the atmosphere each year. The project will play a key role in lowering emissions while helping the U.K. keep control of its low-carbon future."

Artist's rendering of the Sizewell site, with Sizewell C at right. Image: EDF Energy

Power & Operations continues

John Dugmore, chief executive of the Suffolk Chamber of Commerce, added, "Sizewell C's DCO application is momentous for businesses and residents in Suffolk. It will boost training and employment opportunities across the county and attract investment to regenerate rural areas and towns."

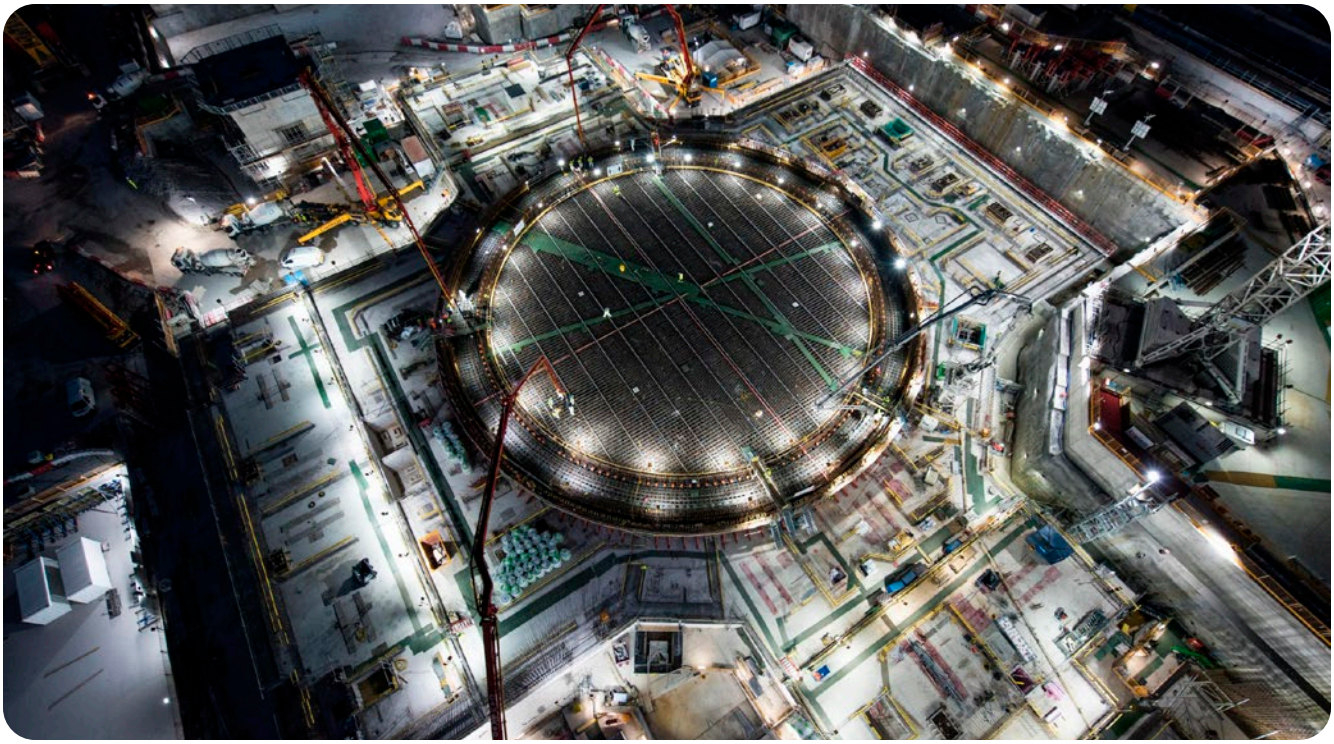
The DCO process, according to the Planning Inspectorate's website, consists of six stages: pre-application, acceptance, pre-examination, examination, recommendation and decision, and post-decision. Upon receipt of an application, the agency has 28 days to decide whether or not to accept it. The pre-examination stage typically lasts for about three months, after which time the examining authority—composed of one to five inspectors—has up to six months to review the application and three months to make a recommendation. The entire process should take about 16 months, the inspectorate said.

Base for second Hinkley Point C reactor completed

Workers at the Hinkley Point C nuclear construction project in the United Kingdom have completed the 49,000-ton base for the station's second reactor, Unit C2, hitting a target date set more than four years ago, EDF Energy said in a June 1 news release.

According to EDF, the pour of 8,991 cubic meters (about 317,514 cubic feet) of concrete represents a new U.K. record for a single continuous concrete pour, surpassing by 37 cubic meters (about 1,307 cubic feet) the previous record, set during the construction of the base for Hinkley Point's Unit C1 in June last year. This latest milestone was reached despite a reduction in the number of workers at the project from 4,000 to 2,000—one of a number of actions taken by EDF to address the COVID-19 crisis.

"I want to thank workers and our union partners for their extraordinary efforts to make safe working possible during the pandemic," said Stuart Crooks, Hinkley Point C's managing director. "They have adapted to major changes in everyday behaviors and working practices which would have been unimaginable a few months



Concrete pour at the Hinkley Point C2 reactor. Photo: EDF Energy

ago. The commitment of our specialist suppliers across the U.K. and in Europe has also been instrumental in helping us safely achieve this major milestone. And we must never forget the duty of care we owe to our community, whose ongoing support is vital to the success of our project."

In September 2008, French utility Électricité de France announced that it had agreed to a takeover of British Energy (which became EDF Energy), operator of Hinkley Point B, a nuclear power station in Somerset with two gas-cooled reactors, and that it was planning to build an adjacent power station, Hinkley Point C, which would house two 1,630-MWe EPRs. The U.K. government approved the project in September 2016, following a favorable vote by the Électricité de France board. Hinkley Point Units C1 and C2 are scheduled to begin commercial operation in 2025 and 2026, respectively. If all goes according to plan, they will be the first new nuclear units in the United Kingdom since Sizewell B started up in 1995.

NUCLEAR POLICY

Gender equity group reports on progress made

Gender Champions in Nuclear Policy (GCNP), launched in November 2018, has released a report on the progress made during its inaugural year toward its goal of achieving gender equity in the nuclear policy field. According to a May 28 announcement, the group has had "mostly positive results."

GCNP was founded by Laura Holgate, vice president for materials risk management at the Nuclear Threat Initiative, and Michelle Dover, programs director at the Ploughshares Fund. Starting out with 18 members—known as "gender champions"—the group has since expanded to include more than 50 members in leading roles at 50 organizations around the world. Among other things, the GCNP champions pledge to avoid appearing on single-gender panels whenever possible.

"This first progress report contains plenty of good news about the champions' pledges and what they and their institutions have learned in the process of implementing them," Holgate and Dover state in the report's introduction. "The report also points to obstacles that nuclear policy organizations continue to face in seeking to achieve gender equity and the substantive benefits that it brings. The existential challenge of nuclear policy in all its dimensions—deterrence, nonproliferation, security, energy, disarmament, and so on—requires our best minds and our most committed participants. Our policy community must be inclusive of diversity of knowledge, perspective, experience, and ways of working if we are to manage these risks and opportunities effectively."

GCNP reports that 74 percent of its gender champions were successful in upholding their commitment to avoid speaking on single-gender panels. "This simple act shows that with directed intent, it's possible to stop the practice of hosting and joining single-gender panels," the report states, adding that an additional five champions (12 percent), whose work focuses on women's issues and who may "appropriately appear on all-female panels," upheld a modified pledge.

Holgate

Dover

GCNP champions include ANS Executive Director/CEO Craig Piercy; Maria Korsnick, president and chief executive officer of the Nuclear Energy Institute; Ernest Moniz, former secretary of energy; Mark Peters, director of Idaho National Laboratory; and Thom Mason, director of Los Alamos National Laboratory.

The full report, *Gender Champions in Nuclear Policy: Impact Report 2019*, is available online at media.nti.org/documents/NTI_Gender_Champ_RPT_H.pdf.

Power & Operations continues

UNITED ARAB EMIRATES

ENEC completes key test for Barakah-4

Emirates Nuclear Energy Corporation (ENEC) has completed cold hydrostatic testing at Unit 4 of the Barakah nuclear power plant, the Arab world's first such facility, located in Abu Dhabi. According to a May 19 ENEC press release, the testing incorporated lessons learned from the plant's three other units and is a crucial step toward Unit 4's completion. All four units are 1,345-MWe APR1400 pressurized water reactors. Abu Dhabi is the capital city of the United Arab Emirates.

The UAE's Barakah nuclear plant in 2019. Photo: ENEC

"I am proud of the continued progress being made at Barakah, despite the circumstances we have all faced in relation to COVID-19," said Mohamed Al Hammadi, ENEC's chief executive officer. "The UAE leadership's decisive and proactive response to the pandemic supported us in taking timely, safety-led actions to protect the health and safety of our workforce and our plant. These actions, alongside the efforts of our talented and dedicated workforce, have enabled the successful completion of cold hydrostatic testing at Unit 4, which was completed in adherence to the highest standards of safety, quality, and security. With this accomplishment, we move another step closer to achieving our goal of supplying up to a quarter of our nation's electricity needs and powering its future growth with safe, reliable, and emissions-free electricity."

ENEC is currently in the final stages of construction of Barakah-2, -3, and -4. Unit 2 is more than 95 percent complete, Unit 3 more than 92 percent, and Unit 4 more than 84 percent, the company said. Construction of Unit 1, begun in 2012, was formally completed in 2018, and in February of this year, the UAE's Federal Authority for Nuclear Regulation issued the operating license for the reactor. The following month, ENEC announced that it had completed fuel loading at Barakah-1. The startup of the unit is expected soon.

VOGTLE

Southern gives nod to NRC on violation at Georgia plant

Southern Nuclear has accepted a "white" finding (one of low to moderate safety significance) and an associated violation notice from the Nuclear Regulatory Commission for a problem at the company's Vogtle nuclear plant, near Waynesboro, Ga. Earlier this year, Southern had contested the severity of the finding, arguing that it should have been characterized as "green" (of very low safety significance).

According to the NRC's March 31 final significance determination letter to Southern, the finding, identified during an agency inspection in 2019, involved a "failure to adequately calibrate containment high range area radiation monitors so that they responded within the required range and accuracy to known inputs." The letter goes on to explain, "This resulted in main control room indications that were biased high and would have resulted in overly conservative Emergency Action Level declarations during the course of certain accident scenarios."

In its April 30 acceptance of the finding and violation, Southern listed corrective actions already taken to address the issue, such as the im-

plementation of a new calibration methodology, as well as future actions. The company added that Vogtle-1 monitors were restored to full compliance with the completion of this year's spring refueling outage and that Vogtle-2 monitors will achieve full compliance no later than October 3, with the completion of that unit's fall outage.

As a result of the white finding, both Vogtle units have been moved from Licensee Response, the first column in the NRC's Reactor Oversight Process Action Matrix, to Regulatory Response, the second column in the matrix. (As reactors move to higher-numbered columns in the five-column matrix, they require additional oversight.) Currently, only the two Vogtle units and the Tennessee Valley Authority's Browns Ferry units reside in the Regulatory Response column. All other reactors in the U.S. commercial fleet are under the standard oversight of column one.

RUSSIA

Floating nuclear plant commissioned

The Akademik Lomonosov, the world's only floating nuclear power plant, has been fully commissioned, reports Rosatom, Russia's state atomic energy corporation.

"Today, we can consider the floating nuclear power plant construction project successfully completed," said Andrei Petrov, director of Rosenergoatom, the electric energy division of Rosatom, in a May 22 press release. "Today, it officially becomes the eleventh nuclear power plant in Russia and the northernmost one in the world."

Rosatom also stated that Rostechnadzor, Russia's technical, nuclear, and environmental watchdog, has carried out an inspection of the Lomonosov project, and that based on the results, has issued a "statement of conformity," verifying that the Lomonosov was built "in accordance with all project documentation requirements."

The plant, deployed at Pevek, in the Chukotka region of Russia's Far East, was connected to the grid on December 19, 2019 (*NN*, Jan. 2020, p. 67). The Lomonosov is equipped with two KLT-40C reactor systems, each with a capacity of 35 MWe, similar to those used on icebreakers.

Power & Operations continues

The Akademik Lomonosov. Photo: Rosenergoatom

According to Rosatom, it has generated over 47.3 million kWh of electricity since being connected to the grid, currently provides 20 percent of the Chaun-Bilibino energy center demand, and will become the main energy source for the Chukotka region following the shutdown of the Bilibino nuclear plant. With a service life of 40 years, the Lomonosov is 140 meters (about 460 feet) long, 30 meters (about 98 feet) wide, and has a displacement of 21,500 tons.

Despite some headlines to the contrary, the Lomonosov is not the world's *first* floating nuclear power plant. That title goes to the USS *Sturgis*, a mothballed Liberty ship that was converted into a barge and outfitted with a 45-MWt, 10-MWe, low-enriched uranium pressurized water reactor. The *Sturgis* operated in the Panama Canal Zone from 1968 to 1976, providing electricity for military and civilian use.

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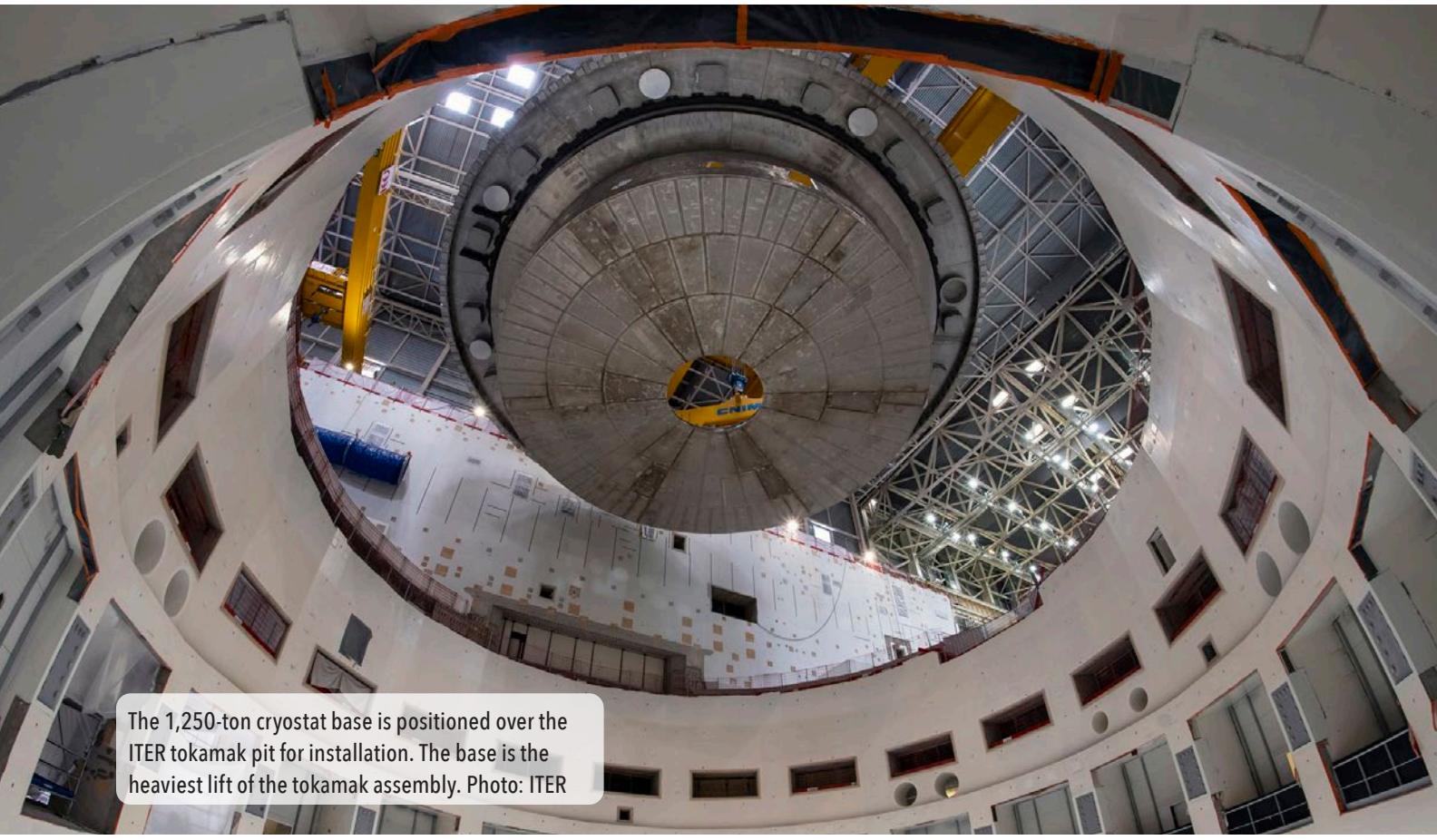


The 1,250-ton cryostat base is positioned over the ITER tokamak pit for installation. The base is the heaviest lift of the tokamak assembly. Photo: ITER

ITER reaches major construction milestone

ITER, the world's largest international scientific collaboration, is beginning the assembly of the fusion reactor tokamak that will include 12 essential hardware systems provided by US ITER, which is managed by Oak Ridge National Laboratory. The 1,250-ton base of the cryostat was placed into the tokamak assembly pit on May 26, marking the first major machine element to be installed at ITER, located in southeastern France.

The installation of the cryostat base was the culmination of a 10-year effort. Manufactured in segments by Larsen & Toubro at its factory in Hazira, India, it was assembled and welded on-site at ITER under the supervision of the Indian Domestic Agency. The elements for the base section were delivered in December 2015 and finalized in July 2019. Taking over from the Indian Domestic Agency, the ITER Organization then proceeded with preassembly work before moving the component into the assembly hall in April.

The cryostat itself, which measures 30 meters high and 30 meters in diameter, is considered one of the most crucial components of the ITER machine. It will act as a thermos, insulating the magnetic system at cryogenic temperature from the outside environment.

The 12 hardware systems include superconductors for the toroidal field magnet system and ORNL-developed pellet injection technology for plasma fueling and performance. These components will help ITER achieve its mission to demonstrate a self-heated burning plasma and 500 megawatts of fusion power.

The 60-foot-tall central solenoid magnet, also fabricated under ORNL management, is considered the "heart" of ITER because it will initiate and drive plasma current inside the tokamak. The first shipment of central solenoid modules will begin later this year, according to ORNL.

"The start of ITER tokamak assembly is a momentous milestone for the project and makes the fusion community—at Oak Ridge and around the world—excited for the future," said Kathy McCarthy, director of the US ITER project.

IDAHO NATIONAL LABORATORY

Nuclear Technology publishes latest research on U.S. transient testing capability

The Transient Reactor Test (TREAT) Facility at Idaho National Laboratory was restarted in 2018 after being in safe standby mode since 1994. The June 2020 issue of *Nuclear Technology* (*NT*) features seven technical papers related to the benchmarking of the facility. Wade Marcum, a lead researcher on the project and guest editor of June's *NT* issue, explained, "The goal of this effort was to understand, to the best of our ability, the expected response of the TREAT reactor upon its restart."

Marcum added that the TREAT Facility brings world-class transient fuel testing capabilities back to the United States. "This test reactor is a true asset to the U.S. nuclear research and development infrastructure, as it provides objective evidence as to the safety, and level thereof, related to nuclear materials and fuels, for which, in many cases, we presently are unable to reliably model," Marcum said.

TREAT is a transient testing reactor designed to impose a highly controlled and prescribed neutronic and thermal hydraulic set of boundary conditions on an experiment located in the central region of its core. TREAT is a truly unique reactor in that nearly any conceivable experimental test chamber may be placed within its core (as long as it is safely designed and passes required safety analyses) and expose that experiment to nearly an infinite number of unique transients—most notably a reactor pulse. The purpose of this reactor is to experimentally test and observe the response of nuclear materials and fuels as they experience off-normal conditions and to expose these materials and fuels to the point that they could conceivably fail mechanically.

Among a number of parallel efforts prior to the TREAT Facility's restart, a Department of Energy Integrated Research Project was funded for the purpose of benchmarking the TREAT Facility. The results of the research are published in the June issue of *NT*, which is free for all ANS members to access at www.ans.org.

View of the top of the TREAT reactor. Photo: INL

Research & Applications continues

RAD CALCULATOR

NSUF rolls out new tool for materials researchers

By Hank Hogan and Tiffany Adams

To get a job done, you need the right tool. Researchers now have one that will make their job easier—the Radioactivity and Damage (RAD) Calculator from the Department of Energy's Nuclear Science User Facilities.

Most experiments conducted through the NSUF have the same underlying goal: quantifying irradiation effects on nuclear fuels and materials. Rather than doing a back-of-the-envelope calculation or a costly in-depth analysis with a nuclear engineer, users now have the flexibility to rapidly change experimental design parameters—such as selecting the reactor to be used, the sample location within the reactor, displacements per atom desired, and the time frame—and see which NSUF reactor can produce the desired result, all within seconds.

The RAD Calculator is free to all to use. Users can access the RAD Calculator by logging into their NSUF account (or by first creating an account) and then, from the left navigation menu, selecting Resources and then RAD Calculator.

The NSUF headquarters is located at the Center for Advanced Energy Studies in Idaho Falls, Idaho. NSUF has 50 user facilities at 21 partner institutions around the United States.

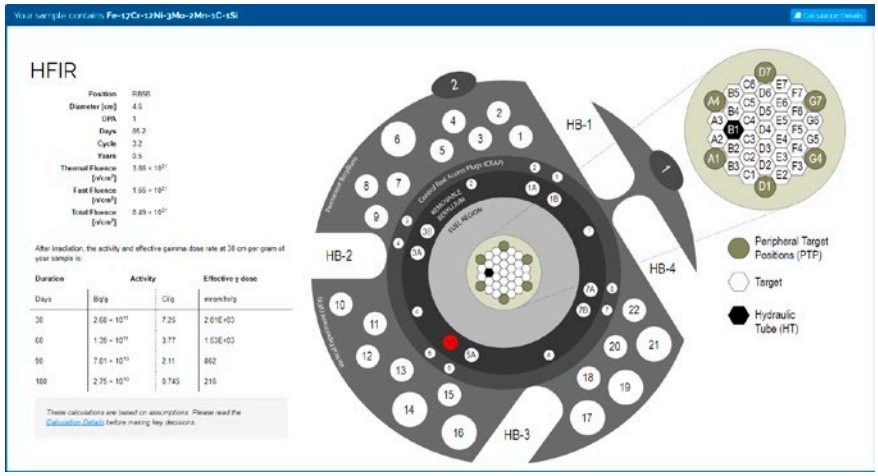
To learn more about the NSUF and how to get access to its neutron, ion, and gamma irradiation, post-irradiation examination, beamline, and high-performance computing capabilities, go to nsuf.inl.gov.

Hank Hogan (Hank@hankhogan.com) is a contract science writer for INL. Tiffany Adams (Tiffany.Adams@inl.gov) is a communications liaison for the Nuclear Science User Facilities.

Select a row to calculate radioactivity and gamma dose rate:

Select	Reactor	Position	Diameter [cm]	DPA	Days	Cycles	Years	Thermal Fluence [n/cm²]	Fast Fluence [n/cm²]	Total Fluence [n/cm²]
○	ATR	A1	1.6	2	76.2	1.4	0.4	9.91×10^{20}	3×10^{21}	6.74×10^{21}
○	ATR	A13	1.6	2	86.1	1.6	0.5	1.2×10^{21}	2.95×10^{21}	6.79×10^{21}
○	ATR	B1	2.2	2	174.3	3.2	1	2.26×10^{21}	3.18×10^{21}	9.53×10^{21}
○	ATR	B9	3.8	2	583	10.6	3.2	2.91×10^{21}	3.45×10^{21}	1.27×10^{22}
○	ATR	EFT	7.6	2	132.1	2.4	0.7	5.34×10^{21}	2.98×10^{21}	1.24×10^{22}
○	ATR	I1	12.7	2	18232.5	331.5	101.3	2.45×10^{22}	2.58×10^{21}	3.05×10^{22}
○	ATR	I21	3.8	2	5091.1	92.6	28.3	1.53×10^{22}	3.32×10^{21}	2.65×10^{22}
○	ATR	I3	8.3	2	15021.1	273.1	83.5	3.19×10^{22}	2.92×10^{21}	4.11×10^{22}
○	ATR	I5	8.3	2	23700.6	430.9	131.7	4.77×10^{22}	2.73×10^{21}	5.64×10^{22}
○	HFIR	PTP	1.1	2	30.9	1.1	0.2	2.85×10^{21}	2.91×10^{21}	8.89×10^{21}
○	HFIR	RB5B	4.6	2	170.4	6.3	0.9	7.72×10^{21}	3.33×10^{21}	1.7×10^{22}
○	HFIR	VXF12	4	2	3451.5	127.8	18.3	7.65×10^{22}	2.93×10^{21}	9×10^{22}
○	HFIR	VXF14	7.2	2	3027.8	112.1	16	6.91×10^{22}	3.09×10^{21}	8.49×10^{22}
○	MITR	ICSA	4.1	2	408.2	6.5	1.6	7.16×10^{20}	3.09×10^{21}	6.56×10^{21}
○	MITR	WATF	5.1	2	371.6	5.9	1.5	1.16×10^{21}	3×10^{21}	7.18×10^{21}
○	PULSTAR	REP	6.4	2	19302.9	221.9	221.9	1.03×10^{22}	2.72×10^{21}	1.62×10^{22}

Above: When users input their material composition, they will be able to choose among several NSUF reactors to accomplish their research goals. Graphic: NSUF



Right: After researchers select an NSUF reactor and placement within the reactor, they will be able to see the selected placement, as well as cycle and dose information, in more detail. Graphic: NSUF

The Elettra-Sincrotrone research facility, located in Trieste, Italy, in May became the 44th member of the IAEA Collaborating Centers network.

IAEA

Elettra designated a collaborating center

A collaborating center agreement was signed by Elettra Sincrotrone Trieste and the International Atomic Energy Agency in May. The agreement focuses on advanced light sources and will support countries in research, development, and capacity-building in the application of advanced and innovative radiation technologies.

Elettra is a multidisciplinary international research organization based in Trieste, Italy, that has worked with the IAEA for more than 15 years. It specializes in generating synchrotron and free-electron laser light and applying it in a wide range of research fields, including materials and life science.

The agreement has a much broader scope than past partnerships between the entities. It includes the design of light sources, beamlines, and optics. Elettra will provide assistance to developing countries planning to build or improve their own synchrotron facilities by training scientists and technologists in key areas.

Elettra is also contributing to COVID-19 research, giving priority to experiments related to SARS-CoV-2 viral proteins and studies of possible drugs for viral infection treatment. Researchers from around the globe will be able to obtain remote access to Elettra/FERMI beamlines and perform experiments on a priority basis on the topic.

Previous partnership agreements have focused primarily on the XRF beamline, developing new hardware and analytical methods, and have supported training and access to that facility.

"Elettra has a long history of collaboration with the IAEA and has already produced excellent results in fields ranging from air pollution to ovarian tumors," said IAEA Deputy Director General Najat Mokhtar, head of the Department of Nuclear Sciences and Applications. "This new agreement will benefit developing member states through its broad focus on advanced light sources, including the free-electron laser, FERMI."

DOE awards $13-billion tank closure contract

The Department of Energy has awarded a $13-billion tank closure contract for services at its Hanford Site, near Richland, Wash. The 10-year contract was awarded on May 14 to Hanford Works Restoration, a joint venture of BWX Technologies and Fluor Corporation that also includes DBD and INTERA, two preselected small businesses that provide specialized modeling and regulatory expertise, respectively.

The C Tank Farm at the Hanford Site near Richland, Wash. (Photo: DOE)

Hanford Works Restoration will take over from Hanford's current tank waste contractor, Washington River Protection Solutions (WRPS), whose contract expires at the end of September. The WRPS contract includes a clause that allows the DOE to end the contract earlier to align with a 60-day transition to the new contract.

About 56 million gallons of mixed chemical and radioactive waste are stored in 177 underground tanks at the site. According to the DOE, under the contract Hanford Works Restoration will "provide services to achieve significant reductions in risk and financial liability and provide the best overall solution to accelerate the closure of waste tanks." The company will be responsible for overseeing the site's tank closure mission, which includes the operation and maintenance of the single-shell and double-shell tank farms, including volume management and secondary waste treatment facilities; the completion of construction, operations, and maintenance of equipment necessary to pretreat and feed low-level waste to Hanford's low-activity waste vitrification facility; and single-shell tank waste remediation and closure to support the environmental cleanup of the Hanford Site.

In announcing the indefinite delivery/indefinite quantity contract, the DOE said, "The proposal submitted by Hanford Works Restoration was determined to provide the best value to the government considering key personnel, technical and management approach, past performance, and cost." The DOE added that it awarded the contract, which includes requirements for work to be performed by small businesses, under full and open competition.

The DOE solicited bids for the new tank waste contract using its new end-state contracting model. The DOE has transitioned to the new contract model in an effort to reduce risk and environmental liability as the department works to accelerate the cleanup and closure of the former plutonium production site.

"This contract award demonstrates that BWXT's nuclear operations and waste management capabilities are key differentiators for Hanford's programs that are of critical importance to the nation and the state of Washington," said Rex D. Geveden, BWXT's president and chief executive officer. "Along with Fluor and our teaming subcontractors, we look forward to getting results under the DOE's end-state contracting model by working together with our customer, regulators, employees, and stakeholders."

Tom D'Agostino, president of Fluor's Government Group, added, "We're pleased that DOE has given us the opportunity to demonstrate the effectiveness of the new end-state contract approach to accelerate closing Hanford's tanks and reduce DOE's liability. Fluor began its 13-year tenure at Hanford in 1996 with a contract to manage most of the site's cleanup work, and we have been an integrated part of the community ever since. We look forward to working with the incumbent tank farm employees, DOE, the regulators, and other Hanford contractors to shift to a unified closure mentality and safely accelerate the completion timeline."

Uncertainties with WTP persist, GAO says

The Department of Energy's Office of Environmental Management has not followed best practices or DOE policy in pursuing alternatives for pretreating radioactive tank waste at the Hanford Site, near Richland, Wash., according to a report released on May 12 by the Government Accountability Office. The DOE has spent over $400 million since 2013 looking into alternatives to pretreating Hanford's low-activity waste (LAW), yet the department has not properly defined a mission need or a life-cycle cost estimate for its preferred alternative, according to the report.

After technical issues with the Waste Treatment and Immobilization Plant's (WTP) pretreatment facility caused the DOE to suspend construction on the facility in 2012, the DOE's preferred alternative strategy for meeting its commitments and begin treating waste by 2023 has been to bypass the pretreatment facility and send separated LAW to the WTP's LAW vitrification facility, an approach the DOE is calling direct-feed low-activity waste (DFLAW).

In a May 2015 report, the GAO called attention to the DOE's shortcomings in defining a mission need statement or a life-cycle cost estimate for its DFLAW alternative (*NN*, July 2015, p. 63). In that report, the GAO recommended that the DOE revise its analysis of waste treatment options to consider a variety of alternatives. In April 2019, the DOE initiated an analysis of alternatives, which it expects to complete in September.

As of February 2020, however, the DOE had not yet defined a mission need for its new analysis of alternatives and did not have a life-cycle cost estimate for its baseline alternative, the GAO said in its report. "Without these, decision-makers will not have the information they need to make the best decisions for pretreating high-level waste, and [the DOE] cannot assure decision-makers that alternative approaches meet mission needs," the report stated.

The GAO report also noted that between 2013 and 2018, the DOE spent $752 million on the WTP's pretreatment facility. More than half of that was spent on simply maintaining the partially constructed facility, the GAO noted, with the rest spent on resolving the facility's technical challenges. The GAO added that the DOE has yet to provide an updated cost estimate for completing the pretreatment facility.

While the DOE and its contractor Bechtel National consider the WTP's technical issues to be conceptually resolved, the GAO said, the department has yet to design, engineer, or test the solutions. The GAO also noted that the Defense Nuclear Facilities Safety Board, the independent

Waste Management continues

Waste Management Briefs

Hanford's vitrified waste can be disposed of on-site, according to the Department of Energy's *Draft Waste Incidental to Reprocessing Evaluation for Vitrified Low Activity Waste Disposed Onsite at the Hanford Site, Washington*, which was released on May 26 with a notification in the *Federal Register*. In the draft evaluation, the DOE demonstrates that Hanford's radioactive tank waste, from which long-lived insoluble radionuclides and cesium have been removed before being turned to a glass form at the site's low activity waste vitrification facility, can be considered waste that is incidental to the reprocessing of spent nuclear fuel. As such, the vitrified waste is not considered high-level radioactive waste and can be disposed of on-site as mixed low-level radioactive waste at Hanford's Integrated Disposal Facility. The low activity waste vitrification facility is part of Hanford's Waste Treatment and Immobilization Plant, which is being built to treat and vitrify Hanford's approximately 56 million gallons of chemical and radioactive tank waste.

The DOE is consulting with the Nuclear Regulatory Commission on the draft evaluation and is also inviting comments from the public until September 26. The draft waste incidental to reprocessing evaluation can be found online, at www. hanford.gov/page.cfm/Vitrified-LowActivityWaste. Comments can be submitted by mail to Jennifer Colborn, U.S. Department of Energy, Office of River Protection, 2440 Stevens Dr., Richland, WA 99354; or by email to VLAWDraftWIR@rl.gov.

Calvert Cliffs may store spent nuclear fuel pellets with a larger diameter than is authorized for the nuclear power plant's dry spent nuclear fuel storage system. In the June 1 *Federal Register*, the Nuclear Regulatory Commission issued an environmental assessment and finding of no significant impact in its review of an exemption request from Exelon Generation to load and store Class 14x14C spent fuel with a larger maximum pellet diameter (0.3810 inches) than is allowed by the certificate of compliance for the storage system it intends to use at Calvert Cliffs, near Lusby, Md. Exelon is planning a loading campaign in early summer 2021 that will move spent fuel from wet storage at Calvert Cliffs to a separate independent spent fuel storage installation using Holtec International's HI-STORM FW storage system, which is certified to hold fuel pellets with a diameter of 0.3805 inches or less. The NRC found no significant radiological or environmental impacts associated with the exemption request and issued the exemption on June 8.

agency that oversees safety at DOE sites, considers the technical challenges to be unresolved.

To date, more than $11 billion has been spent on the WTP, $3.8 billion of which has been spent on the plant's pretreatment facility. Under construction since 2000, the WTP is intended to vitrify Hanford's 56 million gallons of radioactive and chemical tank waste, stabilizing it for permanent disposal.

The full GAO report, *Hanford Waste Treatment Plant: DOE is Pursuing Pretreatment Alternatives, but its Strategy is Unclear While Costs Continue to Rise* (GAO-20-363), can be found online at www.gao.gov.

IDAHO SITE

Final RFP issued for $6.4-billion cleanup contract

The Department of Energy's Office of Environmental Management on May 27 issued a final request for proposals for the cleanup of the Idaho National Laboratory site, near Idaho Falls, Idaho, and the Fort Saint Vrain facility near Platteville, Colo. The 10-year contract for the projects—collectively called the Idaho Cleanup Project—has an estimated ceiling of about $6.4 billion.

The DOE said that it will select the winning bid using a streamlined process under its newly developed end-state contracting model. That model, the DOE said, "focuses on the most discriminating evaluation elements of key personnel, management approach, past performance, and cost to support a qualifications-based selection of the offeror team that represents the best value to the government."

Work to be performed under the new indefinite delivery/indefinite quantity contract includes the operation of the Integrated Waste Treatment Unit at INL; spent nuclear fuel management, including the independent spent fuel storage installations at the INL site and Fort Saint Vrain; transuranic and low-level radioactive waste disposition and management; facility deactivation and decommissioning; environmental remediation activities; and facility infrastructure.

The DOE has established a dedicated webpage for the Idaho Cleanup Project contract at www.emcbc.doe.gov/SEB/icp/. All announcements, documents (including the draft and final RFPs), and related links will be posted there.

DEPLETED URANIUM

DOE moves on sale, disposal of DU stockpiles

The Department of Energy has signed an amendment to a 2016 sales agreement with Global Laser Enrichment (GLE) that will provide the company with access to large stockpiles of DOE-owned depleted uranium hexafluoride (DUF_6) tails as GLE looks to build its proposed uranium enrichment facility at the DOE's Paducah site in Kentucky. As announced on June 5, the amendment is one of the conditions of a 2019 agreement among Australia's Silex Systems Limited, Canada's Cameco Corporation, and GE Hitachi Nuclear Energy for the restructuring of GLE, the exclusive licensee of Silex's laser uranium enrichment technology.

Separately, the DOE announced on June 5 that it has issued a formal record of decision for the shipment and disposal of depleted uranium oxide from the former gaseous diffusion plants at the department's Paducah and Portsmouth, Ohio, sites to one or more disposal facilities in the western United States.

According to Silex, the availability of the DOE's DUF_6 inventories is critical to GLE's proposed Paducah Laser Enrichment Facility (PLEF), which would use Silex's laser enrichment technology to re-enrich the DOE's stockpiles of depleted uranium tails. GLE would sell the resulting natural grade uranium in the form of UF_6 on the global uranium market at a production rate of around 2,000 metric tons per year, equivalent to a uranium mine producing an annual output of around 5.2 million pounds of uranium

Waste Management continues

oxide, Silex said. The production facility will also have the added value of producing uranium that has already been converted to UF_6.

Under the December 2019 restructuring agreement, which is pending regulatory approval, Silex and Cameco agreed to purchase GE Hitachi's 76 percent interest in GLE, with Silex acquiring a 51 percent interest in GLE and Cameco increasing its interest from 24 percent to 49 percent. Government approval of the transaction is expected by the end of the 2020 calendar year.

Silex said that it anticipates beginning commercial operations of PLEF later this decade, subject to technology readiness, regulatory approvals, and prevailing market conditions.

The DOE's record of decision on depleted uranium oxide, meanwhile, will implement the department's preferred alternative for its disposal, as documented in the *Final Supplemental Environmental Impact Statement for Disposition of Depleted Uranium Oxide Conversion Product Generated from DOE's Inventory of Depleted Uranium Hexafluoride*. Specifically, the DOE has decided to dispose of the material, if declared a waste, at one or more of the evaluated disposal sites: the EnergySolutions low-level radioactive waste disposal facility near Clive, Utah; the Waste Control Specialists (WCS) LLW disposal facility near Andrews, Texas; and the Nevada National Security Site LLW disposal facility in Nye County, Nevada. The DOE said that it will ship to the selected commercial sites only if the facility is authorized to receive DU oxide.

The DOE said that its near-term plan is to focus on DU oxide disposal at commercial sites and that it is planning a pilot project in the next year to ship several railcars containing cylinders of the material to either the EnergySolutions or WCS facilities. The DU oxide results from the conversion of DUF_6, a byproduct of the gaseous diffusion process that was used to enrich uranium. Conversion plants now operating at the Portsmouth and Paducah sites convert DUF_6 to DU oxide, a more stable form for possible reuse or disposal.

UNITED KINGDOM

Jacobs to study C-14 in irradiated AGR graphite

The global engineering company Jacobs, under a contract with Radioactive Waste Management Ltd. (RWM), will be studying the release of radioactivity from irradiated graphite taken from reactor core samples at the United Kingdom's nuclear power plants. According to Jacobs, the research will support RWM, a subsidiary of the U.K. government's Nuclear Decommissioning Authority, in its analysis of graphite behavior and the options for graphite waste management in the future.

RWM commissioned Jacobs to measure and characterize releases of carbon-14 for comparison with releases from irradiated graphite in earlier reactor types, including the United Kingdom's first generation of Magnox civil nuclear power plants. Jacobs said that its research will have a significant bearing on the safe management and disposal of graphite waste arising from the decommissioning of Britain's fleet of graphite-moderated advanced gas-cooled reactors (AGR). The United Kingdom plans to close all 14 of its AGRs, located at seven plant sites, by the end of the decade.

The Jacobs contract has an initial duration of two years. Subject to experimental program results, it may be extended by an additional two years.

An aerial view of the Radioactive Materials Handling Facility at California's Santa Susana Field Laboratory, with the DOE-owned buildings numbered. Photo: DOE

ENVIRONMENTAL REMEDIATION

Cleanup of Santa Susana Field Lab site to resume

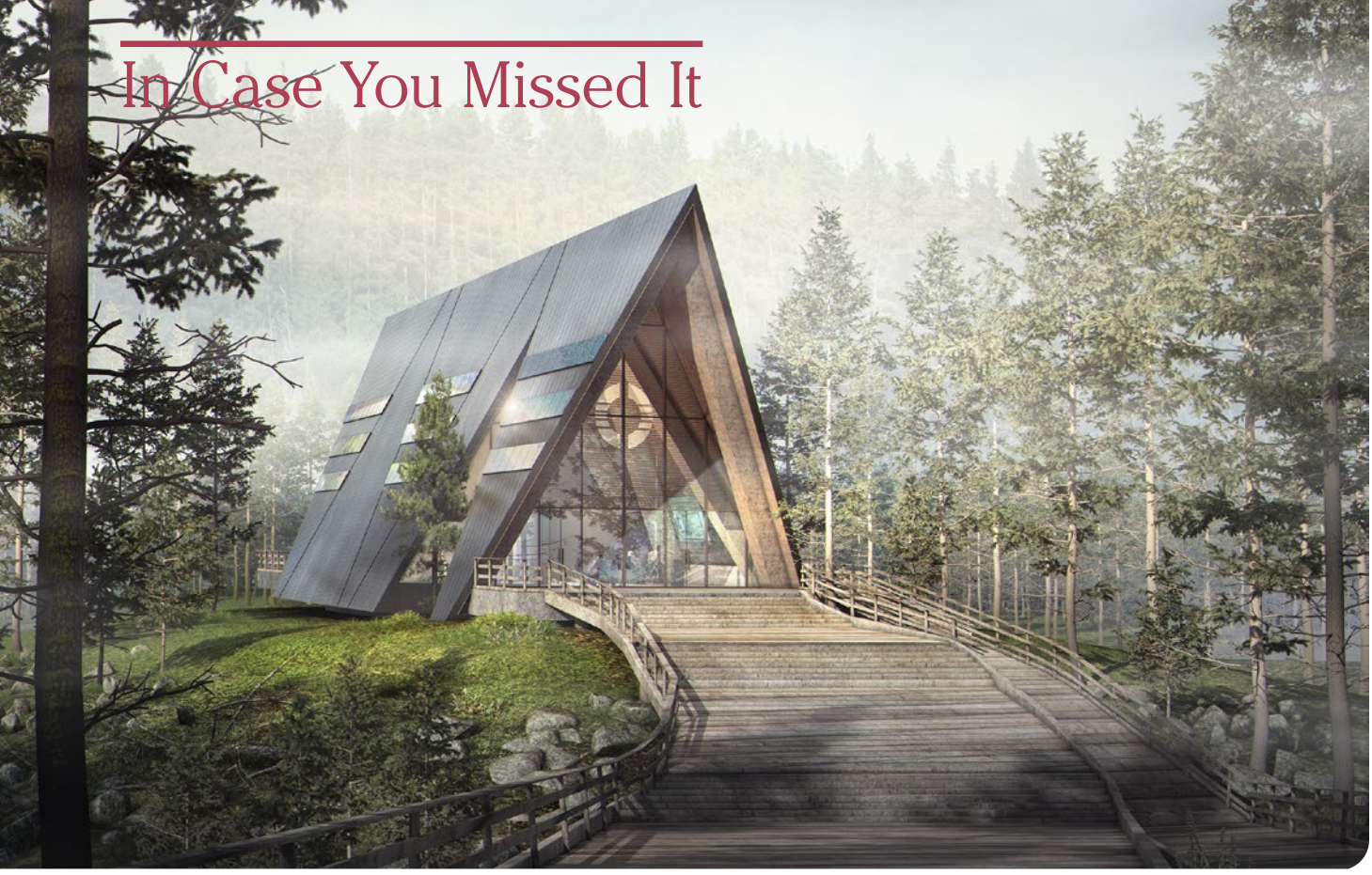
Under an agreement with the state of California, the Department of Energy will soon resume environmental cleanup of the Energy Technology Engineering Center (ETEC) at the Santa Susana Field Laboratory site in Ventura, Calif., about 36 miles northwest of Los Angeles. In a legal order signed on May 19 with the California Department of Toxic Substances Control, the department has agreed to demolish 10 of the remaining DOE-owned buildings within the ETEC, including several of the most contaminated buildings.

The ETEC served as a center for cutting-edge technology development that supported the U.S. nuclear and space programs during the Cold War. The 10 buildings slated for demolition comprise the former Radioactive Materials Handling Facility (RMHF) complex within the center and were used for the processing, packaging, and shipment of radioactive and mixed hazardous wastes. The buildings have been inactive since 2001. Years of rocket testing, nuclear reactor testing, and liquid metal research at Santa Susana Field Laboratory have left the site significantly contaminated.

According to the California Department of Toxic Substances Control, contamination within the 1.5-acre RMHF complex includes radionuclides, heavy metals, solvents, oils and greases, lead-based paint, and asbestos-containing materials. The DOE said that it will continue to work with the state toward processes to remove the remaining DOE-owned buildings at the ETEC and to clean up soil and groundwater at the site. After the 10 RMHF buildings are removed, only eight DOE structures will remain at the ETEC.

Secretary of Energy Dan Brouillette said, "The Department of Energy is committed to making real and significant progress to meaningfully address the environmental legacy challenges from decades of Cold War–era government research. This agreement is an important step that demonstrates how DOE and California can collaborate to bring the ETEC site to its final cleanup and completion."

In Case You Missed It



Artist's conception of Oklo's Aurora. Image: Gensler

Aurora's docketing marks dawn for advanced reactor licensing

Oklo's 1.5-MWe fast spectrum design known as Aurora is the first advanced non–light-water reactor to be accepted for a licensing review by the Nuclear Regulatory Commission. Both the reactor's design and the anticipated licensing process mark a major departure from large light-water reactor design and licensing.

Oklo heralded the NRC's acceptance of its combined license application (COLA) to construct and operate a full-scale demonstration reactor at Idaho National Laboratory on June 15, announcing "a breakthrough in the commercialization of carbon-free advanced fission technologies."

The NRC also issued a press release on June 15, stating that the agency is focused on aligning key design and safety aspects of its review early in the process to provide a predictable and efficient licensing schedule. The NRC and Oklo have engaged in preapplication discussions since 2016.

Oklo has plans to deploy and operate Aurora in remote or off-grid locations for 20 years of power generation without refueling. The Aurora design would use heat pipes to transport heat from the reactor core to a supercritical carbon dioxide power conversion system to generate electricity.

FUEL CYCLE

NRC to prepare EIS for Westinghouse fuel plant

The Nuclear Regulatory Commission will prepare an environmental impact statement (EIS) for Westinghouse Electric Company's application to renew the operating license of its Columbia Fuel Fabrication Facility (CFFF) in South Carolina, the agency announced in a June 5 press release. The plant produces fuel assemblies for use in commercial nuclear power reactors.

DOE

Brouillette touts SMRs in address to space council

In remarks addressed to a meeting of the National Space Council on May 19, Energy Secretary Dan Brouillette said that the development and deployment of small modular reactors could provide sustainable power sources for space applications.

Another nuclear-related area Brouillette cited was the collaboration among the DOE's National Nuclear Security Administration, the Department of Defense, the National Oceanic and Atmospheric Administration, and NASA for the release of space weather data collected by DOE-developed space-based nuclear explosion monitoring payloads. He said that the DOE will rely on those experiences to grow its cooperation and engagement with the newly formed U.S. Space Force by identifying technical capabilities that could support its critical mission.

"One of the most fundamental needs for any space mission is a reliable and sustained supply of power, and this is where we at DOE come to the fore."

Energy Secretary Dan Brouillette

How the United States can retake the global nuclear lead

More than a thousand participants joined a Department of Energy webinar on May 29 for a discussion of the Trump administration's strategy for restoring the United States to a globally predominant position in the field of nuclear energy. The strategy was laid out in the Nuclear Fuel Working Group's recent report, *Restoring America's Competitive Nuclear Energy Advantage*. (For details on the NFWG's report, see our coverage here: www.ans.org/news/article-135/doe-issues-broad-nuclear-energy-strategy/.)

The webinar, hosted by radio talk show host Hugh Hewitt, featured comments from a number of nuclear luminaries, among them Dan Brouillette, U.S. secretary of energy; John Hamre, president and chief executive officer of the Center for Strategic and International Studies; Clarence "Bud" Albright, president and CEO of the U.S. Nuclear Industry Council; and Rita Baranwal, assistant secretary for the DOE's Office of Nuclear Energy.

MOLYBDENUM-99

NRC expected to issue Mo-99 facility license for Shine in 2021

Shine Medical Technologies, which is building a medical isotope production facility in Janesville, Wis., said on May 11 that it expects to have an operating license issued by the Nuclear Regulatory Commission by October 2021. Shine's application seeking approval to operate the facility, which will produce isotopes including molybdenum-99, was accepted and docketed by the NRC last October. Mo-99, the precursor to technetium-99m, is used in more than 40 million medical patient procedures every year.

Dunzik-Gougar leads as new ANS president

Mary Lou Dunzik-Gougar is the 66th president of the American Nuclear Society. On June 11, during a meeting of the Board of Directors that—like the rest of the 2020 ANS Annual Meeting—was held virtually, the duties of president were officially transferred from Marilyn Kray to Dunzik-Gougar, who will serve a one-year term as president. Kray will remain on the Board of Directors for one year as immediate past president.

Dunzik-Gougar, an ANS member since 1994, will continue to lead ANS on the course established by ANS Change Plan 2020 during Kray's term as president. Dunzik-Gougar was serving as vice president/president-elect when the Change Plan was approved by the Board in November 2019, and newly elected Vice President/President-Elect Steve Nesbit was on the Board that approved the plan. The ANS Executive Committee, which now includes Dunzik-Gougar, Kray, Nesbit, Treasurer W. A. "Art" Wharton III, and Executive Director/CEO Craig Piercy, will confidently lead a more streamlined ANS that is prepared to meet its members' needs now and in the future.

Turn to page 54 for a profile of Dunzik-Gougar and the path that led to her ANS presidency.

UWC Virtual Summit follows the successful ANS Virtual Annual Meeting

ANS is celebrating the success of its first Virtual Annual Meeting, which drew a record 2,346 registered attendees. Check out some more of the meeting stats on the next page.

On the heels of that success, ANS has announced that the Utility Working Conference (UWC) will also be converted to a virtual event in 2020. The one-day UWC Virtual Summit, titled, "It's Go Time: Creating Momentum Toward Transformational Change," will be held August 11.

The in-person meeting was originally scheduled for three days in Florida, but plans have changed due to COVID-19.

Dan Churchman of Southern Nuclear is the general chair of the UWC Virtual Summit. Vince Gilbert of Model Performance serves as the technical program chair, while Jon Anderson of ACA Proactive is assistant technical program chair.

The summit will feature an opening plenary session in the morning, which will be followed by three sets of breakout sessions beginning at 11:30 a.m. EDT. The final set will conclude at 5 p.m. A 30-minute break between session sets is also built into the schedule.

For more information about the 2020 UWC Virtual Summit, please visit uwc.ans.org.

ANS Virtual Annual Meeting

By the numbers

The 2020 ANS Virtual Annual Meeting—hosted live via Zoom on June 8-11, 2020, on an ANS-created virtual conference platform—was a great success and attracted more registrants than any ANS meeting in recent decades. Check out the stats below.

2,346 registered attendees

3 plenary sessions with live attendance peaking at over **1,000**

81 technical sessions presented over **4** days

Up to **10** live sessions hosted simultaneously

Average of **95** attendees per technical session

243 attendees for a single technical session
(Transformational Challenge Reactor)

21 panel sessions

60 paper sessions

54 committee and professional division meetings

Attendees hailing from **26** countries

127 hours of session recordings archived in the Meeting Portal for registered attendees to view

ANS News continues

Meet the new ANS officers

Seven newly elected officers of the ANS Board of Directors began their terms on June 11 following the Board meeting during the 2020 ANS Virtual Annual Meeting.

STEVE ARNDT

Welcome back: This will be Arndt's third time serving on the ANS Board, having also been a member in 2011–2014 and 2015–2017, the latter term while he served as ANS treasurer.

The basics: Arndt, ANS Fellow and member since 1981, is a senior technical advisor at the Nuclear Regulatory Commission and an adjunct professor of nuclear engineering at the University of Tennessee–Knoxville.

Board goals: As a Board member, Arndt said he plans to serve and advance the goals and mission of ANS, adding that he wants every member to feel that ANS is supporting them, regardless of what section they are part of, what division they are active in, or their day job.

He said it: "It seems like I have worked on almost everything the Society does over the years, but believe it or not, I am still learning new things about our industry and our Society every day."

Bet you didn't know: Arndt and his wife, Linda, scheduled their wedding to coincide with the 2013 ANS Annual Meeting in Washington, D.C. The reason was so their ANS friends wouldn't have to travel for both a wedding and the Annual Meeting.

LORI A. BRAASE

Welcome back: Braase, ANS member since 2000, also served on the ANS Board in 2005–2007.

The basics: Braase is the program manager for Gateway for Accelerated Innovation in Nuclear at Idaho National Laboratory, where she has worked for 29 years.

Board goals: Braase said she wants to find ways to add real value for the new generation of nuclear engineers, scientists, developers, and investors. She added that there is a bright future for nuclear in clean energy, environmental conversations, technology development, and new visionary applications. She said ANS can be one of many enablers to create the change and lead the way.

She said it: "I am excited for the opportunity to learn more about ANS from the inside out. This is a formative time for the organization with growth opportunities and change. The updated ANS Change Plan can be the foundation for creative thinking, unique engagement techniques, strong customer focus, and community inclusion—all for the benefit of the nuclear future."

HARSH S. DESAI

Shuffle Board: Desai, ANS member since 2011, was elected to fill the Board vacancy created when Steve Nesbit became vice president/president-elect.

The basics: Desai works as a senior manager on policy development, business strategy, and economic analyses at the Nuclear Energy Institute.

Board goals: As a member of the Board, Desai wants to serve the ANS mission and create value for the members. He's also hoping to increase involvement from young and student members. Improving retention among current members and attaining new members are also goals.

Bet you didn't know: Desai is an avid photographer who enjoys chasing tornadoes and traveling. He also brews beer, got engaged in October 2019 to Allison Wall, and is the adoptive father of a black cat named Spock.

ANNA S. ERICKSON

The basics: Erickson, ANS member since 2005, is an associate professor in the Nuclear and Radiological Engineering Department at the Georgia Institute of Technology.

Board goals: As an academician, one of Erickson's main objectives is to promote nuclear science and technology to students and encourage engagement with ANS. Another area of focus for Erickson will be diversity within ANS, which she said plays a major role in attracting new members and promoting innovation.

She said it: "My career path was largely shaped by participating in ANS activities early in my career, attending student conferences and meeting mentors."

Bet you didn't know: Thanks to the recent quarantine, Erickson said her hobbies drastically shifted to gardening and baking, which she has been doing with help from her two kids. They also have a Great Pyrenees dog, whom she says rules the house.

RICHARD H. "CHIP" LAGDON JR.

The basics: Lagdon, ANS member since 1983, is a chief engineer of nuclear operations and safety at Bechtel. He is also a professor in the Nuclear Engineering Department at the University of Tennessee–Knoxville.

Board goals: Lagdon said he wants to help advance the goals of ANS and improve its position within the industry during his time on the Board.

Bet you didn't know: Lagdon's hobbies include swimming and golfing, but he's hoping to take up the guitar soon. He and his wife, Victoria, have been married for 38 years, and they have two sons who are both engineers. On a sad note, the family lost its St. Bernard to cancer last year, but they plan to get another canine companion soon.

STEVE NESBIT

Moving up: Nesbit, ANS member since 1989, moves into the vice president/president-elect position after serving on the Board since 2019.

The basics: A self-employed nuclear industry consultant for LMNT Consulting, Nesbit said his titles run from president to janitor.

Board goals: Nesbit said he wants to see ANS assume a more prominent and appreciated role in the nuclear policy world.

Bet you didn't know: Nesbit used to collect "expensive and/or dangerous hobbies but most fell away with age and responsibility. The survivor turned out to be downhill skiing."

LUC VAN DEN DURPEL

The basics: Van Den Durpel, ANS member since 2004, is the non-U.S. at-large representative on the Board. He is the founder and managing director of Nuclear-21 in Belgium.

Board goals: Van Den Durpel has three objectives during his term. The first is to contribute to the continuous improvement of ANS as drafted in the ANS Change Plan. His second objective is reaching out to other national and regional nuclear societies worldwide to expand ANS's advocacy for nuclear science and technology. Finally, he wants to engage with non-nuclear organizations including energy and/or scientific and technological societies to improve the position of nuclear science and technology applications in the mindset of many stakeholders.

He said it: "The capabilities and challenges for nuclear science and technology are global, and ANS's historic role as the leading nuclear society can be enriched both by reaching out toward the international community as well as by being the 'go-to' nuclear learning society."

Bet you didn't know: Van Den Durpel and his wife, Régine, have two children, Isabelle and Matthieu. As a teenager, his hobby was astronomy before he turned to sailing, which he admits he hasn't been doing lately but plans to start again in coming years.

ANS News continues

ANS congratulates award recipients during 2020 Virtual Annual Meeting

The recipients of four ANS awards—the Dwight D. Eisenhower Medal, the Walter H. Zinn Medal, the Landis Young Member Engineering Achievement Award, and the Mishima Award—were recognized on June 8 during the opening plenary session of the 2020 ANS Virtual Annual Meeting by Hussein S. Khalil, Honors and Awards Committee chair.

The Presidential Citation, Distinguished Service Award, and Leadership Award were presented by then ANS President Marilyn Kray on June 9 during the President's Special Session. The Nuclear Statesman Award is cosponsored by the Nuclear Energy Institute, and was presented by Maria Korsnick, president and chief executive officer of NEI, during the President's Special Session.

Dwight D. Eisenhower Medal

Presented to **Peter B. Lyons**, ANS Fellow and member since 2003, former assistant secretary for nuclear energy at the Department of Energy, in recognition of his influential and prominent leadership in nuclear technology policy spanning five decades and for the vital role he played in the nuclear renaissance of the early 21st century.

Walter H. Zinn Medal

Presented to **William E. Burchill**, ANS past president (2008–2009) and member since 1970, retired Nuclear Engineering Department head at Texas A&M University, for major research contributions in materials corrosion and degradation processes in nuclear energy systems, and for impact on the nuclear industry through the development of improved fuel cladding concepts as well as education and mentorship of undergraduate and graduate students.

Landis Young Member Engineering Achievement Award

Presented to **Janelle P. Wharry**, of Purdue University, in recognition of her development of innovative methods for mechanical testing of materials under extreme radiation environments

Mishima Award

Presented to **Rudolph Johannes Maria Konings**, of the European Commission Joint Research Center, for numerous and pioneering achievements furthering the understanding of nuclear fuels.

Presidential Citation

Presented to the **Young Members Group**, for outstanding leadership in generating digital content and creating value for the Society.

Susan Eisenhower congratulates Peter Lyons on award

Susan Eisenhower has issued a letter congratulating Peter B. Lyons, the 2020 recipient of the ANS Eisenhower Medal. Lyons, ANS Fellow and member since 2003, was honored on June 8 during the award ceremony segment of the opening plenary of the 2020 ANS Virtual Annual Meeting. Attendees can view the presentation via the ANS meeting portal.

Eisenhower's letter reads as follows:

> I am delighted that Dr. Pete Lyons has been awarded the ANS Eisenhower Medal for his exceptional work in the nuclear field. It has been an honor and a personal pleasure to have worked with Pete over the years, and I can attest to the fact that he was in critical policy roles at key times when it truly mattered. His legacy as an advocate of nuclear power will long be remembered. I could not be prouder of the fact that Pete Lyons will forever be associated with Dwight Eisenhower's name through this prestigious award.
>
> Susan Eisenhower
> June 8, 2020

The Eisenhower Medal is awarded to individuals in recognition of outstanding leadership in public policy for nuclear science and technology or outstanding contributions to the field of nuclear nonproliferation. It was established in 2014 by the Nuclear Nonproliferation Policy Division and was elevated to the status of a top-tier ANS award in 2018.

Distinguished Service Award

Presented to **John S. Bennion** of GE Hitachi, ANS member since 1995, in recognition of his lifelong service to increase public understanding of nuclear science and engineering by promoting the importance of professional licensure at the section, division, and national level.

Leadership Award

Presented to **Rebecca L. Steinman** of Exelon Generation, ANS member since 1994, in recognition of her unwavering commitment and continuous drive toward excellence in the area of increasing public understanding of nuclear science and engineering by contributing to the work of professional associations, schools, and the professional, scientific, and technical press.

Henry DeWolf Smyth Nuclear Statesman Award

Presented to **Siegfied S. Hecker** of Stanford University, ANS member since 2004, for sustained international leadership involving nuclear technologies, including the U.S.-Russian Lab-to-Lab Program, which prevented "brain drain" of scientists after the collapse of the Soviet Union.

ANS News continues

ANS names nine new Fellows

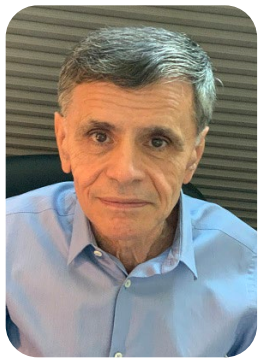
ANS Fellows hold the highest grade of membership in the Society. The following new Fellows were honored on June 8 during the opening plenary session of the 2020 ANS Virtual Annual Meeting.

Rita Baranwal, ANS member since 2008 and the assistant secretary for nuclear energy at the Department of Energy, for leading the way to a new nuclear energy paradigm through visionary leadership that has spawned innovation by refocusing the efforts of the DOE laboratory complex to advance the U.S. nuclear industry.

Yaron Danon, ANS member since 2012 and director of the nuclear engineering program at Rensselaer Polytechnic Institute, for significant contributions to nuclear engineering and science through novel experimental and analytical research leading to more accurate nuclear cross-section data essential to the design of safe and reliable nuclear reactors.

Mitchell Farmer, ANS member since 2014 and nuclear engineer at Argonne National Laboratory, for innovative, sustained, and internationally recognized contributions addressing risk-significant severe accident issues in support of the light-water reactor industry. His work has helped shape the thinking of the nuclear industry and regulatory bodies around the world regarding the efficacy of accident management strategies.

Dennis W. Henneke, ANS member since 2010 and consulting probabilistic risk assessment (PRA) engineer at GE Hitachi (GEH), for contributions to PRAs and risk-informed applications since 1982, including risk monitors, fire PRA, PRA standards, and multiunit PRA, as well as for leading the development of PRAs for advanced boiling water reactors and sodium-cooled fast reactors at GEH.



Kostadin N. Ivanov, ANS member since 1993 and head of the Nuclear Engineering Department at North Carolina State University, for sustained and internationally recognized contributions to multidimensional reactor physics, multiphysics methodologies, and uncertainty analysis for design and safety analysis of nuclear systems.

Richard Y. Lee, ANS member since 1983 and chief of the Fuel & Source Term branch at the Nuclear Regulatory Commission, for sustained efforts to modernize methods for the safety analysis of power reactors including computer codes for fuel performance, neutronics, and accident analysis, as well as for his contributions to international cooperation to improve the analysis of power reactors.

Thomas A. Mehlhorn, ANS member since 2001 and private consultant with Mehlhorn Engineering Consulting Services, for scientific leadership in developing predictive simulation tools, discriminating diagnostics, and validation experiments, leading to major advances in the generation and application of intense ion and electron beams and Z-pinches for nuclear fusion, nuclear science, and defense missions.

Juergen Rapp, ANS member since 2012 and distinguished research and development staff at Oak Ridge National Laboratory, for technical leadership in fusion plasma-surface interactions, including the development of impurity seeding to mitigate fusion power exhaust, and in the development of experimental facilities for studying plasma-surface interactions at Magnum-PSI (Netherlands) and proto-MPEX (United States).

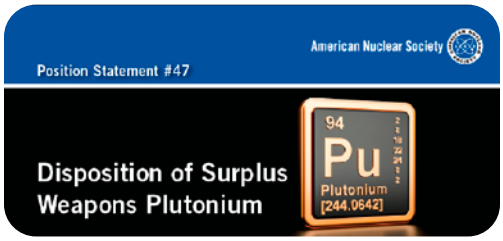
Kumar Sridharan, ANS member since 2013 and professor in the Engineering Physics and Materials Science and Engineering Departments at the University of Wisconsin–Madison, for major research contributions in materials corrosion and degradation processes in nuclear energy systems, and for impact on the nuclear industry through the development of improved fuel cladding concepts as well as education and mentorship of undergraduate and graduate students.

Audited ANS financial statements available online

ANS members are invited to review the Society's audited financial statements for the calendar year ending December 31, 2019. The statements are housed online as a PDF and are accessible to members who are logged in to the ANS website at ans.org/members/ansdocs/.

ANS News continues

ANS releases revised position statement on surplus weapons plutonium



Because timely disposition of surplus weapons-grade plutonium is critical, the ANS Public Policy Committee (PPC) has revised ANS Position Statement #47, *Disposition of Surplus Weapons Plutonium*. The revised statement was published on the ANS website in May.

The Department of Energy's plan to convert weapons-grade plutonium into mixed oxide fuel was canceled in 2018 in favor of a "dilute-and-dispose" option. Dilute-and-dispose faces technical and regulatory challenges and is opposed by Russia, the United States' original partner in plutonium disposition. The PPC determined that a revised position statement was necessary. After careful evaluation, ANS recommends that the DOE reconsider its decision and evaluate the option of using weapons-grade plutonium as fuel for advanced reactors.

Position Statement #47 reads in part: "The United States expended vast resources to produce a large stockpile of weapons-grade plutonium and then invested additional resources in a program to dispose of the material before ultimately canceling that program. Rather than rushing to implement an alternative that has its own challenges and produces no benefit to the American people, the government should delay converting plutonium metal to plutonium oxide, reevaluate all of its options, and consider a program of using surplus plutonium as fuel for advanced reactors, with a primary focus on fast-neutron-spectrum reactors."

To read the entire statement and explore the library of ANS position statements, visit ans.org/policy/statements/.

- E. Gail de Planque Medal
- Distinguished Public Service Award
- Distinguished Service Award
- Fellow of ANS
- Landis Public Communication and Education Award
- Nuclear Historic Landmark Award
- Mary Jane Oestmann Professional Women's Achievement Award
- Reactor Technology Award (awarded with the Atomic Energy Society of Japan)
- Seaborg Medal
- Alvin M. Weinberg Medal
- Young Member Excellence Award
- Young Members Advancement Award

Nominations now being accepted for 2020 ANS Winter Meeting awards

For more than 50 years, the ANS Honors and Awards Program has recognized outstanding achievements and meritorious service in the various fields served by our Society.

The recipients of the national awards listed at left will be honored on November 16 during the opening plenary of the ANS Winter Meeting. Honorees will be notified of their selection by October.

All members are encouraged to review the nomination requirements for these awards and consider nominating a qualified colleague. Many ANS awards are open to non–ANS members, and nominating colleagues who are not members is one way to foster new ANS relationships.

More information on each award, including past award recipients and nominations forms, is available at ans.org/honors. There you'll also find information about awards administered by ANS professional divisions. If you have questions about a specific award, please contact Hussein Khalil, chair of the Honors and Awards Committee, at honors@ans.org.

The deadline for submission of nominations for Winter Meeting awards is August 1. Because of the large number of nominations typically submitted, late nominations are not accepted.

Nominations needed for the 2021 ANS election

Each year, ANS leaders are nominated and elected from among the dedicated nuclear technology professionals that make up the Society's membership. Now is your chance to nominate candidates to run in the 2021 ANS national election for the offices of vice president/president-elect and treasurer and for five positions on the ANS Board of Directors. All terms will begin in June 2021.

Officer and director candidates must be ANS fellows, members, or emeritus members in good standing. Members affiliated with a national laboratory or with government are especially desired as 2021 vice president/president-elect nominees. Four of the five director seats to be filled in the election are for U.S.-resident candidates; the remaining seat will be filled by a young member (open to those of age 35 and under or those who have graduated within the past five years).

Nominations are due by August 7 and must include a CV or biographical information to be valid for consideration. Send your nominations to Marilyn Kray, chair of the ANS Nominating Committee, by mail to the American Nuclear Society, 555 N. Kensington Ave., La Grange Park, IL 60526; by fax to 708/579-8283; or by email to ajiminian@ans.org.

ANS News continues

New Members

The ANS members and student members listed below joined the Society in April and May 2020.

Alvis, John, Los Alamos National Laboratory
Angelette, Lucas, Savannah River National Laboratory

Ballout, Youssef A., Idaho National Laboratory
Bannur Nagaraj, Venkatesh, Hemato Pte Ltd (Singapore)
Blunn, Adam, Ubaryon Pty Ltd (Australia)
Brown, Jason, Automatic Valve Corporation

Carter, Blake, U.S. Naval Academy
Castley, Danielle, Neutroelectric
Cox, Nathaniel G., Exelon Nuclear
Curtis, Laura, TerraPower

Dahlfors, Marcus, Bangor University (U.K.)
Darbali, Samir, U.S. Nuclear Regulatory Commission
Davis, Kenneth, R.E. Mason Company
Denney, Nathan, Northwind Portage

Gimenes Rodrigues Albuquerque, Luiza, Idaho National Laboratory
Goldstein, Marcel, Allison & Partners

Hall, Robert A., Oak Ridge National Laboratory
Heame, Jason, Texas Engineering Experiment Station
Herrera, Joshua, U.S. Army
Honnold, Philip, Sandia National Laboratories
Huffstatler, Victor A., Entergy/River Bend Station

Jackson, Eric A., Lockheed Martin
Jackson, Gerald P., Beam Alpha Inc.
Johnson, Kaitlin E., University of South Carolina
Johnson, R. Shane, R. Shane Johnson Inc.

Kanter, Seth, Idaho National Laboratory
Kelley, William
Kelly, Rebekah, Lawrence Livermore National Laboratory

Lafreniere, Paul J., Candu Owners Group (Canada)
Lauchlan, Scott, Nuclear Electric Insurance Limited
Lee, Arthur, Chevron Corporation
Lopez Honorato, Eddie, Oak Ridge National Laboratory

Mejia, Cesar, ValvTechnologies

Niemeier, Timothy, Adapt Laser Systems

Pegna, Joseph, Free Form Fibers
Pilar, Jorge, Flowserve Corp.

Rao, D. V., Los Alamos National Laboratory
Rao, Vivek, Oak Ridge National Laboratory
Ray, Philip, GE Hitachi Nuclear Energy
Rodriguez, Daniel Linares, Dragons De Veracruz
Runge, Serge, Nuclear-21
Rushmore, Jason T., Exelon Corporation

Scheanwald, Alan T., Davis-Besse Nuclear Power Station
Smith, Sylena, Westinghouse
Stanford, John P., University of Idaho
Stewart, J. Kelly, Newcastle Consulting

Trikouros, Nick G., U.S. Nuclear Regulatory Commission
Tweed, Brent, NextEra Energy

Varrin, Robert D., Jr., VRD

Wang, Xing, Pennsylvania State University
Weinmeister, Justin, Oak Ridge National Laboratory
Wieselquist, William, Oak Ridge National Laboratory
Wilhelm, Brent, Natural Resources Canada
Williams, Braydon J., Idaho National Laboratory

Zhang, Hongliang, University of Wisconsin–Madison

STUDENT MEMBERS

Air Force Institute of Technology
Anderson, Alfred
Heffelfinger, Aaron

Boise State University
Dhakal, Sandeep
Reynolds, Michael
Vallejo, Kevin D.

Colorado School of Mines
Breathwaite, Melissa

Duke University
Dickinson, Olivia J.

Excelsior College
Bierer, Derek
Di Angelo, Theodore D.
Gegner, Miranda
Keller, Kyle C.
Null, Chris C.
Poston, Nicholas C.
Wilson, Ryan E.

Florida International University
Herrera, Susana

Georgia Institute of Technology
McCluskey, Brendan P.

Idaho State University
Martinez, Orion L.

Kansas State University
Santillana, Rene F.

Korea Advanced Institute of Science & Technology (South Korea)
Oh, Taesuk

Ontario Tech University (Canada)
Nusrat, Omar

Oregon State University
Jensen, Christopher S.
Schoening, Logan E.

Polytechnic University of Milano (Italy)
Lonati, Ivan

Purdue University
Johnson, Richard
Karimi, Reza A.
Seo, Jeongwon

South Carolina State University
Tieken, Joshua E.

Texas A&M University
Gates, Jonathan T.
Jackson, Connor

Ulsan National Institute of Science and Technology (South Korea)
Lim, Doyeong

U.S. Air Force Academy
Asplund, Abigail
Cordone, Megan
DiRubbio, William
Hermann, Abigail G.
Shaw, Connor F.

U.S. Naval Academy
Prince, Madeline I.

U.S. Navy
DeSaveur, Zane A.
Downing, Drew C.
Givens, Warren A.
Hagley, Ian M.
Hanlon, Devon T.
Hannon, Luke E.
Holter, Garrett W.
Hughes, Jeremy L.
Lewis, William R.
Wash, Garrett
Whisenant, William R.
Williams, Austin J.
Wydra, Julia

University of Alaska
Bustillos, Kimberly L.

University of California–Berkeley
Li, Shengzhi
Wu, Zhouhui

University of Idaho
Geddes, Kristen

University of Maryland–College Park
Dodge, Philip

University of Massachusetts
Pospisil, Christina

University of Michigan
Li, Luyao

University of Pittsburgh
Rager, Elizabeth

University of Texas–Austin
Harkawat, Arushi

University of Utah
Holiski, Connor K.

University of Wisconsin–Madison
Prado, Ian
Weinstein, Matthew P.

Institution not provided
Burnett, Benjamin
Chilton, Jonathan
Clignett, Jacob A.
Handley, Joshua A.
Havins, Shannon
Kitchen, Chad
Levy, Michael A.
Ozdemir, Harun B.
Perez, Suriel
Rodriguez, Gamaliel J.
Schulte, Michael
Smith, Steven D.
True, Michael M.
Winsett, Michael C.
Woodworth, Jason J.

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Navigating Nuclear is an ANS Center for Nuclear Science and Technology Information program developed in conjunction with Discovery Education.

BUSINESS DEVELOPMENTS

Framatome acquires BWXT nuclear services

Framatome has completed its acquisition of **BWX Technologies'** U.S. commercial nuclear services business, the France-based company announced on June 2. With this transaction, the company said, Framatome expands its portfolio of equipment and tooling for nuclear power plant inspections and maintenance.

BWXT will receive an 118,000-square-foot manufacturing facility and the associated 11 acres of land from Framatome in the cashless exchange. Under the terms of the agreement, BWXT will transition certain contracts, equipment, and intellectual property to Framatome. BWXT will assume occupancy and ownership of the Framatome facility located near one of BWXT's Virginia manufacturing sites. BWXT's Canada-based nuclear manufacturing and services business is not part of this transaction and will continue its work in North America and overseas.

In a separate development, Framatome announced on May 26 that it has signed a framework agreement with EDF in the United Kingdom to provide engineering services to support ongoing nuclear power station operations. For the first time in the United Kingdom, Framatome will provide dedicated, in-house nuclear engineering services to support the continued operation of eight nuclear stations across the country. These stations include 14 advanced gas reactors and one pressurized water reactor.

Framatome will provide in-house services for the full range of engineering responsibilities focused on design, analysis, calculations, documentation, and modifications. This will include support related to regulations and licensing; electrical, mechanical, safety, and risk-informed engineering; component analysis and fracture mechanics; and instrumentation and control.

■ **Kairos Power** and **Materion Corporation** announced on May 26 the formation of a strategic collaboration to develop a reliable and cost-effective supply of salt coolant for high-temperature molten salt reactors. This coolant is a key component of Kairos Power's fluoride salt–cooled, high-temperature reactor (KP-FHR). Under the agreement, Materion will supply beryllium fluoride, as well as technical consultation and support services. The KP-FHR, an advanced reactor technology being commercialized by Kairos Power, is a zero-carbon source of electricity with cost targets that are competitive with natural gas combined cycle plants.

■ **Tokyo Electric Power Company Holdings** (Tepco) and **Toshiba Energy Systems Corporation** have signed a memorandum of understanding to establish a company to carry out safety upgrade measures at Unit 6 of Tepco's Kashiwazaki-Kariwa nuclear power plant.

In December 2017, Tepco received approval from Japan's Nuclear Regulation Authority to make changes to Units 6 and 7. Tepco is currently working to obtain approval of the construction plan for Unit 7 and is working on preparations for an application for the approval of the construction plan for Unit 6. The 1,356-MWe Kashiwazaki-Kariwa-6, a boiling water reactor, began commercial operation in 1996.

■ **Global First Power** (GFP), **Ultra Safe Nuclear Corporation** (USNC), and **Ontario Power Generation** (OPG) on June 9 announced the formation of a joint venture, the Global First Power Limited Partnership, to build, own, and operate the proposed Micro Modular Reactor (MMR) at Canada's Chalk River Laboratories site. The joint venture is owned equally by OPG and USNC-Power, the Canadian subsidiary of USNC, and is based on the project initiated in 2019 by GFP.

Headquartered in Ottawa, GFP will act on behalf of the limited partnership to oversee the proposed MMR project and provide project development, licensing, construction, and operation of the commercial demonstration reactor at Chalk River. It will serve as a model for potential future MMR projects across Canada to provide safe and sustainable low-carbon power and heat to industries, such as mining, and remote communities.

NOTE: *Nuclear News* publishes news about nuclear industry contracts—but only about contract awards. We generally do not publish announcements that the work is under way or announcements that the work has been completed. Send your new contract award announcements to: Industry Editor, *Nuclear News*, 555 N. Kensington Ave., La Grange Park, IL 60526; fax 708/579-8204; email nucnews@ans.org.

CONTRACTS

TVO awards outage services contract to GE Hitachi

GE Hitachi Nuclear Energy (GEH) announced on June 10 that it has been awarded a contract by Teollisuuden Voima Oyj (TVO) to provide outage services for the Olkiluoto nuclear power plant in Eurajoki, Finland. GEH will provide control rod drive mechanism exchange services for Olkiluoto-1 and -2 for the remainder of the plant's operating license. The first outage supported by GEH was recently completed. The Olkiluoto boiling water reactors produce about one-sixth of all electricity consumed in Finland.

■ The United Kingdom Atomic Energy Authority (UKAEA) on June 1 announced the signing of a multimillion-pound framework agreement with nine engineering companies to aid in the development of fusion energy. The companies included in the four-year engineering design services framework are **Assystem**, **DBD**, **Rolls-Royce**, **Jacobs**, **Frazer Nash**, **Atkins**, **IDOM**, **Mott MacDonald**, and **M5tec**.

The framework will allow companies to work closely with the UKAEA, which researches the development of nuclear fusion energy and its related technologies. The arrangement means that the UKAEA can call upon experts as needed to undertake a range of projects. There is also an opportunity for providers to work together on initiatives valued at over £100,000. ⊠

ACTIONS

Standards approved, comments requested

The following standards have been approved:

■ ANSI/ANS-2.30–2015 (R2020), *Criteria for Assessing Tectonic Surface Fault Rupture and Deformation at Nuclear Facilities* (reaffirmation of ANSI/ANS-2.30–2015).

This standard provides criteria and guidelines for investigations to assess the potential for surface and near-surface faulting and associated near-fault deformation at nuclear facilities, referencing considerable new experience. The standard is an up-to-date compilation of techniques to evaluate fault offset potential and a valuable resource for planning and conducting site characterization studies for future nuclear facilities. It supplements a group of standards (i.e., ANS-2.26, ANS-2.27, ANS-2.29, and ASCE 43-05) whose focus is on vibratory ground motion rather than fault offset hazard.

■ ANSI/ANS-3.11–2015 (R2020), *Determining Meteorological Information at Nuclear Facilities* (reaffirmation of ANSI/ANS-3.11–2015).

This standard provides criteria for gathering, assembling, processing, storing, and disseminating meteorological information at commercial nuclear electric generating stations, the Department of Energy's National Nuclear Security Administration nuclear facilities, and other national or international nuclear facilities. While well-established monitoring and analysis methods are adequately addressed, ANSI/ANS-3.11–2015 (R2020) provides information on newer systems, both hardware and software, and more modern methods to keep up with the state of the science. Meteorological data collected, processed, stored, and disseminated through the implementation of this standard are utilized to support the full life cycle (i.e., siting, construction, operation, and decommissioning) of nuclear facilities. The meteorological data are employed in a large number of applications associated with determining environmental impacts, enabling consequence assessments in routine release and design-basis accident evaluations, supporting emergency preparedness and response programs, and other important applications, such as evaluating beyond design-basis events.

■ ANSI/ANS-8.20–1991 (R2020), *Nuclear Criticality Safety Training* (reaffirmation of ANSI/ANS-8.20–1991; R2015).

This standard provides criteria for nuclear criticality safety training for operations with fissionable materials outside reactors.

Volunteer support needed

The following standards projects are in need of volunteer support. Interested individuals should contact standards@ans.org for more information.

■ ANS-2.3, *Estimating Tornado, Hurricane, and Extreme Straight Line Wind Characteristics at Nuclear Facility Sites* (revision of ANSI/ANS-2.3–2011; R2016).

■ ANS-2.18, *Evaluating Radionuclide Transport in Surface Water for Nuclear Power Sites* (proposed new standard).

■ ANS-56.2, *Containment Isolation Provisions for Fluid Systems After a LOCA* (historical revision of ANS-56.2–1989; W1999).

■ ANS-57.1, *Design Requirements for Light Water Reactor Fuel Handling Systems* (revision of ANSI/ANS-57.1–1992; R2015).

■ ANS-58.2, *Design Basis for Protection of Light Water Nuclear Power Plants Against the Effects of Postulated Pipe Rupture* (revision of historical standard ANS-58.2–1988; W1998).

Comments requested

Comments are requested on the following standards by July 13, 2020:

■ ANS-6.3.1–1987 (R202x), *Program for Testing Radiation Shields in Light Water Reactors (LWR)* (reaffirmation of ANSI/ANS-6.3.1–1987; R2015).

This standard describes a test program to be used in evaluating biological radiation shielding in nu-

clear reactor facilities under normal operating conditions, including anticipated operational occurrences. The program encompasses examining and testing to be performed before startup, during startup, and subsequent to the startup phase. Post-startup tests are required for the shielded components that do not contain sufficient radioactivity during the startup phase to allow valid testing. Shielding of these components is to be tested when radiation sources develop or are introduced in sufficient strength to allow meaningful measurements. Post-startup shield tests are also required whenever radioactive or potentially radioactive equipment that could affect the adequacy of the installed shielding is introduced into the plant or relocated within the plant, or when previously tested shielding has been modified. One special category of post-startup testing is the testing of shielding during refueling operations.

■ ANS-59.51–1997 (R202x), *Fuel Oil Systems for Safety-Related Emergency Diesel Generators* (reaffirmation of ANSI/ANS-59.51–1997; R2015).

This standard provides functional, performance, and initial design requirements for the fuel oil system for diesel generators that provide safety-related emergency on-site power for light-water reactor nuclear power plants. The standard addresses the mechanical equipment associated with the fuel oil system, with the exception of the engine-mounted components. These components, which are mounted directly to the engine structure itself, are excluded except to define interface requirements. It also includes the instrumentation and control functional requirements. The standard excludes

Standards Continues

motors, motor control centers, switchgear, cables, and other electrical equipment used in the operation of the fuel oil system, except to define interface requirements.

■ ANS-59.52–1998 (R202x), *Lubricating Oil Systems for Safety-Related Emergency Diesel Generators* (reaffirmation of ANSI/ANS-59.52–1998; R2015).

This standard provides functional, performance, and design requirements for lubricating oil systems for diesel generators that provide emergency on-site power for light-water reactor nuclear power plants. The standard addresses all mechanical equipment associated with the lubricating oil system, with the exception of engine-mounted components. These components, which are mounted directly to the engine structure itself, are excluded, except to define interface requirements. This standard also includes the lubricating oil system instrumentation and control functional requirements. It excludes motors, motor control centers, switchgear, cables, and other electrical equipment used in the operation of the lubricating oil system, except to define interface requirements.

Comments are requested on the following standard by July 20, 2020:

■ ANS-8.27–2015 (R202x), *Burnup Credit for LWR Fuel* (reaffirmation of ANSI/ANS-8.27–2015).

This standard provides criteria for accounting for reactivity effects of fuel irradiation and radioactive decay in criticality safety control of storage, transportation, and disposal of commercial light-water reactor UO_2 fuel assemblies. The standard assumes that the fuel and any fixed burnable absorbers are contained in an intact assembly. Additional considerations could be necessary for fuel assemblies that have been disassembled, consolidated, damaged, or reconfigured in any manner.

Comments are requested on the following standard by July 21, 2020:

■ ANS-57.8–202x, *Fuel Assembly Identification* (revision of ANSI/ANS-57.8–1995; R2017).

This standard provides requirements and detailed information for uniquely identifying nuclear fuel assemblies/elements, and the corresponding fuel plates or rods inside the assemblies. Detailed recommendations and requirements are provided for the numbering of the geometric orientation for the fuel plates, or fuel rods, inside the fuel assemblies.

PINS

Under the Project Initiation Notification System (PINS), the following standard is being initiated:

■ ANS-3.15–202x, *Risk-Informing Critical Digital Assets (CDAs) for Nuclear Power Plant Systems* (new standard).

This standard provides a risk-informed, performance-based process for assessing the safety significance of plant digital assets. This risk-informed, performance-based process is in lieu of the deterministic methods currently in use. The standard applies to both new and operating plants.

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- Fatigue analysis
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First human trial successfully treated COVID-19 using low doses of radiation

By James Conca

Human medical trials have begun on severely ill COVID-19 patients using low doses of radiation. The first results on a very small group were published this week in a non-peer-reviewed journal that exists to get critical results out quickly to the scientific and medical community.

The results were quite extraordinary.

Researchers at Emory University Hospital, led by Dr. Mohammad Khan, associate professor of radiation oncology, treated five COVID-19 patients with severe pneumonia who were requiring supplemental oxygen and whose health was visibly deteriorating. Their median age was 90 with a range from 64 to 94, four were female, four were African American, and one was Caucasian.

The medical team at Emory University Hospital led by Dr. Mohammad Khan (on the right; Dr. Clayton Hess is on the left, shown on the first day of the low-dose human trial) is the first to demonstrate how low doses of radiation can treat COVID-19. Delivering a low dose of radiation to any part of the body is routine, and using radiation to treat COVID-19 is simple–no new preparation, additional equipment, or training is needed. We do it all the time–and it seems to be working. Photo: Emory University

These patients were given a single low dose of radiation (1.5 Gy) for 10 to 15 minutes to both lungs, delivered by a front-and-back beam configuration.

Within 24 hours, four of the patients showed rapid improvement and were being discharged from the hospital. Blood tests and repeated imaging of the lungs confirmed that the radiation was safe and effective and did not cause adverse effects—no acute skin, pulmonary, gastrointestinal, or genitourinary toxicities.

The gray (Gy) is a dose unit of ionizing radiation defined as the absorption of one joule of radiation energy per kilogram of matter. Medical doses are different from environmental doses, as they are not inundating the whole body but are targeted to a specific organ or tissue, so 1.5 Gy is quite a low dose for medical uses.

This treatment is critical because severe COVID-19 cases cause cytokine release syndrome, also known as a cytokine storm. Such a storm is a deadly, uncontrolled, systemic inflammatory response of the body's immune system resulting from the release of great amounts of pro-inflammatory cytokines, which act as a major factor in producing acute respiratory distress syndrome, which is what often kills in the case of COVID-19.

It's why we need ventilators and intensive care unit beds so badly, and why this pandemic has threatened to overwhelm our hospital systems.

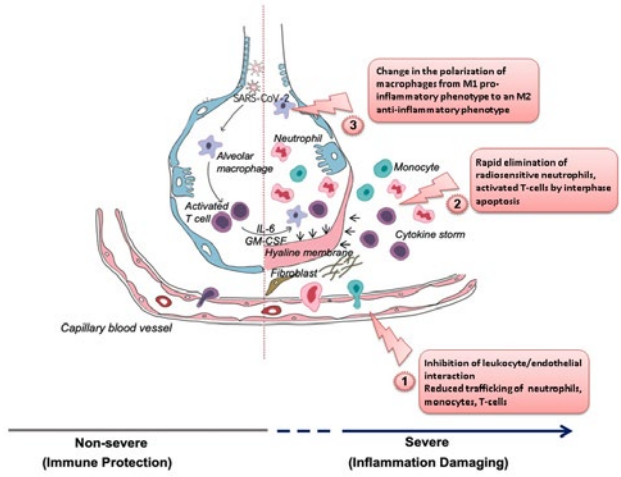
One reason why this trial is so important, and why the success rate was so exciting, is that COVID-19 fatality rates increase with age—8 percent for patients aged 70 to 79 and 14.8 percent for those aged 80 and over—so showing this treatment is safe for these elderly patients was vital. Mortality rates are even higher if you get hospitalized and are in the ICU: over 50 percent.

Radiation's anti-inflammatory effect, not its antiviral action, is what's invaluable to helping patients with COVID-19 and what was demonstrated in this trial. And we are already completely set up for these radiation treatments at almost every hospital and cancer center—no new preparation, additional equipment, or training is needed.

Several medical institutions are starting radiation therapies for COVID-19. The ClinicalTrials.gov website gives information on these trials, including an Italian clinical trial, a Spanish clinical trial, and others that have begun, and more have recently been added to the ClinicalTrials.gov website, with many of them currently recruiting patients. The countries represented include the United States, Spain, Italy, Iran, and India.

Dr. James Welsh at Loyola University Medical Center, a former chairman of the board of the American College of Radiation Oncology and current editor-in-chief of the *Journal of Radiation Oncology*, is moving to begin a national trial within the next few months on this treatment using low-dose radiation to the lungs.

Welsh and colleagues from Beaumont Health, University of Ohio, Baptist Health Miami, and Barrow Neurological Institute just published an article on the basic science behind this method (see figure above).



Potential role of low-dose radiation to combat the cytokine storm in severe pneumonia associated with COVID-19. Three potential mechanisms of low-dose radiation are highlighted, acting on different components of the respiratory syndrome. [Published and modified, with permission, from Y. Shi et al. (2020); doi.org/10.1038/s41418-020-0530-3. Appears in Wilson et al. (2020); doi.org/10.1667/RADE-20-00108.1].

These studies indicated possible mechanisms by which low doses of radiation mitigate inflammation and facilitate healing, one being the polarization of macrophages to an anti-inflammatory or M2 phenotype. The M1 type tends to overstimulate the immune system, which can lead to a cytokine storm, while the M2 type tends to suppress the overreaction of the immune system.

We kind of knew this would work because we did the same thing 70 to 80 years ago. Dr. Edward Calabrese and Dr. Gaurav Dhawan at the University of Massachusetts have reviewed how X-ray therapy was used during the first half of the 20th century to successfully treat pneumonia, especially viral pneumonia like that caused by this coronavirus.

As Welsh puts it, for COVID-19 patients who progress to severe disease where there is no established treatment and death is a significant possibility, low-dose radiation would appear to be a relatively safe strategy that could be widely implemented, once evidence of efficacy is produced. This can be readily achieved with small, pragmatic, and expeditious clinical trials, with an extremely rapid clinical signal of benefit.

As the other human radiation trials move forward, it will be exciting to see the results because we need an easy, quick, and safe treatment for the most dangerous virus of our time.

James Conca is a scientist in the field of the earth and environmental sciences specializing in geologic disposal of nuclear waste, energy-related research, planetary surface processes, radiobiology and shielding for space colonies, and subsurface transport and environmental cleanup of heavy metals.

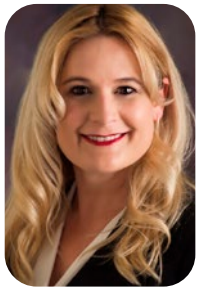
This article is republished, with minimal edits, from a blog post appearing on Forbes.com.

Feitel

Robert J. Feitel was sworn in on May 28 by Nuclear Regulatory Commission Chairman Kristine Svinicki as the agency's new inspector general. Feitel replaces Hubert T. Bell, who retired in 2019.

Lanka

Brian Lanka has been named chief engineering director for the Entergy fleet. Lanka, who was previously director of engineering at Waterford-3, will be responsible



Garbe

for leading multiple fleet-wide engineering initiatives. **Crystal Garbe**, who was plant support engineering manager at Waterford-3, has been named to replace Lanka as director of engineering.

The Department of Energy recently named **Steve Binkley**, former deputy director for Science Programs, to the new position of principal deputy director in the Office of Science. **Harriet Kung**, formerly head of the office's Basic Energy Sciences program, has stepped into Binkley's previous role.

ANS members **Mark T. Peters**, **Kenneth W. Robuck**, and **Thomas R. White** were reelected to the Nuclear Energy Institute's board of directors during the organization's board meeting on May 20. Peters, ANS Fellow and member since 2007, is director of Idaho National Laboratory. He also serves as a senior advisor to the Department of Energy on nuclear energy technologies, research and development programs, and nuclear waste policy. Robuck, ANS member since 2006, is president and chief operating officer of EnergySolutions. White, ANS member since 2013, is chairman, president, and chief executive officer of Sargent & Lundy.

The Nuclear Regulatory Commission has named new senior resident in-

spectors at the Peach Bottom, Summer, and Indian Point plants, and a new resident inspector at the Hope Creek plant. **Scott Rutenkroger** is the new senior resident inspector at the Peach Bottom nuclear plant in Delta, Pa. Most recently, Rutenkroger, who joined the NRC in 2004, was the senior resident inspector at the Limerick nuclear power plant in Limerick, Pa. **Carey "Mac" Read Jr.** has been named the new senior resident inspector at the Summer nuclear plant, located near Jenkinsville, S.C. Read, who joined the NRC in 2013, was a resident inspector for the two units being built at the Summer site before construction was terminated. He had served as the resident inspector at the Surry nuclear power plant in Virginia since 2018. **Niklas Floyd** is the new senior resident inspector at the Indian Point nuclear plant in Buchanan, N.Y. Floyd joined the NRC in 2010 as a reactor engineer in the agency's Region I Office in King of Prussia, Pa., where he became a reactor inspector in the Division of Reactor Safety. **Dan Beacon** is the new resident inspector at Hope Creek, located in Lower Alloways Creek Township, N.J. Beacon joined the NRC at its headquarters in Rockville, Md., in 2014, and most recently was a project engineer in the Region I Office in King of Prussia.

Rutenkroger

Read

Floyd

Beacon

Fromer

DiCola

Gary Fromer has been named chief executive officer of DCO Energy and DB Energy Assets. DCO founder **Frank DiCola** retired from his role as co-CEO and assumed the role of executive chairman of the board. In 2000, DiCola partnered with Joe and Michael Jingoli to found DCO Energy. Fromer, who had served as co-CEO with DiCola for several months, had a long career prior to joining DCO, having served as a senior executive at Constellation Energy, as CEO of CPower, and as a senior executive at SAP.

Nebraska Public Power District recently announced the appointment of two new vice presidents and the promotion of two current vice presidents. **John McClure** has been promoted to executive vice president of governmental affairs and general counsel, and **Traci Bender** was promoted to executive vice president and chief financial officer. **Michael "Mick" Spencer** was named vice president of energy production, and **Art Wiese** was named vice president of energy delivery.

Obituaries

Carter

Robert E. Carter, 100, ANS member since 1956; earned a bachelor's degree in physics from Washington College in Chestertown, Md., in 1942; was recruited to work on the Manhattan Project as a graduate student at Purdue University, where he conducted physics research using the university's cyclotron; in 1943, he was transferred to Los Alamos, N.M., where he was assigned to create an operating nuclear reactor that ran on enriched uranium; following his work on the project, returned to earn his postgraduate degree at the University of Illinois at Urbana-Champaign; worked as a physicist at Los Alamos National Laboratory; retired at age 80; died April 7.

Direct Answer

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ANS

Calendar

● First time listed, or significant change made.
■ ANS event.
■ Non-ANS event cosponsored by ANS.

July

July 26–30—**47th Annual Review of Progress in Quantitative Nondestructive Evaluation**, Minneapolis, Minn. event.asme.org/QNDE.

August

August 2–4—**44th Annual Nuclear Information Records Management Conference**, Summerlin, Nev. www.nirma.org/annual-conference.

August 11–13—**EDG Diesel Fuel Owners Group (DFOG) Annual Meeting**, San Antonio, TX. www.dfog.mpr.com/news/.

September

Sept. 8–10—**2020 RadWaste Summit**, Henderson, Nev. www.radwastesummit.com.

Sept. 9–11—**World Nuclear Association Symposium 2020**, London, England. www.wna-symposium.org.

Sept. 10–11—**Decommissioning Strategy Forum**, Nashville, Tenn. www.decommissioningstrategy.com.

■ Sept. 13–17—**ICRS 14/RPSD 2020**, Seattle, Wash. icrs14.ans.org.

Sept. 14–15—**New Advanced Clean Energy Summit (ACES 2020)**, Denver, Colo. event.asme.org/ACES.

Sept. 16–18—**National Cleanup Workshop**, Alexandria, Va. www.cleanupworkshop.com.

● Sept. 18–23—**31st Symposium on Fusion Technology (SOFT2020),** Virtual meeting**.** soft2020.eu.

Sept. 30–Oct. 3—**Nuclear Energy: Challenges and Prospects**, Sochi, Russia. nsconf2020.ru/en.

October

Oct. 4–8—**Women in Nuclear Global Conference**, Niagara Falls, Ontario, Canada. www.win-global.org/activities/annual.

Oct. 7–8—**9th EU Nuclear Power Plant Simulation Forum**, Brussels, Belgium. nrg-events.com/enppstech/.

Oct. 13–15—**ETEBA Business Opportunities and Technologies Conference (BOTC)**, Knoxville, Tenn. www.eteba.org.

Oct. 12–17—**28th IAEA Fusion Energy Conference (FEC 2020)**, Nice, France. www.iaea.org/events/fec-2020.

Oct. 19–20—**20th Nuclear Security Information Exchange Meeting**, Vienna, Austria. www.iaea.org/events/evt1903488.

Oct. 19–23—**International Conference on the Management of Naturally Occurring Radioactive Materials (NORM) in Industry**, Vienna, Austria. www.iaea.org/events.

Oct. 26–30—**NuMat 2020: The Nuclear Materials Conference**, Ghent, Belgium. www.elsevier.com/events/conferences/the-nuclear-materials-conference.

Oct. 31–Nov. 7—**2020 IEEE Nuclear Science Symposium and Medical Imaging Conference (NSS/MIC)**, Boston, Mass. conferences.ieee.org/conferences_events/conferences/conferencedetails/42677.

November

Nov. 3–6—**Technical Meeting on Nuclear Power Plant Personnel Training**, Toronto, Ontario, Canada. www.iaea.org/events/EVT1804444.

Nov. 9–12—**International Conference on Generation IV and Small Reactors (G4SR-2)**, Toronto, Ontario, Canada. www.g4sr.org.

Nov. 9–13—**International Conference on Radiation Safety: Improving Radiation Protection in Practice**, Vienna, Austria. www.iaea.org/events/international-conference-on-radiation-safety-2020.

■ Nov. 15–19—**2020 ANS Winter Meeting and Nuclear Technology Expo**, Chicago Ill. answinter.org.

Nov. 24–26—**9th International Conference on Nuclear Decommissioning (ICOND 2020)**, Aachen, Germany. www.icond.de/welcome.html.

Nov. 30–Dec. 2—**12th Annual European Power Strategy & Systems Summit**, Prague, Czech Republic. www.europeanpowergeneration.eu.

December

Dec. 7–10—**OECD/NEA Specialist Workshop on Advanced Measurement Method and Instrumentation for Enhancing Severe Accident Management in an NPP Addressing Emergency, Stabilization and Long-term Recovery Phases (SAMMI-2020)**, Fukushima, Japan. www.sammi-2020.org.

Dec. 8–10—**PowerGen International**, Orlando, Fla. www.powergen.com/welcome.

Dec. 8–10—**World Nuclear Exhibition (WNE 2020)**, Villepinte, France. www.world-nuclear-exhibition.com.

January

- Jan. 18–22—**15th International Congress of the International Radiation Protection Association (IRPA15)**, Seoul, South Korea. www.irpa2020.org/.
- Jan. 28–29—**ICNETH 2021: 15. International Conference on Nuclear Engineering and Thermal Hydraulics**, New York City, N.Y. waset.org/nuclear-engineering-and-thermal-hydraulics-conference-in-january-2021-in-new-york.
- Jan. 28–30—**11th International Conference on Future Environment and Energy (ICFEE 2021)**, Tokyo, Japan. icfee.org/.
- Jan. 28–30—**SNMMI 2021 Mid-Winter Meeting**, San Francisco, Calif. www.snmmi.org/MeetingsEvents/Content.aspx?ItemNumber=33340.

Nuclear-Related Meetings Affected by COVID-19

As of June 10, 2020, the following meetings have been rescheduled, postponed, or canceled because of COVID-19 concerns.

Rescheduled

Utility Working Conference
Original date: August 9–12
New Date: August 11 (Virtual)
uwc.ans.org

Technical Meeting on Nuclear Power Plant Personnel Training
Original date: August 18–21
New Date: November 3-6, 2020
www.iaea.org/events/EVT1804444

31st Symposium on Fusion Technology (SOFT2020)
Original date: Sept. 20–25
New date: Sept. 18–23 (Virtual)
soft2020.eu

Postponed

46th Annual Nuclear Information Technology Strategic Leadership (NITSL) Conference
Original date: July 13–16
nitsl.org/2020-nitsl-conference-1

2020 Nuclear & Space Radiation Effects Conference (NSREC)
Original date: July 20–24
www.nsrec.com

Advances in Thermal Hydraulics (ATH 2020)
Original date: Oct. 20–23
www.sfen-ath2020.org

Canceled

ASME Pressure Vessels & Piping Conference (PVP)
Original date: July 19–24
event.asme.org/PVP

POWER 2020
Original date: August 2–6
event.asme.org/POWER

28th International Conference on Nuclear Engineering (ICONE 28)
Original date: August 2–6
event.asme.org/ICONE

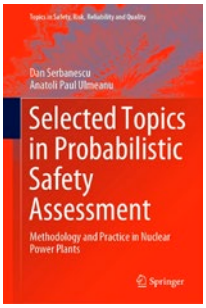
Regulatory Affairs Forum,
Original date: August 11–13
www.nei.org/conferences/regulatory-affairs-forum

13th International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Operation and Safety (NUTHOS-13)
Original date: August 23–26
www.cns-snc.ca/events/nuthos-13

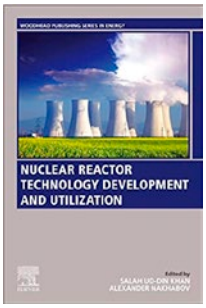
International Conference on Nuclear Plant Chemistry (NPC 2020)
Original date: Sept. 28–Oct. 1
Web www.sfen-npc2020.org

Publications

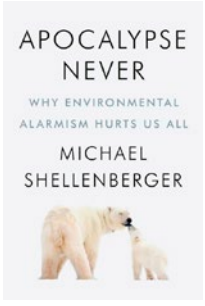
Recently Published



Selected Topics in Probabilistic Safety Assessment: Methodology and Practice in Nuclear Power Plants, by Dan Serbanescu and Anatoli Paul Ulmeanu. Probabilistic safety assessment (PSA) is a structured, comprehensive, and logical analysis method aimed at identifying and assessing risks in complex technological systems, such as nuclear power plants. It is also known as probabilistic risk assessment. This book presents the theoretical basis to understand the numerous and complex aspects that are covered by PSA, and it will help the reader better understand and effectively manage risks. The book provides PSA methods and techniques, and it includes recommended procedures that are based on the experience of the authors and are applicable to different levels and types of PSA that are used for nuclear power plant applications. It provides quantitative risk methodology documentation for PSA, and it can be used as extra reading for PSA courses for practitioners. (159 pp., HB, $179.99, ISBN 978-3-030-40547-2, or eBook, $139, ISBN 978-3-030-40548-9. Order from Springer: phone 800/777-4643; email customerservice@springernature.com; Web www.springer.com.)



Nuclear Reactor Technology Development and Utilization, edited by Salah Ud-Din Khan and Alexander Nakhabov. This book presents the theory and principles of the most common advanced nuclear reactor systems and provides a context for the value and utilization of nuclear power in a variety of applications, both inside and outside a traditional nuclear setting. As countries across the globe realize their plans for a sustainable energy future, the need for innovative nuclear reactor designs is increasing, and this book will provide a deep understanding of how these technologies can aid in a region's goal for clean and reliable energy. The authors, alongside their team of expert contributors, discuss a variety of important topics, including nuclear fuel cycles, plant decommissioning, and hybrid energy systems, while considering a variety of diverse uses, such as nuclear desalination, hydrogen generation, and radioisotope production. The knowledge acquired will enable the reader to conduct further research in academia and industry and to apply the latest design, development, integration, safety, and economic guidance to their work and research. (520 pp., PB, $221, ISBN 978-0-12-818483-7. Order from Elsevier: Web elsevier.com/books.)



Apocalypse Never: Why Environmental Alarmism Hurts Us All, by Michael Shellenberger. According to the author, climate change is real, but it is not the end of the world, and it is not even our most serious environmental problem. In 2019, as some claimed that "billions of people are going to die," contributing to rising anxiety, including among adolescents, Shellenberger decided that as a lifelong environmental activist, a leading energy expert, and the father of a teenage daughter, he needed to speak out to separate science from fiction. Despite decades of news media attention, he says, many remain ignorant of basic facts: Carbon emissions have peaked and have been declining in most developed nations for over a decade, and the risk of the earth's warming to very high temperatures is increasingly unlikely, thanks to slowing population growth and abundant natural gas. He also notes that the people who are the most alarmist about the problems also tend to oppose the obvious solutions, such as nuclear power. (432 pp., HB, $29.99, ISBN 978-0-06-300169-5. Order from HarperCollins Publishers: harpercollins.com.)

ANS Technical Journals

NUCLEAR SCIENCE AND ENGINEERING • JULY 2020

Reactivity Feedback Effect on Supercritical Transient Analysis of Fuel Debris *K. Fukuda et al.*

Consistent Transport Transient Solvers of the High-Fidelity Transport Code PROTEUS-MOC *A. Hsieh et al.*

Identification of Working Conditions in Secondary Loop of Nuclear Power Plant Based on Improved Multiple PCA Modeling *Y. Zhang et al.*

A Linear Prolongating Coarse Mesh Finite Difference Acceleration of Discrete Ordinate Neutron Transport Calculation Based on Discontinuous Galerkin Finite Element Method *Y. Chan, S. Xiao*

Modeling and Estimation of Nuclear Reactor Performance Using Fractional Neutron Point Kinetics with Temperature Effect and Xenon Poisoning *K Rady et al.*

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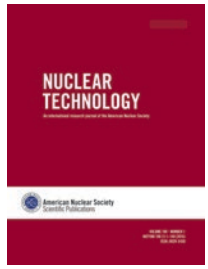

A Robust Cybersecurity Solution Platform Architecture for Digital Instrumentation and Control Systems in Nuclear Power Facilities *F. Zhang et al.*

Comparison of Multilayer Perceptron and Long Short-Term Memory for Plant Parameter Trend Prediction *J. Bae et al.*

Development of an Experimentally Validated MCNP6 Model for 11C Production via the 14N(p,α) Reaction Using a GE PETtrace Cyclotron *A. Hall et al.*

Quantification of Cardiac Dyssynchrony Entropy Implemented in a Commercial Nuclear Medicine Software Application *N. Baughan et al.*

A Direct Nondestructive Assay for the Pu of U/TRU Ingot in Pyroprocessing Using 244Cm Neutron Albedo Reactivity Technique and Its Error *T.-H. Lee et al.*

Performance Analysis of Silicon Carbide Composite Clad Uranium Carbide Fuel for a Long-Life Gas-Cooled Fast Reactor Under Normal Operation—Part I: Design Criteria and Material Data *H. Choi et al.*

Performance Analysis of Silicon Carbide Composite Clad Uranium Carbide Fuel for a Long-Life Gas-Cooled Fast Reactor Under Normal Operation—Part II: Modeling and Simulation *H. Choi, J. Bolin*

Benchmark of GOTHIC to EBR-II SHRT-17 and SHRT-45R Tests *J. W. Lane et al.*

A Probabilistic Model for Estimating the Life Expectancy of Used Nuclear Fuel Containers in a Canadian Geological Repository: Effects of Latent Defects and Repository Temperature *A. K. Järvine*

Highly Available Nuclear Power for Mission-Critical Applications *J. Doyle et al.*

Homography Transformation Correction Method for Position Error Generated in Readout Circuit Based on Resistive Network for the Compton Imaging System *S.-J. Jeon et al.*

An Overview of the Application of Pulsed Neutron Activation in Flow Measurements *M. R. Hadizadeh*

FUSION SCIENCE AND TECHNOLOGY • JULY 2020

Thermomechanical Solid Breeder Multiple-Effects Experiment (TESOMEX) with Volumetric Heating and FEM Benchmark Analysis *M. Lotfy et al.*

Hydrogen Transport in Tungsten for Nuclear Energy Application: Temperature Dependence and Compensation Effect *K. J. Yang et al.*

Analysis of the Reactor Experiment Results on Irradiation of Lead-Lithium Eutectic *T. V. Kulsartov et al.*

Measurement for Palladium Hydride and Palladium Deuteride Isotherms Between 130 K and 393 K *M. Sharpe et al.*

Advanced Tools for ITER Tritium Plant System Modeling and Design *J. M. Nougués et al.*

Code-to-code Comparison for a PbLi Mixed-Convection MHD Flow *S. Smolentsev et al.*

Likely U.S. Regulatory Considerations for DT Fusion Power Reactors *R. L. Hirsch et al.*

Inhibition Effect of CO on Hydrogen Permeation Through a Pd/Al2O3 Composite Membrane: A Comprehensive Study on Concentration Polarization and Competitive Adsorption Effect *L. Yue et al.*

The Current Status of the Heavy Water Detritiation Facility at the NRC (Kurchatov Institute) – PNPI *S. D. Bondarenko et al.*

Why did you decide to work in the UAE?

I came to the United Arab Emirates to be a part of history, to help start up the first commercial nuclear power station in the Arab world. Something I don't think most people realize is that 88 percent of the UAE population is made up of expats, with people from 200 different countries living and working here. These demographics are reflected at the Barakah site as well, providing an amazing opportunity to live and work in a uniquely diverse society. English is the official language in the UAE, but it's the native language of only a tiny fraction of the population. Ensuring clear communication is a constant challenge, one that I enjoy tremendously.

Language isn't the only difference, though. Arab culture is in some ways at the opposite end of the spectrum from the United States. When meeting with an Emirati colleague, it would be very impolite to "just get down to business." Relationships are so important here. Before discussing business, we'll have coffee and chat about our personal lives or our families. The pandemic has made things more difficult, as many of us are working remotely. It's difficult to build and maintain these personal relationships, and remote communications are easier to misinterpret. There are new risks.

But as nuclear professionals, we know how to deal with risk. We identify, quantify, and mitigate risks every day. I am proud to be part of an industry that can safely address these challenges and continue to provide safe, clean electricity around the world. There isn't any place I would rather be right now.

Gale Hauck

Gale Hauck (hauckge@westinghouse.com), Westinghouse's mechanical team lead for the Barakah nuclear power plant project, has been working in the UAE since early 2018. Before joining Westinghouse in 2008, she worked for Entergy at the Indian Point nuclear power plant and for Fluor at the Hanford Site. Hauck is the founder and current chair of the United Arab Emirates ANS Section and 2nd vice chair of the ANS International Committee. She served as a member of the ANS Board of Directors from 2014 to 2017.


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