Nuclear News

November 2021

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The U.S. Army's Deactivated Nuclear Power Plant Program

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Feature Articles

D&D work in action at the SONGS facility. See more on page 48.

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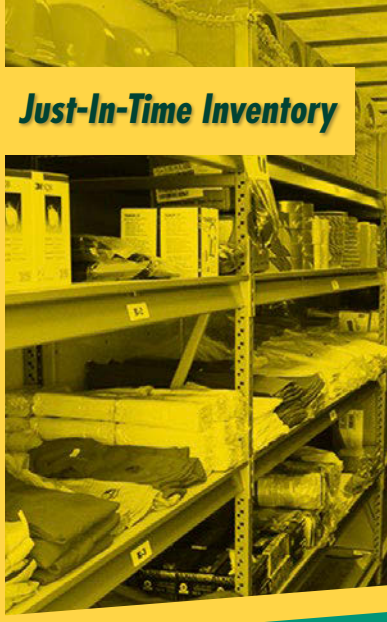
On the cover: Yankee Rowe before and after D&D.



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Some basics of D&D

The last day of November this year marks the opening of the 2021 ANS Winter Meeting and Technology Expo, taking place through December 3 in Washington, D.C. For registrants, the meeting is also being live streamed, and select session recordings will be available for on-demand viewing afterward on the ANS website.

This year's Winter Meeting features two embedded topicals: the 14th International Topical Meeting on Nuclear Applications of Accelerators, also known as AccApp, which runs through December 4; and Decommissioning Environmental Science and Remote Technology 2021 (DESD/RRSD 2021), which is a joint effort by ANS's Decommissioning and Environmental Services Division and the Robotics and Remote Systems Division.

Recently, I had the chance to talk with Jim Byrne, general chair of DESD/RRSD 2021. Byrne, of Byrne & Associates, is a longtime ANS member and oft chair of ANS's Meetings, Proceedings & Transactions Committee. With the theme of this issue of *Nuclear News* being "Decontamination & Decommissioning," I asked Byrne what's new in the field.

"Experience," he commented. "As the companies now in the D&D business build up experience, they will make the jobs go quicker and cheaper." D&D companies working in the U.S. include EnergySolutions, Holtec, and Accelerated Decommissioning Partners.

The hardest part of D&D is proving to the Nuclear Regulatory Commission that the job is done, according to Byrne. The NRC has established, as an acceptable criterion for release of any site for unrestricted use, a dose of 25 millirem (0.25 millisievert) per year total effective dose equivalent to a typical person who may use the site for the next *X* number of years for agricultural, residential, or industrial purposes. The dose limit includes the dose from drinking groundwater. The licensee will be required to show that the site can meet this criterion before the license will be terminated for unrestricted use. In addition, the licensee will need to show that the amounts of residual radioactivity have been reduced to levels that are "as low as reasonably achievable"—ALARA—which means that all doses are to be reduced below required levels to the lowest possible level considering economic and societal factors. Determination of ALARA levels must consider any detriments, such as deaths from transportation accidents that are potential results from decontamination and waste disposal.

"Trying to demonstrate that a site meets this criterion is sometimes pretty difficult," Byrne said. "Taking the plant down and cutting up the reactor vessel, that's all engineering and technique. It's finding the last little bits of radioactivity that's the hardest."

Of note, it's easier to begin a D&D job in the United States than in other developed countries, Byrne said. "Internationally, the rules are different in various places," he said. "In the U.S., we can basically go in and start decommissioning after submitting a post-shutdown decommissioning activities report without specific NRC approval. A lot of other countries have to write their safety cases and get them approved by their regulators before the job starts."

In detail, the regulations here are already established, and there is no need to go back to the NRC to get approval to start decommissioning. By contrast, in Canada, for example, a detailed decommissioning plan needs to be written for a plant that will go into D&D, and that plan must go to the Canadian Nuclear Safety Commission for approval.

Plenty more on D&D can be found in this issue, and still more will be available at the DESD/RRSD 2021 topical meeting. I hope you attend, along with the ANS Winter Meeting and AccApp.—*Rick Michal, Editor-in-Chief (rmichal@ans.org)*

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In the Pacific Northwest, a world without nuclear is a world without salmon

In the fine article "What would the world look like without nuclear?" (*Nuclear News*, p. 6, Aug. 2021), Matthew Mairinger describes how nuclear provides benefits to medicine, agriculture, irrigation, waste management, and engineering safety while preventing over 64 gigatons of CO_2-equivalent greenhouse gas emissions. More particularly, here in the Pacific Northwest where I live on unceded, ancestral, and traditional Coast Salish and Nooksack lands, advanced nuclear reactors offer the hope of saving our salmon by putting an end to Columbia River dams while creating clean energy jobs and taking authentic steps toward establishing a socially just culture. Realistically, there is no such thing as a silver bullet, but the nuclear industry has always offered us the intelligent, sophisticated scientific and engineering prowess we need if we are to cut greenhouse gas emissions in half over the next few years.

Environmental idealism, bureaucratic policy, and political posturing continue to delay the transition from dams to advanced reactors. Like starving men hoarding their food, our unwillingness to embrace advanced reactors simply ensures that we'll drive the salmon to extinction even as the solution sits right under our noses.

Some insist that the cry to remove dams is an absurd quest to return to a pristine, pre-colonialist world, but advanced reactors are hardly a step back in time. Nor is this advocacy for advanced reactors intended to demean the historic value of these dams. Whether or not we agree with their decisions now, faulting the honest intentions of our ancestors is anachronistically flawed. For those who lost their farms to the Dust Bowl and the Depression, for those unable to feed their children in those harsh times, and for an entire world in the throes of World War II, the dams were lifesaving. I think we need to respect that history. But by now it is clear that these dams kill fish, and they also do grave harm to Indigenous peoples.

With advanced reactors in the mix, there is no longer a substantive argument justifying dams. If people sincerely believe in saving the salmon, then simply replace the dams with advanced reactors. To argue otherwise is both hypocritical and blindly privileged, exposing a raw and selfish truth: What we value most of all is cheap electricity.

It's true we've established a Columbia River machine economy upon which irrigators, barge operators, and residential and industrial power consumers depend, but then this is where the conversation always ends—at an impasse, a classic zero-sum game. But advanced reactors can stop this madness. Ideological antinuclear claims aside, advanced reactors will overcome the historical concerns regarding waste management, nuclear proliferation, cost per kilowatt hour, and overall safety. Advanced reactors offer new jobs, and the Bonneville Power Administration will easily continue to manage the flow of electricity throughout the Western states.

Advanced reactors will ameliorate cultural genocide, create opportunities to optimize irrigation systems, increase agricultural profit margins, power hydrogen trains to transport goods and people, load-level intermittent renewable energy, open doors to alternative flood control strategies, reduce river temperatures, restore wild fish, and free the recreationalist west-siders and the east-side farmers and ranchers from their seemingly intractable vitriolic exchanges. Advanced reactors will quickly pave a smooth road to hope and salvation for all.

Jerry Bryan
Bellingham, Wash.

About the Reactor Safety Study article

I have studied the article "The origins of *The Reactor Safety Study*" by Thomas Wellock in the September 2021 *Nuclear News*. The intense report covers a lot of territory, but it is light on detailing the heavy hand of Admiral Rickover. On page 50, I read the words "navy discipline" and in endnote 12 there is mention of "Edward J. Bauser." What was Bauser doing and where was Rickover?

Robert Leyse
Sun Valley, Idaho

Thomas Wellock responds: I appreciate Mr. Leyse's interest in my article. Like him, I expected to find the influence of Admiral Rickover in the launching of *The Reactor Safety Study* (WASH-1400) under Professor Norman Rasmussen, but I did not find evidence of that.

Yet, some of Rickover's disciples lent a helping hand to the study. Mr. Leyse astutely points to the possibility of Rickover's influence in a 1971 memo I cite from Saul Levine to Edward Bauser located in the papers of the Joint Committee on Atomic Energy. At the time, Levine, an Atomic Energy Commission regulatory staff member, was temporarily assigned to the Joint Committee under Bauser, the committee's executive director. Both men had been nuclear navy officers, the latter a key assistant to Rickover in the development of the U.S.S. *Nautilus*. Levine's memo helped convince the Joint Committee to request from the AEC a study of the risks of a reactor accident, a study the agency had already promised to Sen. Mike Gravel of Alaska. In late 1972, Levine, now back at the AEC, was tasked with managing the study's large staff for Rasmussen.

Thus, while Rickover did not inject himself into the WASH-1400 debate, the study's history is a reminder that his pervasive influence on nuclear power extends to the many capable people in the industry who learned reactor safety under him.

PRA issue is a highlight

The September 2021 *Nuclear News* (the PRA issue) issue has so much good content and I haven't yet finished reading all of it. I am excited about the scope of content. PRA doesn't usually have the beautiful visuals and flashy engineering content that other fields have, so this is really great to have something to show beyond a line diagram!

The infographic on page 8 is impressive, and Matt Denman's insight in his Q&A article is great. I'm still working my way through the rest.

Katrina Groth
College Park, Md.

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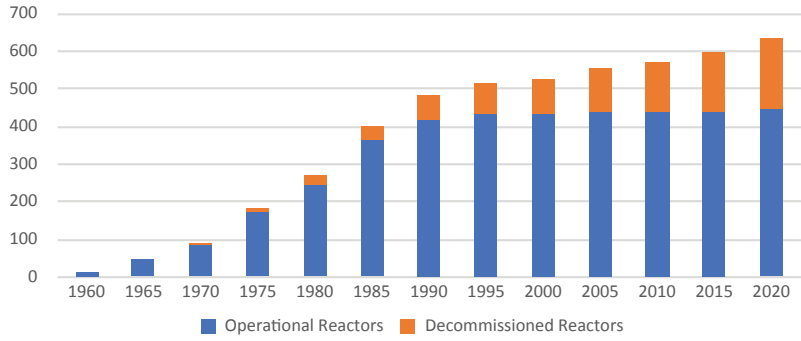
&D in depth

According to International Atomic Energy Agency statistics, 194 power reactors around the world have permanently shut down, shifting from operations to decontamination and decommissioning (D&D). Here's a closer look at the ever-expanding set of former power producers, and research reactors, too.

Numbers tell the story

While the number of retired power reactors around the world has increased predictably, new construction has kept the number of operating reactors around 440 since the mid-1990s. Recent IAEA forecasts suggest that operational nuclear generating capacity could hold its ground or double by 2050.

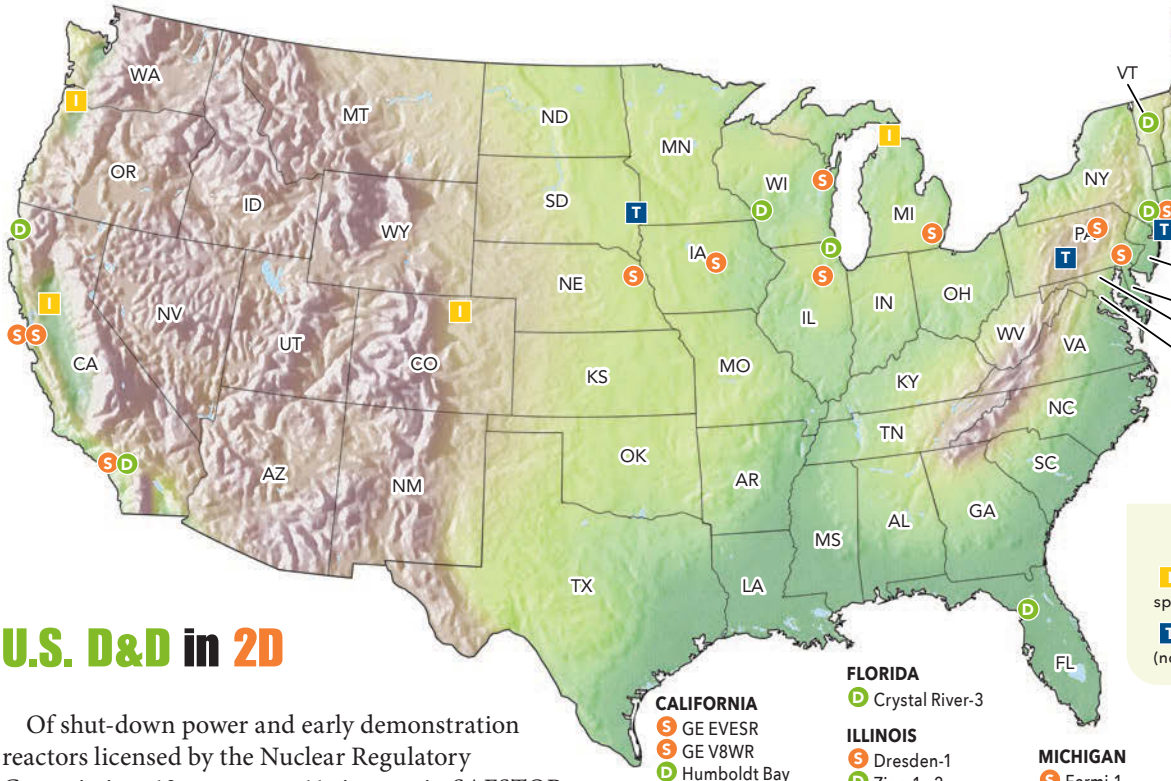
(Data source: IAEA PRIS)



U.S. D&D in 2D

Of shut-down power and early demonstration reactors licensed by the Nuclear Regulatory Commission, 13 reactors at 11 sites are in SAFSTOR, 13 reactors at 10 sites are in DECON, seven reactors at seven sites have been permanently decommissioned with fuel stored on-site, and three reactors at three sites have had their license terminated, with no fuel on-site.

(Data sources: NRC, Status of the Decommissioning Program 2020 Annual Report and Backgrounder on Decommissioning Nuclear Power Plants)



KEY

- S SAFSTOR
- D DECON

Decommissioning Completed

- I **ISFSI only** (independent spent fuel storage installation)
- T **License Terminated** (no fuel on-site)

CALIFORNIA
- S GE EVESR
- S GE V8WR
- D Humboldt Bay
- I Rancho Seco
- S San Onofre-1
- D San Onofre-2, -3

COLORADO
- I Fort St. Vrain (DOE license)

CONNECTICUT
- S Millstone-1
- I Haddam Neck

FLORIDA
- D Crystal River-3

ILLINOIS
- S Dresden-1
- D Zion-1, -2

IOWA
- S Duane Arnold

MARYLAND
- D N.S. Savannah

MASSACHUSETTS
- D Pilgrim
- I Yankee Rowe

MAINE
- I Maine Yankee

MICHIGAN
- S Fermi-1
- I Big Rock Point

NEBRASKA
- S Fort Calhoun

NEW JERSEY
- D Oyster Creek

NEW YORK
- S Indian Point-1
- D Indian Point-2, -3
- T Shoreham

OREGON
- I Trojan

PENNSYLVANIA
- T Saxton
- S Peach Bottom-1
- S Three Mile Island-1, -2

SOUTH DAKOTA
- T Pathfinder

VERMONT
- D Vermont Yankee

WISCONSIN
- D La Crosse
- S Kewaunee

Zion Containment Demo Time Lapse Sequence

Now or later

Reactor owners in the United States can choose one (or both) of two approaches to decommissioning. SAFSTOR, the current choice for 13 shut-down reactors, keeps the plant intact (with fuel removed) for decades while radioactivity decays, making eventual dismantlement quicker and safer, while under DECON, the current D&D method of choice for 13 reactors, the objective is to remove contaminated equipment and materials and dismantle the plant without delay.

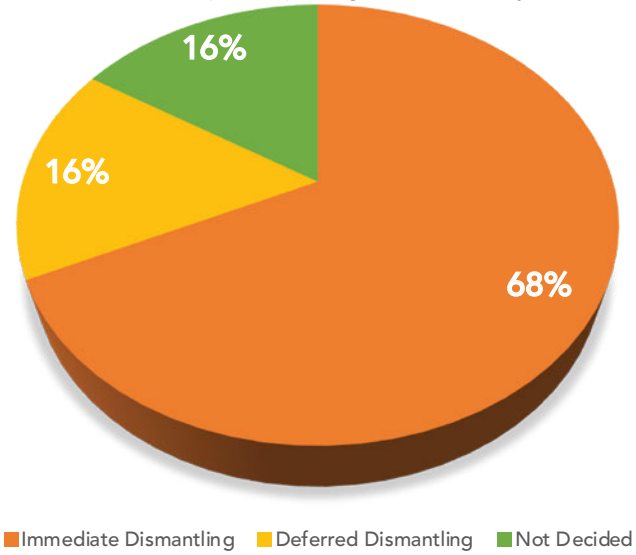
Three Mile Island-1, a SAFSTOR reactor, currently has the longest horizon for decommissioning completion: 2079. Zion-1 and -2 and La Crosse, by contrast, are DECON sites that are to be released from NRC obligations (independent spent fuel storage installations excepted) in 2022.

(Data source: NRC, Status of the Decommissioning Program 2020 Annual Report*)*

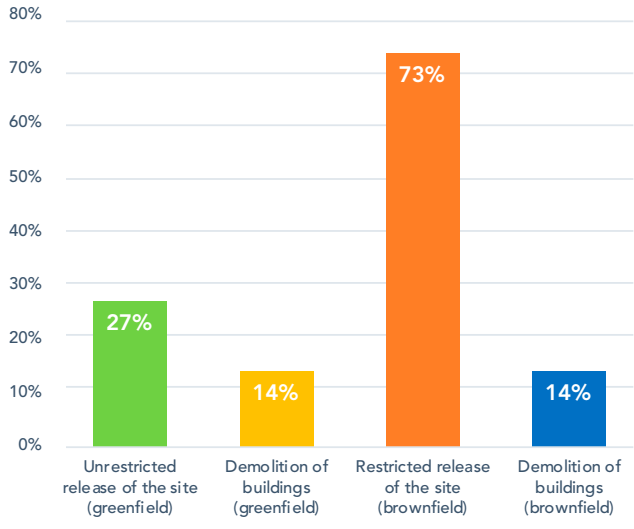
Global research reactor survey

Statistics provided in *Data Analysis and Collection for Costing of Research Reactor Decommissioning*, a report published by the IAEA in September 2021, reveal that the owners of 68 percent of the 24 reactors reviewed chose immediate dismantling, while 16 percent selected deferred dismantling and the remainder were undecided. Of the 24 reactors, 27 percent were destined for greenfield status (unrestricted site release), while 73 percent would become restricted brownfield sites. Twenty-eight percent of all cases studied (an even split between greenfield and brownfield) would include the demolition of buildings.

Chosen decommissioning strategy for research reactors participating in IAEA study



Planned end state for research reactors participating in IAEA study

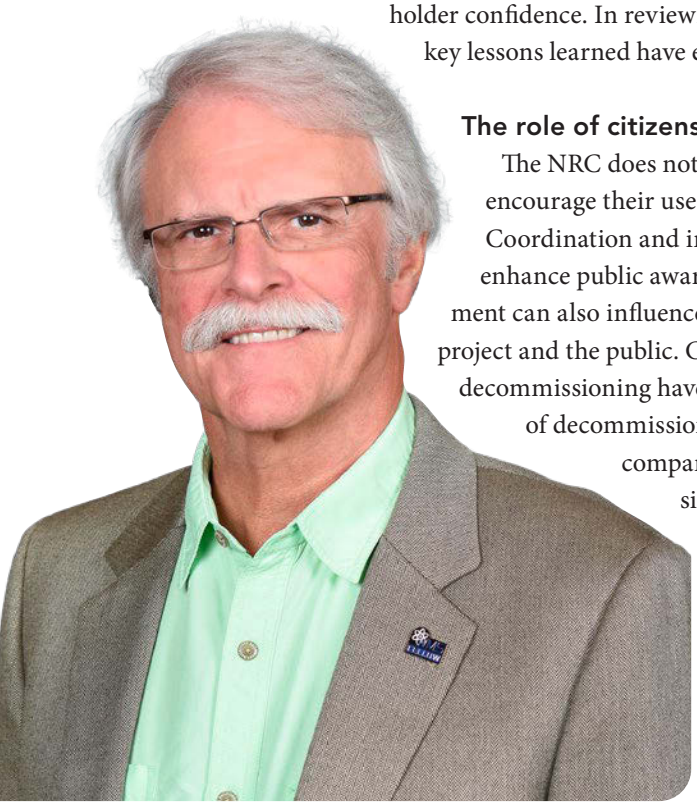


(Data source: IAEA)

Maximizing decommissioning lessons learned

By Larry W. Camper

The track record for the successful decommissioning of nuclear facilities, both nationally and internationally, is impressive. In the United States, we have decommissioned many nuclear facilities, including complex materials sites, uranium recovery sites, research and test reactors, and nuclear power plants. To date, according to the Nuclear Regulatory Commission, 10 nuclear power plants have been completely decommissioned for unrestricted use, and another 26 power reactor sites are currently undergoing decommissioning through either SAFSTOR or DECON, following NRC regulatory requirements. In addition, the Nuclear Energy Institute identifies three nuclear power plants that were successfully decommissioned outside of NRC jurisdiction. While such a track record is impressive, the nuclear industry must be vigilant in focusing on lessons learned in order to continue to make gains in efficiency, cost savings, improved environmental stewardship, and enhanced stakeholder confidence. In reviewing the outcomes of decommissioning over many years, a number of key lessons learned have emerged.



Larry W. Camper is a retired NRC senior executive and is currently a consultant to the nuclear industry.

The role of citizens advisory panels and concerned stakeholders

The NRC does not require the establishment of a citizens advisory panel, but it does encourage their use by utilities or owners of plants undergoing decommissioning. Coordination and interaction with a citizens advisory panel provide an opportunity to enhance public awareness and trust in the decommissioning process. Stakeholder involvement can also influence the overall decommissioning process and foster trust between the project and the public. Concerned stakeholders near nuclear power plant sites undergoing decommissioning have raised a number of important issues, such as the adequacy and use of decommissioning trust funds; the experience and expertise of the commercial companies conducting the decommissioning; whether NRC decommissioning dose standards are being met; taking an active role in the decommissioning process to ensure an appropriate and successful end state; and concerns and implications about the loss of jobs and tax revenue.

The meaningful and active use of a citizens advisory panel by utilities or plant owners can go a long way toward addressing such concerns and provide an opportunity for successful communication, which can serve to make the decommissioning process much smoother, without avoidable conflicts and potential litigation. It is important to establish the panel early in the process and ensure its continuing existence throughout the decommissioning project.

Business models to complete decommissioning

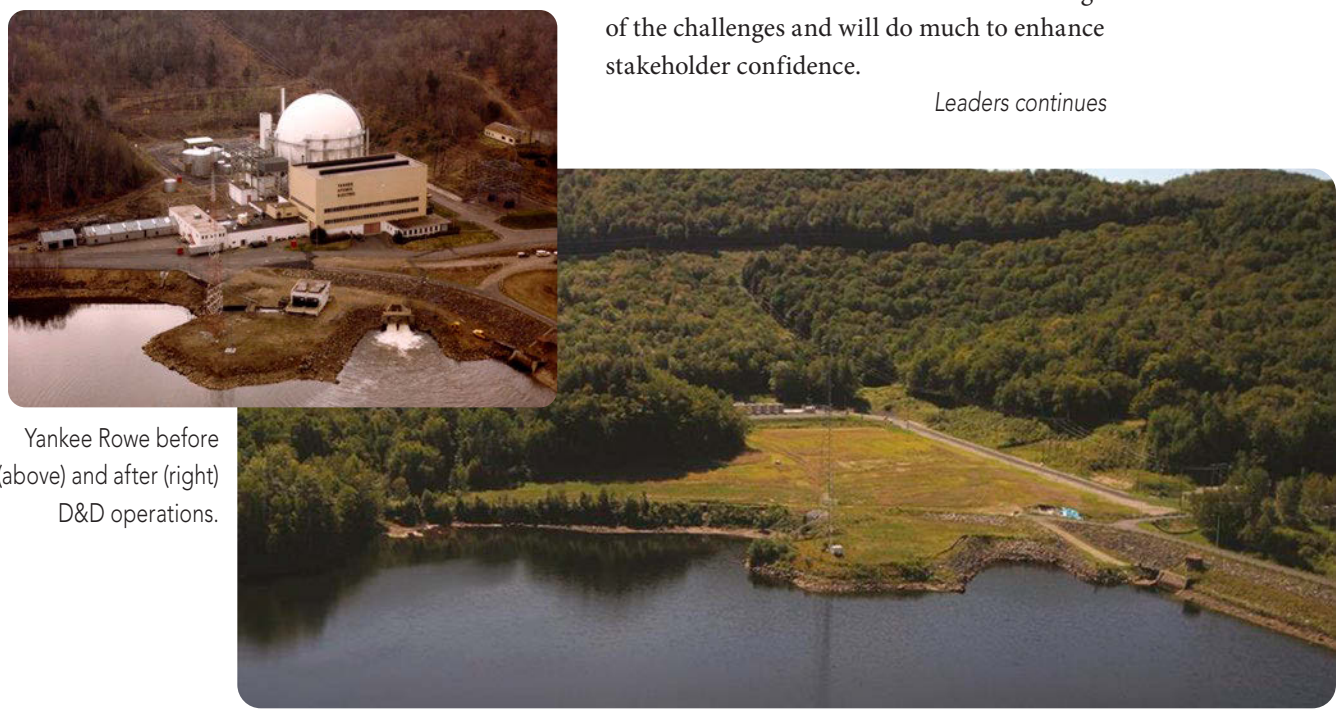
The question of who (utility or contractor) will conduct the decommissioning process has undergone significant change over the past several years. Today, four models have emerged: (1) the licensee performs the decommissioning; (2) the licensee manages a decommissioning contractor; (3) the license is temporarily transferred to a decommissioning company (stewardship); and (4) the license is permanently transferred (asset acquisition). Historically, the first two methods have prevailed (e.g., Trojan and Big Rock Point), but over the past 10-plus years, the latter two approaches have emerged as preferable. Operating utilities find themselves in a competitive marketplace and thus welcome the opportunity to transfer decommissioning risk to companies with the expertise needed to successfully decommission a nuclear power plant. This option allows the utilities to continue their focus on operating efficiency.

The learning curve on the last two methodologies remains active, but successful decommissioning is taking place, and lessons learned will continue to become available as these two methodologies are used to complete the decommissioning of nuclear power plants. The NRC evaluated the potential financial risks associated with the license transfer models and identified no regulatory gaps or policy issues. The NRC staff did recommend nine inspection program and training enhancements and updated internal guidance to address the new models and related lessons learned.

Begin with the end state in mind

It is important when planning a nuclear power plant decommissioning project to begin with the end state in mind. Focusing on the end state will facilitate the development of the post-shutdown decommissioning activities report, the development of the license termination plan, and the development of the final status survey. Presumably, unrestricted release will be pursued, and so it is important to ensure that the dose limitations in 10 CFR Part 20, Subpart E, will be met. As with any large-scale project, numerous decisions will arise during the decommissioning process, and having a clear understanding of the desired end state will facilitate those decisions. Establishing and articulating the end state demonstrates a clear understanding of the challenges and will do much to enhance stakeholder confidence.

Leaders continues



Yankee Rowe before (above) and after (right) D&D operations.

Use of emerging technologies

The technology available today to improve the decommissioning process serves to reduce the amount of time, cost, and radiation exposure to workers for completing the decommissioning of a nuclear facility. Three examples are the use of improved segmentation techniques, the use of artificial intelligence in planning the reduction of exposure to workers, and the use of remote technologies (robotics). Utilities are taking advantage of these technologies and continue to improve the decommissioning process. As a result, decommissioning projects are completed more efficiently, resulting in cost savings and a reduction in worker exposure. The technology continues to change, and industry must remain vigilant in understanding and using it to the maximum advantage.

Efficiency in waste handling and shipment

Improvements in the segmentation of certain components, along with improvements in the overall cutting and packaging program, have led to substantial improvements in the efficiency and cost of the disposal of radioactive waste. In addition, ensuring that the resulting waste requires disposal in a commercial low-level waste disposal facility has led to reductions in the actual volume requiring shipment. In several cases, contractors have taken advantage of the alternate disposal authorization in 10 CFR 20.2002 to maximize efficiency.

The NRC staff recently issued SECY-20-0098, which recommends combining a rulemaking on the disposal of Greater-Than-Class C (GTCC) waste with the ongoing 10 CFR Part 61 proposed rulemaking. Combining these regulations should have a positive effect on the disposal of GTCC waste in a near-surface disposal facility. Based on the NRC staff's technical analysis, such an outcome could include the disposal of reactor internals (GTCC waste) resulting from decommissioning rather than storage in containers in an independent spent fuel storage installation for an indefinite period of time. The evaluation performed by the NRC staff in support of this recommendation was thorough and technically sound, drawing upon lessons learned from the protracted storage and limited disposal of GTCC waste. The NRC determined that Agreement States can effectively regulate the majority of GTCC waste.

Safety must be the top priority for a nuclear power plant or other nuclear facility undergoing decommissioning.

Industrial safety and worker issues

Just like for an operating plant, safety must be the top priority for a nuclear power plant or other nuclear facility undergoing decommissioning. Once a nuclear power plant enters active decommissioning, it becomes a beehive of activity, with many contractors, subcontractors, and workers involved in daily decommissioning operations. As a result, there are many chances for industrial safety issues and worker concerns to arise. Therefore, it is important to create a strong safety-conscious work environment, including a continuing focus on nuclear safety.

Part of this process is to create an employee concerns program (ECP) and a corrective action program (CAP). Workers should be encouraged to use the ECP for filing legitimate concerns, and the primary decommissioning contractor should ensure that all such concerns are fully evaluated and feedback is provided to the concerned worker(s). The CAP should be used to address all matters requiring corrective actions, which often involve work permits and outcomes from various actions taken by the on-site workforce. It is important that the CAP bring to successful closure the various events tracked within the system, and the workforce must be made aware of the outcomes. Management has learned to place a high premium on the CAP and has worked diligently to maximize its use.

Identification and management of project risk

Any large-scale industrial project carries many risks that may impact the overall outcome of the project, cause delays, or increase costs. Project managers have many tools in their arsenal that can aid in addressing such challenges and obstacles. One such tool is a project risk register, which is a document and system used to manage risk and to fulfill regulatory compliance.

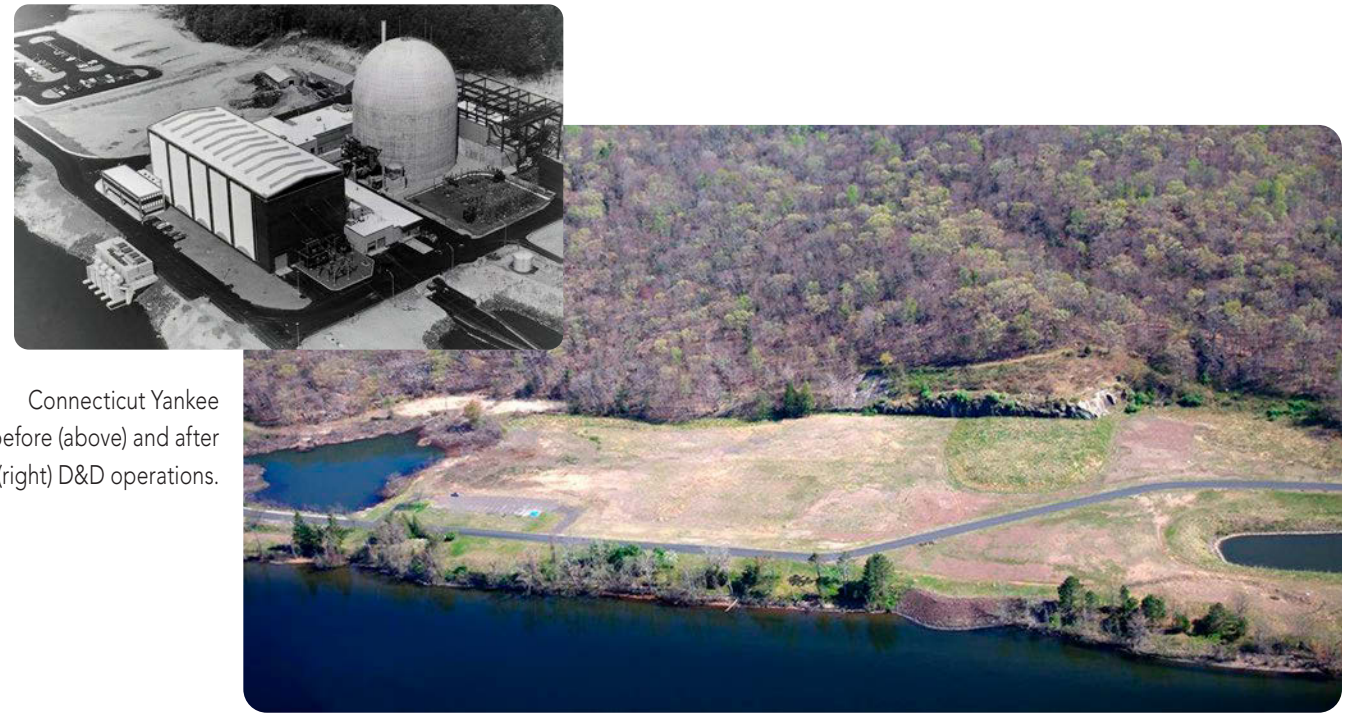
The risk register serves as a repository for all identified risk categories and, typically, information about each risk, such as the nature of the risk, reference to the owner of the project risk, and mitigation measures. The information is usually displayed as a scatterplot or as a table.

Risks in a large-scale decommissioning project will change over time. It is important to build, update, share, and maintain the project risk register with the management team in an active, ongoing manner. A key component of the risk register is identifying the probability and impact of various risks using qualitative and quantitative assessment. Ultimately, the success of a risk register is linked to risk ownership and mitigative measures taken through a CAP. Drawing upon lessons learned in other decommissioning projects can facilitate identification and management of project risks depicted in a thorough and dynamic risk register.

Role of a risk-informed regulatory process

The NRC has taken steps to become a more risk-informed regulator on many fronts, including in the inspection of nuclear power plants undergoing decommissioning and other types of facilities involved with decommissioning. The emphasis on inspection activities during the decommissioning

Leaders continues



Connecticut Yankee before (above) and after (right) D&D operations.

of a nuclear power plant focuses on higher-risk activities, such as fuel movement, segmentation and removal of large components, or packaging of radioactive waste. The inspection procedures used by the NRC are set forth in *Inspection Manual Chapter 2561*. Currently, the NRC staff is working on updating its procedures associated with the inspection of materials sites and uranium recovery sites undergoing decommissioning, bringing to bear the NRC's "Be riskSMART" initiative, which will greatly enhance the focus on higher-risk activities. These updated inspection procedures are risk-informed and based on lessons learned.

Use of regulatory exemptions

In view of the current regulatory requirements set forth in 10 CFR Part 50 for operating nuclear power plants, the transition from an operating nuclear power plant to one entering decommissioning currently results in the need to seek multiple exemptions from regulatory requirements. Several nuclear power plant sites have sought such exemptions, which has been very costly and time-consuming for the utilities. Further, the numerous exemption requests have increased the burden on the NRC staff, which must review the exemptions and communicate with the commissioners in authorizing exemptions to the "front-end technical specifications."

To address this issue, in May 2018, the NRC staff submitted SECY-18-0055, a proposed rulemaking that would codify changes requiring an exemption and thus eliminate the need to seek multiple exemptions for a nuclear power plant undergoing decommissioning. The proposed rulemaking is a considered and balanced approach to addressing the transition from operations to decommissioning drawing upon lessons learned from the transition to decommissioning of many nuclear power plants. It is important for the commission to take positive action on the proposed decommissioning rulemaking in order to improve the efficiency and effectiveness of the power reactor decommissioning program and provide an opportunity for the industry and stakeholders to fully understand the process.

These are only a few of the lessons learned that can and should be shared with the industry in order to continuously improve the decommissioning process. In addition, it is important for industry personnel to review and comment on NRC guidance documents (e.g., NUREG-1757, Volume 2) and rulemakings to influence outcomes and share experience and lessons learned with the regulator.

In the final analysis, it is important to demonstrate that our industry can successfully build nuclear facilities, operate them safely, and decommission them in a manner that protects public health and safety and ensures good environmental stewardship. Successful decommissioning can aid in ensuring the role of nuclear power in the future, so we should strive to learn all that we can, share experience and wisdom, and strive for success. Learning never stops.

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Spotlight On . . .

The ANS Decommissioning and Environmental Sciences Division

By John Fabian

"A group of professionals having fun in the fields of decommissioning and environmental sciences for the nuclear industry."

That's how the ANS DESD describes itself on its website (desd.ans.org). The focus of this professional is the development and use of skills and technologies needed for the optimal management of the end-of-life care (decommissioning, decontamination, and remediation), long-term surveillance, and maintenance of nuclear installations, materials, facilities, and sites.

Meetings

DESD is active at both ANS national meetings every year. In addition, this year the division has organized an embedded topical meeting at the ANS Winter Meeting in Washington, D.C., held November 30–December 3. Titled Decommissioning Environmental Science and Remote Technology 2021, the topical is centered around the theme "Tech + Green = Clean" and is a joint effort between DESD and the Robotics and Remote Systems Division. Between them, the divisions will host three plenary sessions and 16 technical sessions (half for DESD and half for RRSD) covering a wide range of topics, such as Environmental Considerations and Innovative Technologies for Decommissioning, Nuclear Security Cost Optimization Methods for the 21st Century, Robotics & Remote Systems for Surveillance in Hazardous Environments, and much more. As the ANS Winter Meeting—and its embedded topicals—will be a hybrid virtual and live event, roughly half of the topical's sessions will be available for virtual attendees, but the others will be available only to attendees participating in person in Washington, D.C.

The three plenary sessions follow the theme for the meeting:

- Part I: Tech + Clean = Green—Policy.
- Part II: Tech + Clean = Green—Practice.
- Part III: Tech + Clean = Green—As Applied at Fukushima.

General chair Jim Byrne said, "The first session will have speakers from the Nuclear Regulatory Commission, the International Atomic Energy Agency, and the OECD Nuclear Energy Agency to discuss the guidance each provides with respect to decommissioning. The second session will feature

speakers from the Department of Energy, TEPCO, and EnergySolutions to provide some current examples to discuss how decommissioning guidance is implemented in performing decommissioning projects. Then the third session, if the panelists can participate during the ongoing pandemic, will focus on the ongoing work at Fukushima Daiichi and discuss what has been done over the last decade and [plans] for the remaining decommissioning tasks."

Awards

The DESD strives to recognize and honor accomplishments of colleagues who have made outstanding contributions to the field of decommissioning, decontamination, and site reutilization. To recognize these accomplishments, it annually solicits nominations for the DESD Lifetime Achievement Award and the DESD Award of Excellence. These awards allow division members to recognize their colleagues who have demonstrated outstanding achievement, service, and contribution to the technical area. Typically, nominations open every January and close at the end of August.

The Lifetime Achievement Award is intended to recognize a more senior-level individual for their achievements and contributions to the advancement of any one of or all of the fields of decontamination, decommissioning, or site reutilization. Strong consideration is given to individuals who have made significant contributions to the state of the art of the DESD area; were instrumental in an important publication in the decommissioning and environmental sciences area, sustained noteworthy technical achievement; or have an industrywide sustained record of significant achievement, accomplishment, and technical excellence. The Lifetime Achievement Award is intended to reward an individual member, and the award is made specifically to that individual. The most recent recipient of the award was Jan Van Erp, in 2017; all recipients of the award can be viewed on DESD's website, desd.ans.org.

The ANS DESD Award of Excellence is intended to recognize individuals for their efforts and achievements on a specific project that has contributed to the advancement of any one of or all of the fields of decontamination, decommissioning, or site reutilization. The award is intended to reward member(s) of a project team and should be based upon the contributions of an individual or group of individuals making a specific and significant focused contribution to a state-of-the-art project, an important publication, or other major technical achievement. The most recent award was given in 2016 for placing the Kewaunee nuclear power plant into SAFSTOR.

At the national level, DESD sponsors the W. Bennett Lewis award. This award was established in 2006 by what was then called the Environmental Sciences Division, to honor Lewis, a visionary who understood the importance of providing a clean and abundant source of energy to support the world

Spotlight On continues

population for generations to come. As listed on the ANS Honors & Awards website, "The award recognizes individuals who have made major lifetime contributions in nuclear science and engineering toward minimizing environmental footprint, attaining long-term global sustainable energy and development, and having shown great foresight in elucidating these goals as recorded in archival publications."

ANS and the professional division awards are an important program to honor deserving professionals. The 2021 Winter Meeting award recipients can be found on *Nuclear Newswire*, and the presentations will be held during the Winter Meeting. If you know a deserving professional who is eligible and qualified in one of the fields served by the Society, please nominate the individual or group by email to honors@ans.org.

John Fabian is director of the ANS Publications Department.

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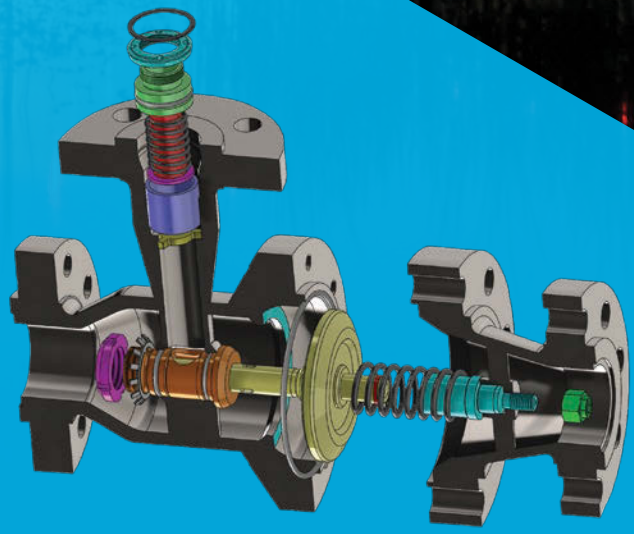

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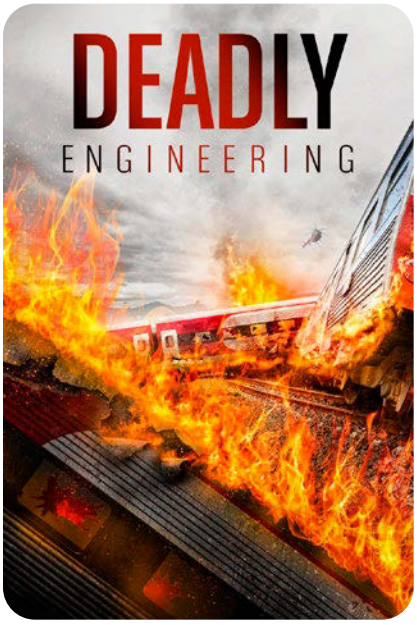
When the Science Channel is light on science

By Steve Redeker

In September, cable television's Science Channel aired an episode on power plant catastrophes as part of its series *Deadly Engineering*, with one principal segment on the 1979 Three Mile Island accident. The episode contains several inaccuracies and distortions—perhaps the biggest mistake being that the TMI accident was featured in *Deadly Engineering* at all, since no deaths or long-term adverse health trends resulted from the accident.

Leaving that aside, the episode includes other errors that executives at Science Channel should have caught and corrected before airing. They also should have made sure to include knowledgeable scientific reviewers from both sides of the nuclear issue, which they did not.



The biggest falsehood in the episode comes very near the beginning, with the horribly erroneous claim that most of eastern Pennsylvania was made permanently uninhabitable by the accident. Incredibly wrong, and likely believable and very frightening to some viewers.

In addition, the described health impacts of the accident are wrong, and the show provides no facts or expert comments to support these statements. The only comments come from local residents, who state that there were "deformities with animals" and "anomalies with plants," such as "two-headed dandelions" and trees with "distorted tops."

A knowledgeable reviewer could have pointed out to the producers that the Pennsylvania Department of Health for 18 years maintained a registry of more than 30,000 people who lived within five miles of TMI at the time of the accident—and this study showed no evidence of unusual health trends, according to the World Nuclear Organization.[1]

For Science Channel to say "two-headed dandelions" (when dandelions in fact have flowers and not heads) and "distorted" treetops (when trees may appear to be distorted to anyone at any time) destroys whatever credibility the channel may have had.

The episode contains a further gross distortion related to a statement by then Nuclear Regulatory Commission commissioner Victor Gilinsky. Gilinsky says correctly that several days into the event, "The water was fairly badly contaminated," referring to the reactor coolant containing a significant concentration of fission products, which the episode never makes clear. Instead, the video accompanying Gilinsky's statement shows a person sampling river water, which likely would lead lay viewers to think that the local river water was badly contaminated (it was not). A knowledgeable reviewer would have caught this significant error before it was allowed to air.

To the show's credit, the TMI segment does properly capture the plant's technical aspects and accurately conveys the communication problems and the public's reaction to the accident as it was unfolding. However, gross factual errors and misleading statements have no place in media purporting to present scientific fact.

1. https://world-nuclear.org/information-library/safety-and-security/safety-of-plants/three-mile-island-accident.aspx

Nuclear professionals must actively work to prevent and correct these errors and the impressions they make. One avenue is social media. For example, Science Channel has Facebook pages for series and episodes where people can comment and ask questions. It is important that nuclear professionals respond to these inaccuracies to set the record straight. More importantly, media executives must be encouraged to use knowledgeable reviewers to improve their episodes. Science Channel executives in particular should be contacted and urged to correct their ways. Executives' email addresses are on the Internet. Nuclear professionals must respond to every inaccurate segment on nuclear and not assume that some other professional will do it. You may even be asked to act as a knowledgeable reviewer someday.

When informed of the noted errors in the TMI episode, a Science Channel executive responded to me, saying, "We always try to get the facts right at Science and correct them when we don't." One can only hope that Science Channel will do just that, but it takes effort by nuclear professionals to step up.

By the way, the *Deadly Engineering* series now has three episodes that deal with nuclear accidents. In addition to the one on TMI, the program's very first episode features Chernobyl. Finally, the third segment, on Fukushima, aired September 29, not in time to be reviewed for this edition of *NN*. But the trailer says the plants exploded, and the concurrent video shows what looks like some non-Fukushima facility engulfed in flames. I wonder what other errors have been made.

Steve Redeker is a 40-year ANS member. Now retired, he spent 28 years in commercial nuclear plant operations, engineering, and management, including as decommissioning manager at the Rancho Seco nuclear power plant. He also served for five years as a U.S. Navy nuclear officer on submarines.

Energy*Solutions* announced the stock transfer of Kewaunee from Dominion Energy in May 2021 and is in the process of approval by the U.S. Nuclear Regulatory Commission and Public Service Commission of Wisconsin.

Energy*Solutions* Models Success in D&D

by Jeremy Kartchner, freelance energy writer

Contrary to what some believe, the nuclear industry, far from fading into the past, is experiencing an ongoing evolution. New generations of nuclear power technologies move closer to reality, while traditional nuclear generators are reaching retirement and entering decommissioning. As research on Small Modular Reactors (SMR) advances, prototype production is in full swing with the potential for SMRs to eventually replace the current fleet. And while technology advances, so do markets seeking to deal with the challenge of climate change in the face of the retirement of the currently operating nuclear power plants in the U.S. In an exceptional recent win for nuclear power, the Illinois legislature approved $700 million in subsidies for the Byron and Dresden nuclear stations over the next five years. It remains to be seen if this will be an isolated move in today's nuclear plant lifecycle.

Wisconsin's Kewaunee Power Station (KPS) is the tenth facility over the past decade to announce it would enter rapid decommissioning and return the site to greenfield status ahead of schedule. In May 2021, Energy*Solutions* announced the stock transfer of KPS from Dominion Energy and is in the process of approval by the U.S. Nuclear Regulatory Commission (NRC) and Public Service Commission of Wisconsin. In addition to KPS, Three Mile Island Unit 2 (TMI-2), Zion, La Crosse, San Onofre Nuclear Generating Station (SONGS), Fort Calhoun, Crystal River, Pilgrim, and Vermont Yankee, comprise the full roster of U.S. nuclear power plants at various phases of decommissioning.

> In the case of Zion, the License Transfer Model advanced the restoration of the Lake Michigan property to its natural state by nearly thirty years.

For much of the U.S. nuclear industry, the assumption regarding plant decommissioning was an approach known as SAFSTOR, a regulatory framework whereby the plant would be shut down and defueled, essentially put into a static, "hibernated" state with final decontamination and decommissioning occurring as much as fifty years later.

As the industry evolved, it became clear that early decommissioning—rather than SAFSTOR—was more attractive to all stakeholders (e.g., owners, licensees, regulators, communities, etc.). In a few early cases (e.g., Trojan, Maine Yankee, Connecticut Yankee, etc.) the owner-utilities led the decommissioning efforts. As it became apparent that such endeavors were a specialized set of expertise and capability, commercial solutions emerged in the market.

There are currently three basic commercial models to decommission a nuclear power plant or reactor: License Transfer, Decommissioning General Contractor, and Asset Transfer (which, for purposes of this article, includes a stock transfer). Currently, Energy*Solutions* is the only company performing decommissioning under each of these models.

License Transfer Model

Energy*Solutions* pioneered "D&D" (decontamination and decommissioning) under the License Transfer approach in 2010, when the NRC approved the Zion Nuclear Power

Station nuclear license transfer from Exelon to Energy*Solutions*. The License Transfer model allows accelerated decommissioning to proceed with minimal original owner involvement, but without obligating the decommissioning company with the long-term nuclear fuel liability. Thus, at the regulatory completion of D&D, the license, with its long-term fuel obligation, transitions back to the original owner. In the case of Zion, this approach advanced the restoration of the Lake Michigan property to its natural state by nearly 30 years. The physical work of the project is complete, and the NRC is currently reviewing the request for all licenses to be transferred back to Exelon.

Dairyland Power Cooperative (DPC) also executed a License Transfer agreement with Energy*Solutions* for the rapid decommissioning of the La Crosse Boiling Water Reactor (LBWR) in Genoa, Wisconsin. Located on the banks of the Mississippi River, this 50-Mw electrical output plant has now been successfully decommissioned, the land fully restored, and final approval to transfer the license back to Dairyland Power Cooperative is expected in early 2022.

Decommissioning General Contractor Model

In cases where the parent utility/owner of the nuclear power plant cannot transfer the nuclear plant license (due to statutory, fiduciary, or other obligations), but desires to proceed with near-term decommissioning, the Decommissioning General Contractor strategy is used. Southern California Edison (SCE) opted to use the Decommissioning General Contractor (DGC) model for SONGS. SCE contracted with a joint venture of

The physical work of the Zion Nuclear Power Station decommissioning project is complete, and the U.S. Nuclear Regulatory Commission is currently reviewing the request for all licenses to be transferred back to Exelon.

Located on the banks of the Mississippi River, the La Crosse Boiling Water Reactor has now been successfully decommissioned, the land fully restored, and final approval to transfer the license back to Dairyland Power Cooperative is expected in early 2022.

As the Decommissioning General Contractor, Energy*Solutions* safely removed, packaged, and transported the below-grade reactor at SEFOR for permanent disposal at a licensed facility. The project was executed on schedule and budget and the property, rid of all radioactivity, remains with the University of Arkansas.

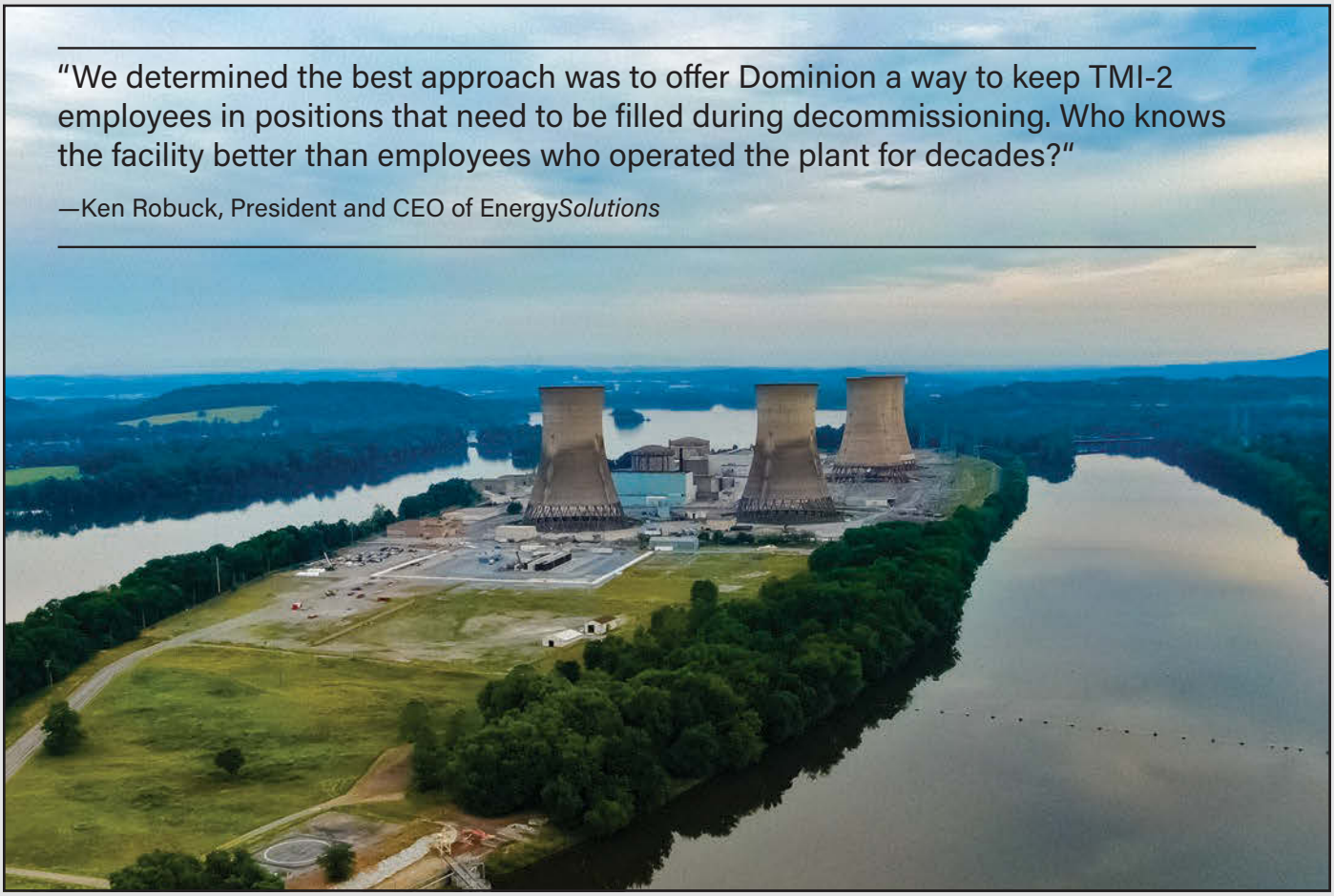
The Decommissioning General Contractor model being used at SONGS allows the utility to maintain ownership and the nuclear license (with the long-term fuel liability), and retain staff, while an experienced decommissioning company (Energy*Solutions*) executes decommissioning.

Energy*Solutions* and AECOM ("SONGS Decommissioning Services") to perform the decommissioning work. As the DGC, the ES/AECOM joint venture reports to SCE throughout project execution, but does not hold the nuclear license nor the long-term fuel liability.

Similarly, but with important distinctions, Omaha Public Power District (OPPD) opted to use the DGC model, but also created a support team of OPPD employees who would partner with the DGC company with specific execution responsibilities in the D&D effort, effectively acting as a partner to the DGC company. This model allows the utility to maintain ownership and the nuclear license (with the long-term fuel liability), and retain staff, while an experienced decommissioning company (Energy*Solutions*) executes decommissioning.

As the Decommissioning General Contractor, Energy*Solutions* is successfully decommissioning the Southwest Experimental Fast Oxide Reactor (SEFOR) located near Fayetteville, Arkansas. This three-year project, overseen by the University of Arkansas, involved the passivation and removal of all sodium, hazardous, radioactive, and non-radioactive waste; dismantlement of the entire facility; and removal of the below-grade reactor, which was safely packaged and transported for permanent disposal at a licensed facility. The SEFOR project was executed on schedule and budget and the property, rid of all radioactivity, remains with the University of Arkansas.

> "We determined the best approach was to offer Dominion a way to keep TMI-2 employees in positions that need to be filled during decommissioning. Who knows the facility better than employees who operated the plant for decades?"
>
> —Ken Robuck, President and CEO of Energy*Solutions*



Asset Transfer Model

The Asset Transfer model provides for the complete divestiture of the nuclear asset: property, equipment, license, and fuel liability. And in some cases may include transfer of employees. This approach was used at TMI-2 and at the KPS, (although the Kewaunee assets will be acquired "indirectly," through the purchase of 100% of the stock in Dominion Energy Kewaunee, Inc. Energy*Solutions* successfully negotiated the asset transfer of TMI-2 from FirstEnergy in 2019. In May 2021, Dominion Energy reached stock purchase agreement with Energy*Solutions* for KPS. During KPS negotiations, Dominion Energy and Energy*Solutions* executives discussed the best approach for the approximately 50 employees still working at the shutdown plant. The stock purchase ensures the D&D process benefits from the value added by contracting for the services of employees retained by Dominion.

"We discussed the current employee situation at the plant and determined the best approach was to offer Dominion a way to keep employees in positions that need to be filled during decommissioning," stated Ken Robuck, President and CEO of Energy*Solutions*. "Who knows the facility better than employees who operated the plant for decades? Offering Dominion a

The Nuclear Ship *Savannah* was envisioned to be an ambassador around the world for the positive aspects of radioactive materials, including the power density of nuclear fuel. On the first core, the ship steamed over 300,000 nautical miles, or roughly twelve times around the globe.

way to retain their employees with decommissioning jobs allows the employees to continue to live and work in the community, where many of them have spent the majority of their careers. It is a model for success and one we will consider going forward with any decommissioning project."

The KPS sale will be finalized in early 2022. Energy*Solutions* has applied for a license transfer with the NRC and for approval by the Public Service Commission of Wisconsin. Upon transfer approval, Energy*Solutions* will immediately commence decommissioning, which it estimates will be fully executed in only eight years.

Regardless of the D&D model applied for a nuclear power plant, test reactor, or ships powered by a reactor, an experienced decommissioning company takes advantage of every opportunity to apply lessons learned and ensure safety is the culture that drives any decommissioning project.

"The key to achieve excellence in safety when completing the life-cycle of a nuclear power plant or reactor is to apply lessons learned from every project we execute," says Energy*Solutions*' Ken Robuck. "We must always maintain safety, not only as our first priority on a particular decommissioning project, but as an element embedded in our company culture, at every office and job site."

Nuclear Ship *Savannah*

Nuclear decommissioning is not limited to power plants on land. In the spring of 2020, Radiation Safety & Control Services, Inc. (RSCS), a New Hampshire corporation supporting the decommissioning of nuclear plants for over 25 years, announced a partnership with Energy*Solutions* to decommission the world's first nuclear-powered merchant ship, the N.S. *Savannah*.

The *Savannah* was conceived and built during the Eisenhower Administration as a tangible worldwide ambassador of Atoms for Peace. The project was a joint program of the U.S. Atomic Energy Commission—which provided the ship's nuclear power plant, fuel, and training for operators—and the Maritime Administration, which provided the ship itself and operated and maintained it on behalf of the United States. In eight years of service from 1962 to 1970, the ship sailed some 455,000 nautical miles, traveled to over 40 foreign and 30 domestic ports, and was visited by over 1.4 million persons.

The program had two major purposes which it satisfied completely; first, to demonstrate the nation's intent to use nuclear technology for peaceful, non-military purposes; and second, to explore the technical and administrative questions associated with employing nuclear powered merchant

ships in international commerce. Although only three other nuclear merchant ships have been built since *Savannah* (one of which, the Russian arctic barge carrier *Sevmorput*, is still in service), the lessons learned remain applicable should the significant economic challenges to commercial nuclear shipping ever be met.

The ship's nuclear power plant is a Babcock & Wilcox pressurized water reactor designed to civilian standards using low-enriched uranium. The design was unusual for its time as it was designed to be refueled from the top of the reactor vessel. The 80-Mw reactor is a tall, narrow cylinder, housed in a cylindrical containment vessel with rounded ends and a 14-foot (4.3 m) diameter vertical cylindrical projection (cupola) housing the control rod drives. In addition to the reactor vessel and control rod drive tower, the 50-foot (15 m) long containment vessel houses the pressurizer, two horizontal steam generators and primary coolant loops, and many of the auxiliary systems and equipment. The reactor was refueled (shuffled) once, in 1968. On the first core, the ship steamed over 300,000 nautical miles, or roughly twelve times around the world.

Savannah received its operating license from the AEC in 1965. A dedicated servicing facility was located in Galveston, Texas, where the ship was refueled and later defueled. *Savannah* made its last voyage in November 1970, and the plant was defueled in 1971. The plant was further modified under the NRC's 1974 mothballing protective storage criteria and received a possession-only license in 1976. The exceptional significance of *Savannah* to the nation's heritage was recognized as early as 1971, in the first formal surveys made after the passage of the 1966 National Historic Preservation Act.

In 1983, *Savannah* was placed on the National Register of Historic Places and was also named a mechanical engineering landmark by the American Society of Mechanical Engineers. In 1991, the ship was named a nuclear landmark by the American Nuclear Society, and a National Historic Landmark by the U.S. National Park Service. From 1981 to 1994, *Savannah* was used as a museum ship at the Patriots Pont Naval and Maritime Museum near Charleston, South Carolina.

Throughout its life, *Savannah* has been owned and maintained by the Maritime Administration (MARAD), originally as part of the U.S. Department of Commerce, and since 1981 as part of the U.S. DOT. When *Savannah* was returned to MARAD in 1994, the ship was placed into long-term retention at the agency's James River Reserve Fleet. MARAD expected to keep *Savannah* there until at least 2025; however, after the events of 9/11, a decision was made to advance decommissioning.

Funding for the project was long in coming, but in 2017 MARAD was able to begin its first decommissioning phase, which included advance and detailed planning, outfitting of the ship, and minor dismantlement of outlying components and equipment. Phases II and III of the project include industrial dismantlement inside the Reactor Compartment, waste material handling and disposal, and license termination. Using an approach similar to the decommissioning general contractor, MARAD awarded an integrated decommissioning and license termination services contract to the joint venture formed by RSCS and Energy*Solutions*. Known as "Nuclear Ship Support Services, LLC" (NSSS), the contractor will perform the Phase II decommissioning (expected to be complete in mid-2023) and Phase III License Termination (expected to be complete in 2025) activities.

As with all licensed facilities, the NRC will control and oversee the decommissioning and license termination processes. Decommissioning activities include safely removing the control rod drive system, pressurizer, reactor pressure vessel, neutron shield tank, steam generators, primary system piping, and outlying equipment. With some exceptions, these materials are considered LLRW and will be disposed of at the Energy*Solutions* Clive, Utah, LLRW disposal facility. The NSSS team will carefully perform the decommissioning to preserve the ship for future use. Working with MARAD, selected components may be retained for future interpretation.

RSCS started working with MARAD in 2007 to perform radiological protection, radiological emergency support, and decommissioning planning. After a five-year gap, in 2018 RSCS joined the Phase I decommissioning team to complete activities in early 2020.

"This ship is designed with a one-of-a-kind reactor and associated support systems," says RSCS' Jay Tarzia. "The goal of the project is to safely and surgically decommission the ship, maintaining maximum ship integrity, to preserve the national historic landmark. As such, we assembled a world-class team with our partner Energy*Solutions* to fulfill MARAD's mission to achieve license termination while also preserving the ship's historic integrity."

> "The key to achieve excellence in safety when completing the lifecycle of a nuclear power plant or reactor is to apply lessons learned from every project we execute. We must always maintain safety, not only as our first priority on a particular decommissioning project, but as an element embedded in our company culture, at every office and job site."
>
> —Ken Robuck, President and CEO of Energy*Solutions*

Panel shares tips to empower women to succeed in the nuclear field

Six women who shared personal stories and tactics to help others succeed in their careers in the nuclear field hope they have ignited a conversation that will continue far beyond a single webinar.

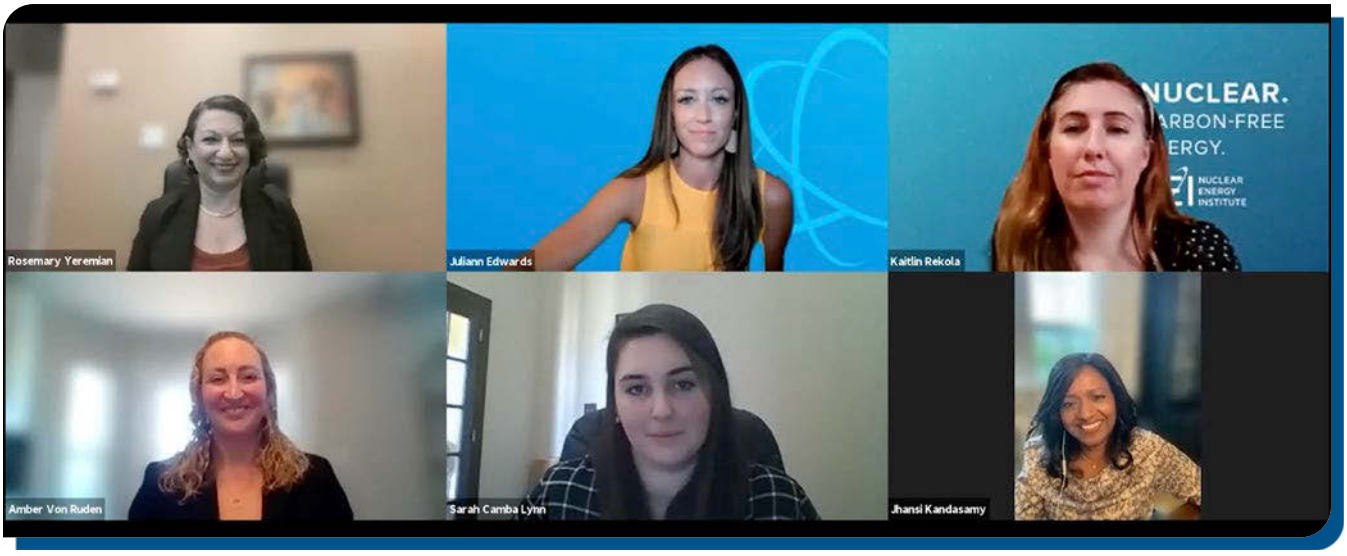
"Empowering Women to Succeed" was hosted by the American Nuclear Society on September 22, presented by a group of four nuclear organizations—ANS, North American Young Generation in Nuclear (NAYGN), U.S. Women in Nuclear (U.S. WIN), and the Nuclear Energy Institute (NEI)—which have pledged to work together as #AtomicAllies.

Moderated by Rosemary Yeremian, vice president of corporate strategy for X-energy Canada, who recently published a book titled *Step Up: The Key to Succeeding in Male-Dominated Businesses*, the panel included five other established and emerging nuclear leaders who spoke about their own experiences in the nuclear workforce and the importance of reflection and self-determination.

Yeremian was introduced by Timothy Crook, incoming chair of the ANS Operations and Power Division, who also coordinated the Q&A session that wrapped up the webinar. If you missed it you can watch the recording, online at ans.org/webinars/archive.

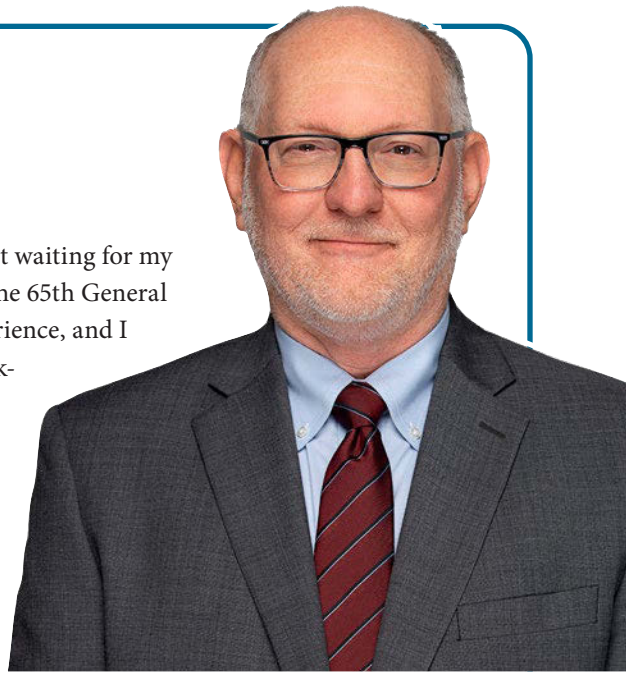
Leading off, Yeremian said that when 75 percent or more of the people in a professional workforce have the same gender, workplace interactions will have a different "flavor." A pattern of competition in any field can result in a zero-sum game of one-upmanship, and those looking for success must "step up to the plate

Panel continues on page 32



The panelists at the September 22 "Empowering Women to Succeed" webinar. Clockwise from top left: Yeremian, Edwards, Rekola, Kandasamy, Camba Lynn, and Von Ruden.

The big nuclear world



Steven P. Nesbit
president@ans.org

As I write this column, it's late September, and I'm sitting in Dulles Airport waiting for my connecting flight back to Charlotte from Vienna, Austria, where I attended the 65th General Conference of the International Atomic Energy Agency. It was quite an experience, and I want to share a few observations with you. But first, let me provide some background on the IAEA, which is perhaps not as well-known to Americans as to those in other countries.

The IAEA was established in 1957 within the United Nations family and as an outgrowth of President Dwight Eisenhower's famous 1953 "Atoms for Peace" speech. It is the world's central intergovernmental forum for scientific and technical cooperation in the nuclear field. The objectives of the IAEA's dual mission—to promote and control the use of the atom—are defined in Article II of the IAEA Statute.

When you hear "IAEA," you probably think first about the agency's nuclear nonproliferation mission—ensuring compliance with the Nuclear Non-Proliferation Treaty and other agreements through inspection, monitoring, and analysis. That mission does not have a direct impact on U.S. nuclear workers because the U. S. is a nuclear weapons state. For the world at large, however, the IAEA has a significant footprint, not just in the nuclear safeguards area but in promoting the peaceful use of nuclear energy, promulgating standards, assisting member states, enabling information transfer, and encouraging international cooperation. The large majority of IAEA member states do not have nuclear power plants, although a number of those countries aspire to them. The U.S. government is very involved in IAEA activities, primarily through the Departments of Energy and State.

I represented the American Nuclear Society as a registered observer at the 65th General Conference. I also attended official side events and participated in meetings with government and industry representatives, both U.S. and foreign. I met with leaders of societies for nuclear professionals in other countries and regions of the world. Rather than provide a detailed play-by-play, I'd like to share a few of my takeaways:

If you have ever attended the Nuclear Regulatory Commission's annual Regulatory Information Conference, you have something of a feel for the IAEA General Conference. There are hours and hours of plenary meetings each day, but the real action takes place in other venues, including hall conversations.

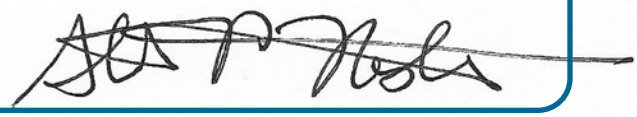
Just about all the attendees speak English. Thank God.

Many foreign governments and companies are very interested in using U.S. technology.

While the focus in the U.S. is on advanced non-light water reactors, that is not necessarily true overseas. There is appreciable interest in large LWRs and in light water small modular reactors. Potential customers value a proven track record.

We are lucky to have a government that appreciates the value of nuclear energy. Some European countries (e.g., Germany) vehemently oppose using nuclear energy to reduce greenhouse gas emissions but are fine with expanding the use of natural gas. Go figure.

An element of truth abides in the perception that Americans are insular and overly focused on our own affairs. There is a big nuclear world out there. It needs us and we need it. Opportunities for nuclear professionals to engage with international colleagues come up from time to time in work activities, ANS meetings, and other venues. I encourage you to take advantage of them.



Nuclear Trending continues

Panel, continued from page 30

and play the game."

"We have to recognize that if anyone, male or female, wants to get ahead in nuclear, we have to carve a path for ourselves where none existed before," Yeremian said. "We have to volunteer for new projects. We need to take credit for our accomplishments. We need to be confident. We need to not back down. And we have to do all this elegantly and while keeping our cool. It's not an easy task, but it can be done."

Amber Von Ruden, of Exelon, is a past president of NAYGN. She talked about the perception of assertive personality traits in females as intimidating or aggressive when "in reality we are assertive, directive, confident, and ambitious leaders."

Von Ruden described being told in a performance review that she was sometimes perceived as intimidating, only to have her plant manager later intercede and praise her leadership style. "What I realized from that experience was I really did not need to fundamentally change," Von Ruden said. "Having that plant manager be a champion and an ally for me and tell me, 'you go, girl, you can have this assertive personality and we'll respect it at a leadership team level,' really went a long way for me in rebuilding my leadership confidence."

Kaitlin Rekola, senior staff council at NEI, spoke about work-life balance, which she said could be framed as "creating an environment for yourself that sets boundaries and allows you to be present where you are needed."

Rekola posed five questions that anyone assessing their work-life balance can ask themselves: "Am I spending time the way I want to? Have I set boundaries to protect the most important parts of my life? Are my habits and routines in line with my priorities? Have I communicated my priorities to those people closest to me? Do I have a system to identify and prevent burnout?"

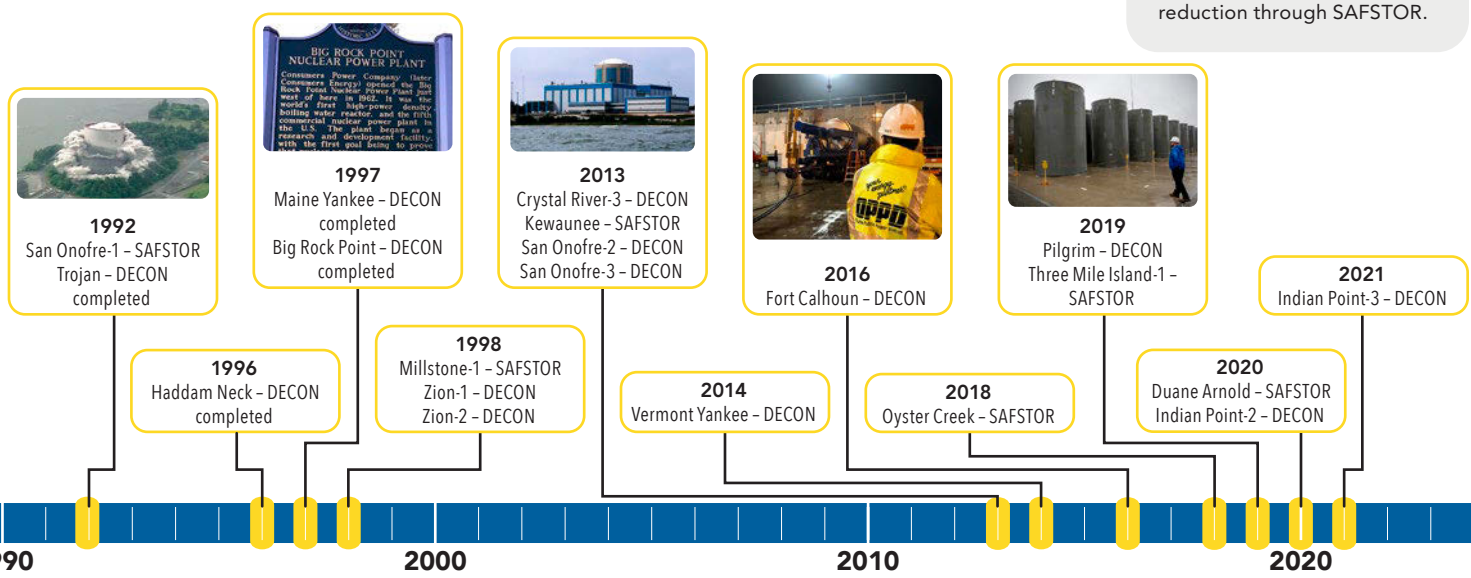
Sarah Camba Lynn, of Luminant, is treasurer on the ANS Young Members Group Executive Committee. She spoke about taking credit for accomplishments and described the potential pitfalls that await a young engineer in workplace meetings if that engineer lacks confidence or has already experienced the frustration of suggesting an idea that is quickly dismissed, only to be suggested later by someone else who then gets credit for the idea.

"One way that I found to combat this is actually seeking out allies before you go into meetings," Camba Lynn said. After discussing her

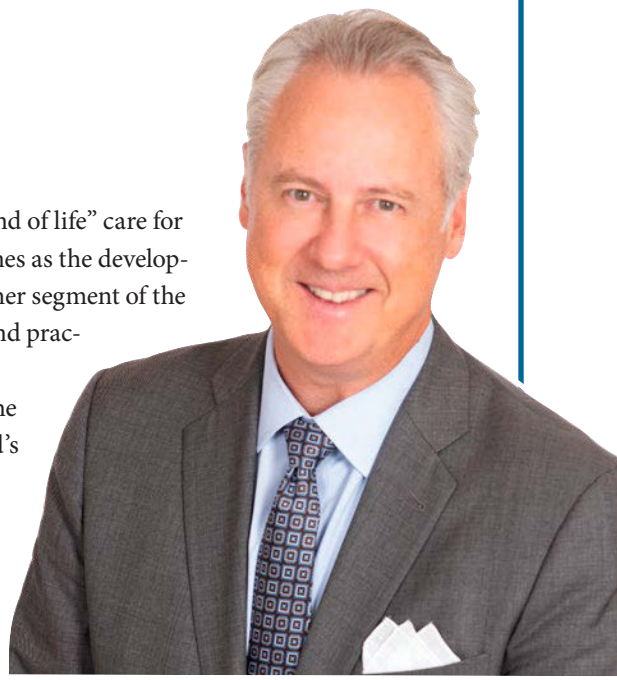
Panel continues on page 34

Nuclear Notables—Decommissioning status for U.S. nuclear power plants shut down since 1990

Turn to page 10 for more on the choice between rapid dismantlement through DECON or radiation reduction through SAFSTOR.



Are we good enough for nuclear?



Craig Piercy
cpiercy@ans.org

This month's issue of *Nuclear News* is dedicated to the people who provide "end of life" care for our nuclear reactors and facilities. Yes, D&D work may not get the same headlines as the development of advanced reactor designs. But if you look closely, you will find yet another segment of the nuclear professional community quietly driving advancements in technology and practice that lower costs, speed up time frames, and improve overall results.

Many of our former nuclear plants are now essentially greenfield sites, with the on-site storage of spent fuel remaining as the only outward reminder of the land's history. Clearly, our professionals have done their work well. Now, if only our elected leaders would do theirs.

Which brings me to a larger observation that has seeped into my thinking over the past few months. As a community, we spend a lot of time trying to convince people of the societal value of nuclear technology. In those discussions, we almost always start from a defensive position.

You know how it goes. "Yes, I know what you've seen on TV, but nuclear really does have an excellent record of safety. Yes, even though U.S. policies have been stuck in the mud for 20 years, we really do know what to do with the waste. Yes, there have been significant cost overruns with the most recent U.S. projects, but nuclear energy really will be affordable the next time around. Yes, it is possible for bad actors to use fissile material or radiological sources, but our nonproliferation regime really is strong and getting stronger."

It seems that in these exchanges we are always trying to soothe the same nagging doubt we sense in our conversational partner, that somehow nuclear as a technology simply isn't good enough for us, our kids, our country, our world. Yet, I've begun to wonder whether we have the question backwards—that it's not whether nuclear is good enough for us, but rather, are we good enough for nuclear?

Nuclear has an unrivaled capability to address our environmental challenges and enable the kind of just, sustainable, long-term economic prosperity we all want for our nation and the world. But it is an exacting technology, one that doesn't abide amateurs or dilettantes well and requires a healthy dose of national commitment, competence, patience, and trust from both the public and our political and business leaders.

Nations that succeed in nuclear technology development seem to share a set of common characteristics. They tend to be comfortable thinking long term and willing to make investments that don't show an immediate return. They have a genuine appreciation for the geopolitical importance of civil nuclear technology, recognizing both the power of its influence and the practical limits of its control. They have a polity that generally follows the science, and they can resist the temptation to score cheap political points at the expense of reasoned policy. Finally, and perhaps most importantly, they have a certain level of trust in their public institutions, a precious commodity that studies consistently show is in a steady, long-term decline.

On that basis, it's pretty obvious that America still has some work to do to be "good enough for nuclear." But I am an optimist by nature, and I see positive progress, whether it is the growing bipartisan base of support for nuclear in Congress, the successful preservation of existing plants in some states, or the increasing number of companies that are accepting nuclear as clean energy for environmental, social, and governance purposes. I hope that as we dust ourselves off from this "high-entropy" period in our history, we will emerge a bit wiser about the risks and benefits of the big choices ahead.

Nuclear Trending continues

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ideas with a colleague before a meeting, she knows, "If I bring something up, within a couple minutes, he will echo that and say, 'Hey, I really like Sarah's idea because of these three reasons.'"

Camba Lynn explained, "Now, that does two things. If you're lacking confidence like I was, you know you have someone in the room to continue that discussion. And if you find yourself in this situation where your idea has been dismissed . . . it's a lot harder for it to be repackaged and credited to someone else."

Juliann Edwards, of Energy Solutions, has worked in sales and business development for 15 years. She spoke about how she addresses workplace harassment—which affects 85 percent of women—using her training and experience in negotiation.

"In my opinion, harassment, sexual harassment, bullying is all a form of negotiation," Edwards said. "Person A is trying to get person B to say yes to something or they're trying to indirectly get you to accept or be more tolerant of that type of behavior that's inappropriate."

Edwards offered specific tools from the art of negotiating to prevent and address harassment and swiftly return the focus of conversation to business goals while building experience, self-confidence, and community with other women and supportive colleagues.

Jhansi Kandasamy, of GE Hitachi, is a past chair of U.S. WIN. Kandasamy spoke about natural leadership qualities, prefacing her comments by explaining she was not born a leader. Instead, she said, as a young electrical engineer at a nuclear plant, "I had to work extra hard. I had to know from a technical perspective exactly what I was talking about. Why are we building it there? What is that wiring going to do? Is it going to hurt the outcome that's needed? I had to know the ins and outs of everything and be better than my male counterpart," she said. "I hate to say that, but that's how it was back then."

Kandasamy learned to be more vocal and earn the respect of her colleagues by asking questions in the field. She shared a motto that she uses today as a leader in her company: "Motivate. Innovate. Execute/Create. Celebrate. . . . Repeat."

ANS urges Congress to address availability of HALEU for advanced reactor fuel

Congress needs to take swift action to build a domestic supply of high-assay low-enriched uranium (HALEU) to fuel advanced reactors, the American Nuclear Society declared in a September 14 letter to Sens. Joe Manchin (D., W.Va.), chair of the Senate Energy and Natural Resources Committee, and John Barrasso (R., Wyo.), the committee's ranking member.

The letter, signed by ANS President Steven Nesbit and executive director/chief executive officer Craig Piercy, notes that while many advanced reactor designs—including nine of the 10 designs awarded funding under the Department of Energy's Advanced Reactor Demonstration Program—require HALEU (uranium enriched to between 5 percent and 20 percent) as reactor fuel, such fuel is currently available only in limited amounts from the DOE via down-blending of existing stockpiles of material and from Russian imports.

"Without a substantial domestic HALEU enrichment capability, we risk not having the fuel needed to power advanced nuclear energy as part of our clean energy future," the letter states. "Long-term reliance on Russian state-owned uranium producers exposes our largest carbon-free energy source to unacceptable business and political risk. The maturation of new nuclear technologies and advanced reactor designs underscores the need for securing our domestic nuclear fuel supply chains."

Graphic: DOE/Office of Nuclear Energy

ANS calls for an investment of $200 million annually over five years to process DOE material at levels sufficient to supply demonstrations of next-generation reactor designs. "To address enrichment," the letter adds, "ANS recommends $1.5 billion total over 10 years to produce 20 tons annually, which is what our experts believe will be needed in that time frame."

Nesbit joins panel on Illinois radio program

Following the passage of Illinois's Energy Transition Act in September, an NPR affiliate in central Illinois hosted a 30-minute panel discussion with three guests to discuss the landmark legislation. The radio program, *The 21st Show*, invited Jennifer Walling, executive director of the Illinois Environmental Council; Mark Denzler, president and chief executive officer of the Illinois Manufacturers' Association; and Steven Nesbit, president of the American Nuclear Society, to discuss the different sides of this debate. Two were supporters of the bill, and one was opposed to it.

Nuclear Trending continues

Because of the "landmark but controversial clean energy bill," as described on *The 21st Show*'s website, "nuclear power plants will be kept on line, and solar and wind developments will continue to grow, while coal and natural gas power plants are expected to gradually go off line. In the long term, Illinois's electricity will be produced completely from clean sources by 2050."

The host of the show, Brian Mackey, opened the segment with a sound bite from Illinois Gov. J. B. Pritzker's press conference where he signed the legislation on September 15. Pritzker said that Illinois "is taking a giant step forward to mitigate the impacts of climate change and establish the most aggressive clean energy standards in the Midwest, supporting the creation of thousands of clean energy jobs."

Mackey noted that while the legislation did have bipartisan support, the bill did not pass unanimously. Those opposed to it believe it will harm businesses and manufacturers, will cost downstate jobs, and will not end fossil fuel consumption. One Republican senator said that while Illinois will decrease its carbon emissions, states like Indiana and Kentucky are still relying on coal plants. It was also noted that depending on who is doing the estimating, residents of Illinois could pay anywhere from $2 to $15 more per month for electricity.

After this setup, Mackey turned to the panelists and asked for their views on the legislation. While it is difficult to make progress with listeners about the benefits of nuclear in such a short segment, it was positive to hear the host and the panelists endorse keeping nuclear power plants on line (even as a bridge to more renewables, as begrudgingly stated by Walling). It was refreshing to hear from others outside the nuclear community that, realistically, there is no way to decarbonize and provide reliable power without nuclear, especially in Illinois, where nuclear currently produces over 50 percent of the state's total net electricity generation.

For more in-depth coverage of the webinar go to ans.org/news/article-3264/.


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Cintichem's research reactor and hot cell facility decommissioning

By Thomas S. LaGuardia and Joseph E. Carignan

The Cintichem radioisotope production facility was located in Tuxedo, N.Y., 60 miles northwest of New York City, on a 100-acre site in the Sterling Forest Industrial Park. The facility was owned and operated by Union Carbide Corporation until 1984, when it was sold to Hoffman-LaRoche, a large pharmaceutical company.

The facility consisted of a 5-MWt, pool-type research reactor and production facility, connected via a 12-foot-deep, water-filled transfer canal to a bank of five adjacent hot cells. The facility began operation in the early 1960s, producing neutron-irradiated, enriched uranium target capsules. The fuel was 93 percent high-enriched uranium.

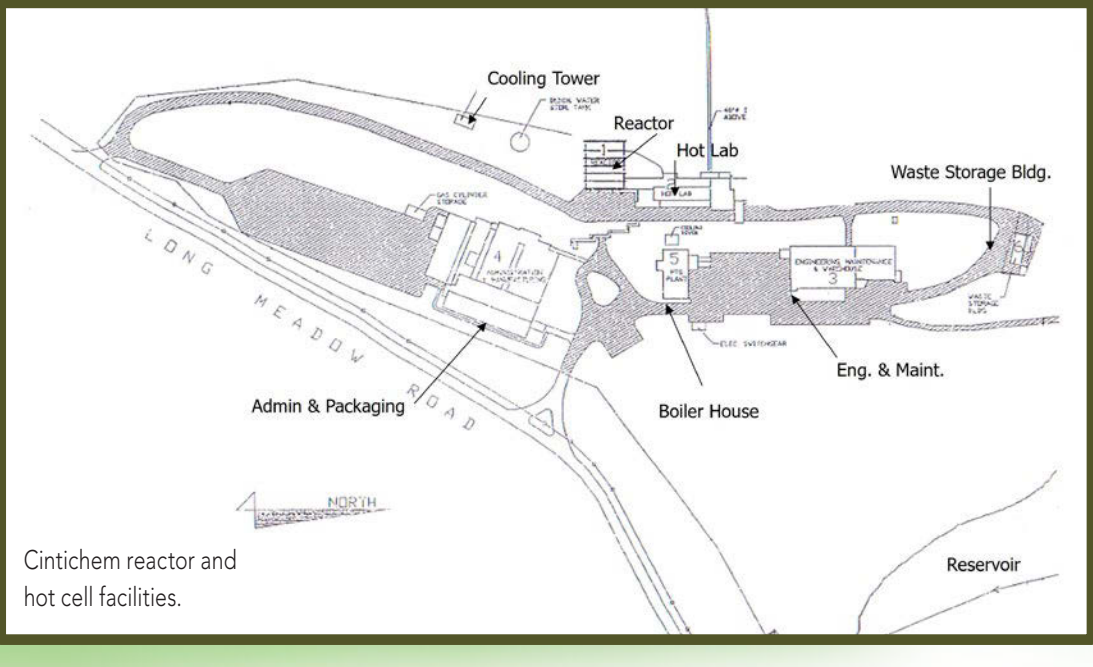
Cintichem developed a process for separating radioisotopes from the mixed fission product matrix for use by the medical industry. By the late 1970s, 200,000 curies of radioisotopes were being produced weekly. The facility operated for a period of 30 years for 906,000 MW-hours, resulting in an average utilization of greater than 90 percent. As an expected consequence of this production process, the hot cells became contaminated with mixed fission products and transuranics, and activation products were created in the reactor core and biological shield structures.

In 1989, during the conduct of routine surveys, radioactive material was discovered in site groundwater. To determine the location of the leaks and the extent of the problem, various below-grade samples were taken from areas near the reactor, the hot cell underground ventilation system, the hold-up tank, the gamma pit, and the transfer canal. All these areas were found to contain radioactive contamination. The total curie content of radioactive materials on-site (excluding the fuel) was estimated at 4,200 curies. Contamination was principally located in the areas shown in the sidebar below.

In early 1990, after attempts to isolate the leaks were unsuccessful, the decision was made to permanently shut down and decommission the facility (i.e., terminate the radioactive materials licenses).

Contaminated areas at Cintichem

- Hot cells (five total).
- Reactor/hot cell transfer canal.
- Neutron-activated concrete and reactor core structure (exclusive of spent fuel and control elements).
- Underground hot cell exhaust system.
- Waste processing system (including below-grade hold-up and storage tanks).
- Soil and bedrock underneath and around the site buildings (from surface to greater than 35 feet below grade).
- Reactor primary and secondary systems.



Cintichem reactor and hot cell facilities.

Continued

Project management

Hoffman-LaRoche made the decision to hire a contractor to assist in decommissioning the site. The company solicited bids for the decommissioning and, in 1990, awarded the contract to TLG Services (TLG), located in Bridgewater, Conn. The management approach was to have TLG become an integral part of the existing Cintichem organization. TLG was to act as project co-manager and supervisor, working alongside the owner in a seamless team, providing the decommissioning expertise the site did not have.

As part of the integration process, duties and responsibilities were defined using a "responsibility matrix" based on TLG's and Cintichem's core competencies, experience, and contractual obligations. TLG was responsible for on-site management (co-management), as well as supervision of the key decommissioning and waste management activities. This included field manual labor personnel working alongside the Cintichem staff. As the licensee, Cintichem retained overall responsibility for the site's day-to-day operations. A summary of the areas of responsibility is shown in the table below.

The owner and TLG worked closely as a team, providing hourly labor workforce (e.g., health physics staff, laborers, and other craft personnel). The labor force reported directly to the TLG management and field supervisory

Responsibility matrix for Cintichem management and field services

	Responsibilities		
Project Scope	**D&D Contractor**	**Cintichem**	**Others**
Planning Phase			
• Site Characterization			
Site Survey	Directed	Performed	—
Activation Analysis	Performed	—	—
Hydrogeology	—	—	Performed
• Cost Estimate	Performed	—	—
• Conceptual Engineering	Performed	—	—
• D&D Plan Preparation	Performed	Performed	—
Site Transition			
• Personnel Hire/Training	Directed	Performed	—
• Reconfiguration of Site	Directed	Performed	Performed
• Purchase Equipment	Directed	Performed	—
• Preliminary Decontamination	Directed	Performed	—
• D&D Planning Approval	Performed	Performed	—
• Procedures/Policies	Performed	Performed	—
D&D Work			
• Line Management	Performed	Performed	—
• Mechanical/Structural Engineering	Performed	—	—
• D&D Labor	Augmented	Performed	Specialty Contractor
• Health Physics/Safety Labor	Augmented	Performed	—
• Maintenance/Craft Support	—	Performed	—
• Soil Criteria	Performed	—	—
• Bedrock Dose Assessment	Performed	—	—
• Final Survey	Directed	Performed	—

Note: The total project labor force was 177, which included six full-time and two part-time seconded D&D contract personnel.

staff. The owner/TLG team also provided the on-site engineering, quality assurance, administration, site services, security, and waste management staff. This integrated approach consisted of a total project labor force of 177 workers. This included six full-time and two part-time TLG employees as seconded D&D contract personnel. The primary scope of TLG's involvement is summarized at right.

Project overview

The Cintichem decommissioning project was initiated in June 1990, when the planning, site preparation, and mobilization phase began. This first phase lasted approximately one year before the NRC issued a decommissioning order for the site. Phase 2, the physical decontamination and dismantling of the plant, began in December 1991.

Continued

The primary scope for TLG

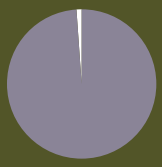
- Site characterization and decommissioning plan preparation.
- Decontamination and dismantling program management.
- Health and safety program management.
- Radiological engineering support and craft labor supervision.

TLG also provided technical support, including:

- Environmental pathways analysis (determination of soil and bedrock release criteria using RESRAD [Ref. 1]) for approval from the Nuclear Regulatory Commission and the New York State Department of Environmental Conservation.
- Structural analysis and shoring design during dismantling activities.
- Cost estimating/scheduling services.
- Reactor support structure and pool wall activation analysis.
- Radwaste management and health physics training, as well as procedure development and review.

Eight years of accomplishments

By August 1996, the reactor building and approximately 70 percent of the land area had been approved for free release by the NRC, the New York Department of Labor, and the New York State Department of Environmental Conservation. In that time:



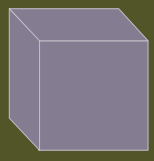
More than 99 percent of the physical decommissioning work was completed.

Essentially all the radioactivity (approximately 5,000 curies) had been removed.

Zero reportable safety incidents throughout the duration of the project.

500,000 person-hours of hands-on labor and 319,000 person-hours of technical, engineering, and management labor were recorded.

A total 165 person-rem of radiation exposure occurred.



Approximately 400,000 cubic feet of radioactive waste was disposed of.

Hydrolazing the hot cells to decrease radiation levels from 1,000 R/hour to below 100 R/hour.

Constructing the outer support structure.

Decontamination, decommissioning, and site restoration

The team began actively decontaminating and dismantling the facility in early 1992, focusing on reducing radiation levels and hot spots in the plant. Within one year after commencing decontamination activities, the radiation level in each of the five hot cells was reduced from a high of 10,000 R/hour to less than 100 mR/hour.

During the decontamination and removal of radioactive material within the structure, it became evident due to the amount of material and soil being removed that it would be necessary to provide a means to support the building structure, as well as contain and control the work environment. After careful evaluation, the decision was made to construct an external steel frame over the hot cell building roof, which was then resupported by an external steel frame structure. This permitted demolition and excavation beneath the hot cells, the reactor pool, the hot cell transfer canal, and other areas within the plant while maintaining containment and structural integrity.

Decontamination, decommissioning, and site restoration tasks accomplished:

Within the first two years (1990–1991):

- The fuel transfer canal was completely decontaminated (approximately 10,000 ft^2 of concrete wall and floor surfaces).
- The five hot cells were cleaned of legacy wastes and completely decontaminated. The hot cell radiation levels were 1,500 R/hour γ and 10,000 R/hour β and contained strontium-90, cesium-137, nickel-63, cerium-144, and antimony-125.
- The reactor core support structure was removed, and the pool area was cleared of extensive activated and contaminated debris. The reactor core structure (primarily aluminum) had radiation levels in excess of 1,000 R/hour. The reactor contained the isotopes silver-110m, cobalt-60, iron-55, technetium-99, nickel-63, hydrogen-3, and strontium-90.
- Experimental beam tubes through the biological shield were core drilled for removal.
- The biological shield dose rates were approximately 3 R/hour.
- Major underground tanks (100,000-gallon tanks) were decontaminated and surrounding contaminated soil removed.
- The hot cell underground exhaust duct was removed. Dose rates were 10 R/hour γ and 100 R/hour β.
- Numerous glove boxes (iodine-125, iodine-131, xenon, etc.) were removed and shipped for disposal.
- Four uranium labs were decontaminated and dismantled.
- Twenty wall storage vaults were removed by core drilling.
- Ninety percent of all radioactivity was removed from the site and 100 percent of all waste greater than Class A.

In the following three years (1992–1994):

- The activated reactor pool wall and biological shield wall structures were decontaminated and demolished.
- All ventilation exhaust system material (500-foot exhaust duct up the side of a mountain) was removed using a helicopter to transport the sections to the base of the mountain.

In the final five years (1994–1998), up until license termination:

- 400,000 ft^3 of contaminated soil and rubble were removed. The level of soil contamination was as high as 500,000 pCi/gm in various locations.
- One hundred percent of all contaminated piping and structures were removed and concrete structures decontaminated.
- The reactor building, pump room, hold-up tank, reactor water storage tank, 30 percent of the original radiation-controlled area, and 100 percent of the unaffected site were final surveyed.
- Hot cells and T-1/evaporator rooms were demolished, and contaminated subsurface soil and bedrock were removed.
- Final survey of affected bedrock contamination areas were core drilled and sampled.
- The termination survey plan was written by TLG and was approved by the NRC. The final surveys commenced in 1996 and were completed in 1997. The NRC, the New York Department of Labor, and the New York State Department of Environmental Conservation terminated the licenses.
- Site restoration was completed in 1998.

Continued

Waste management

The team worked closely together to ensure safe and effective waste disposition. TLG provided the on-site waste management supervision, and the existing Cintichem staff provided the waste handlers for packaging, transport, and disposal.

In addition to the extensive radiological contamination and the activation challenges of working in a relatively small area, the team also encountered toxic and hazardous substances. These substances included asbestos, brick and sheet lead, nitric acid, and graphite blocks from the thermal column. This material was properly characterized, removed, packaged, transported, and disposed of in accordance with federal, state, and local regulations. A total of approximately 11,326 m^3 of waste was generated, of which 3,400 m^3 was material and 7,900 m^3 was soil.

The radiological wastes resulting from the decommissioning were sent to Chem-Nuclear, in Barnwell, S.C, and to Envirocare, in Clive, Utah. The project realized major savings using bulk shipments of components in SeaVans shipping containers and bulk shipments of contaminated soil in covered tractor-trailers. All shipments were made in accordance with applicable Department of Transportation regulations, without incident.

Regulatory requirements

For structures/equipment, the following criteria were imposed:

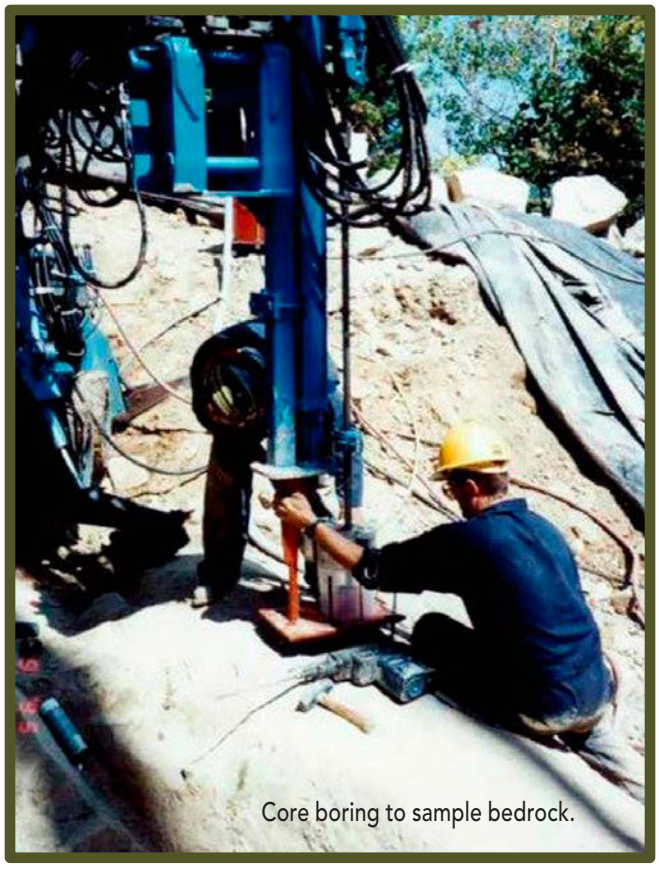
- Rx mix: 13,500 dpm/100 cm^2.
- HL mix: 1300 dpm/100 cm^2.
- 5 μR/hr at one meter.

For soil down to bedrock, the following criteria were imposed:

- 10 mR/year; 3 mR/year ALARA goal.
- Average less than 5 μR/hour at one meter.
- Soil, site-specific criteria, RESRAD model.
- Bedrock, site-specific criteria, custom model.

For drinking water, the following criterion was imposed:

- Less than 4 mR/yr.



Core boring to sample bedrock.

Regulatory interface

The Cintichem project operated under licenses from the NRC, the New York State Department of Labor, and the New York State Department of Environmental Conservation. The regulatory criteria included SECY 94-145 (Ref. 2); New York Codes, Part 38 (Ref. 3); and AEC Regulatory Guide 1.86 (Ref. 4).

TLG provided technical support and guidance to Cintichem management in interfacing with the three regulatory agencies and in meeting regulatory requirements. One significant challenge to the project was in addressing the contamination levels in the bedrock on which much of the site was built. Numerous core boring samples were taken in the bedrock to determine contamination levels. To address this concern and obtain site release, numerous RESRAD computer analyses were performed to demonstrate to the NRC that radiological contamination in the bedrock was safe to leave in place and still meet the NRC's criteria for license termination.

Final site survey

The final site survey addressed NUREG 5849 guidance (Ref. 5). There were 37 affected areas and 100 unaffected areas.

For structures, the gamma dose, total surface contamination, and removable contamination were surveyed covering 20,150 m²:

- Unaffected survey units: 30 random points/ greater than 1 Pt/50m².
- Affected survey units: 1 Pt/m² Rx, 5 Pts/m² hot lab, grid.

For land, the gamma dose rate, soil samples, hot spot scans, and biased samples were surveyed covering 372,500 m²:

- Unaffected survey units: 30 random points.
- Affected survey units: 10- by-10-meter grid, 5 points/grid.

For bedrock, cores were taken covering 10,300 m³ as follows:

- 5 cores/100 m².
- Biased cores.
- 0.3-m-interval samples.

In addition, during decommissioning, the following samples were taken:

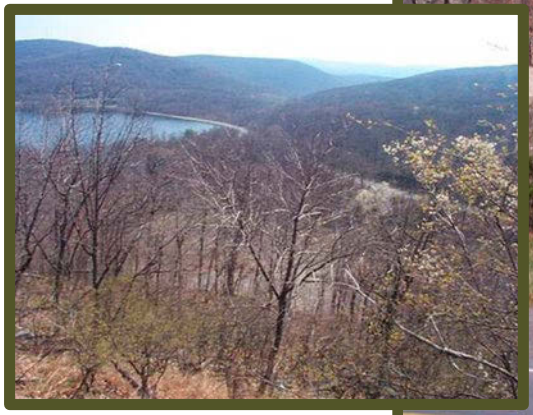
- Miscellaneous items (during D&D).
- Concrete blocks and rubble: 2,800 m³.
- Sorted soil: 5,300 m³.
- Miscellaneous equipment: 170 m³ (5,500 items).
- D&D tools and equipment: 600 m³.

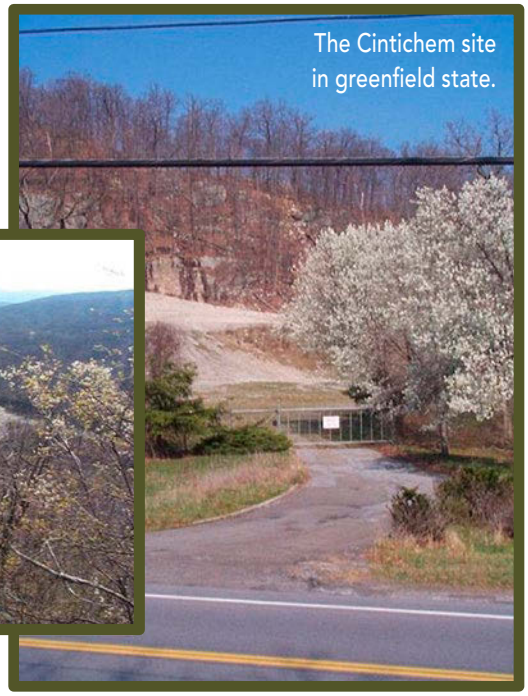
In all, the final site survey effort consisted of:

- 32,000 tons of material.
- 3,430 soil/bedrock samples—approximately 271,300 measurements.
- 8,000 soil samples—approximately 1.4 million measurements.
- 160,000 person-hours (field and laboratory)—approximately 20 measurements/ person-hour.
- 0.3 analyses/person-hour (strontium-90 + γ spectrometry).

Public involvement

The team held quarterly meetings with local public interest groups. This consisted of evening meetings where the status of the project was explained and anticipated future activities were outlined for the public. Questions and answers were handled by the TLG/Cintichem team as a joint effort.





The Cintichem site in greenfield state.

Cost and schedule

The overall cost of the project was $112 million, and the period of performance was between 1989 and 1998. TLG performed its work on a time-and-materials basis for approximately $4 million.

Continued

Lessons learned

- Bedrock with a high natural background radiation level required more complex analyses to meet release criteria.
- Access to areas can be difficult due to building and floor demolition, requiring lifts and scaffolding in many areas. This also results in additional safety measures.
- Underground sewer pipes and process lines were difficult to survey (the project had more than 670 meters to survey).
- Contamination can be difficult to survey or find when hidden due to cracks, seams, paint, and water.
- Releasing structures requires a significant labor effort. The project had to survey over 2,000 small areas (pigeonholes) on the interior corrugated roof and the walls.
- During characterization and surveying, ambient background can interfere with results.
- The site was constructed on the side of a mountain and bedrock. Rain and snow would recontaminate areas already decontaminated and considered "clean."
- A cost-benefit analysis during waste processing and disposal determined that the efforts to minimize waste by decontamination or efficient packing are not always cost-effective.
- Surface decontamination is normally not cost-effective for most building structures, depending on the cost of decontamination versus the cost of direct disposal (cost-benefit analysis).
- Complete characterization may not be accomplished up front, and it is often an iterative process.
- Don't take vendor information at face value. Verify by mock-ups or references from other companies that have successfully used the approach or product.
- Aggressive D&D should be the first approach to reduce costs and personnel dose:
    - Reduces radiation levels, which will often result in savings in the cost of doing the work and dose to personnel and the overall project.
    - Disposal cost can change during the decommissioning project so that disposition of radiological material while costs are known is prudent.
    - Understand labor/time/decontamination. Often it may not be cost-effective to decontaminate material but more cost-effective to ship material as radioactive waste.

Lessons learned

During the 1990s, the decommissioning of commercial facilities with nuclear material and contamination was relatively new. Over the years, computer technology, tools, and equipment have advanced significantly. In addition, many of the lessons learned have been factored into ongoing projects today. In the case of Cintichem, many of the tools used were off-the-shelf from local vendors or were fabricated on-site. As with any complex project extending over years of activities, prudent reviews can reveal important lessons learned to be applied to future projects of a similar nature. The sidebar above details the lessons learned by Cintichem during this project.

References

1. *Multi-Agency Radiation Survey and Site Investigation Manual* (NUREG-1575), U.S. NRC.

2. *Increase of Tritium and Iron-55 Unrestricted Use Limits for Surface Contamination at Shoreham and Fort St. Vrain*, SECY-94-145, U.S. NRC, May 27, 1994.

3. *Ionizing Radiation Protection*, Title 12, New York State Department of Labor, New York.

4. *Termination of Operating Licenses for Nuclear Reactors*, Regulatory Guide 1.86, Atomic Energy Commission, June 1974.

5. *Manual for Conducting Radiological Surveys in Support of License Termination* (NUREG/CR-5849), Oak Ridge Associated Universities, U.S. NRC, 1992.

Thomas S. LaGuardia (tsl8@aol.com) has more than 50 years of decommissioning experience and is the founder of TLG Services, Inc. He has served as editor for three editions of The Decommissioning Handbook *and also authored the first definitive text on preparing cost estimates for decommissioning nuclear power plants.*

Joseph E. Carignan (jecarignan@aol.com) formed Carignan & Associates, LLC, in 2015 to provide support services to the nuclear industry in the areas of decommissioning cost estimation, due diligence, assessments, and management support. He has over 35 years in the nuclear industry related to decommissioning activities, both domestically and internationally.

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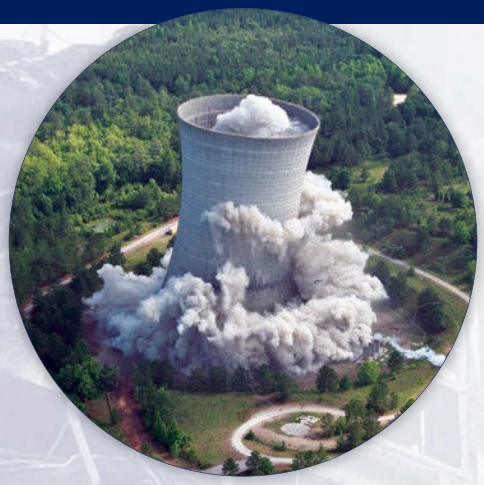

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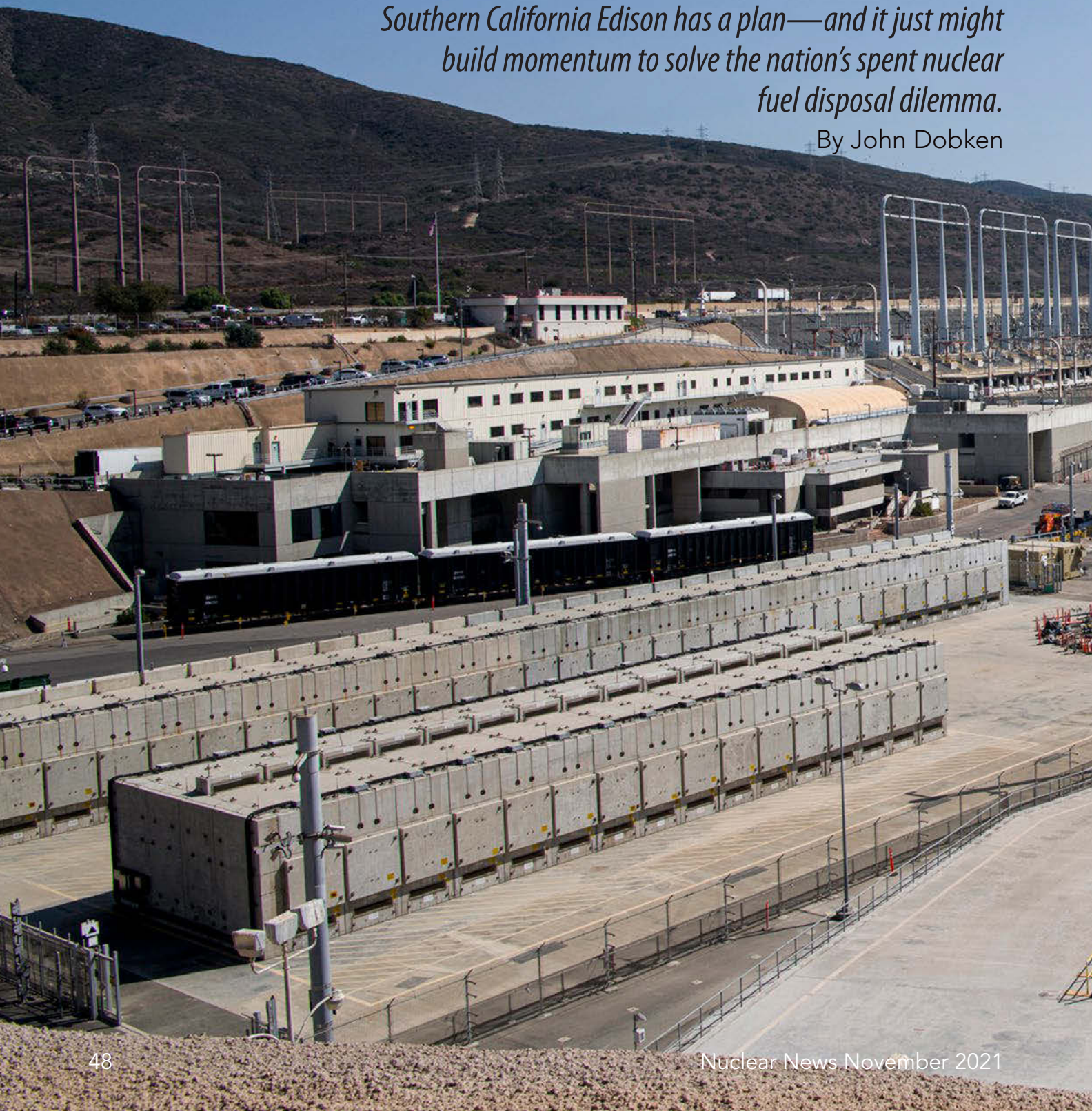
DECOMMISSIONING San Onofre

Southern California Edison has a plan—and it just might build momentum to solve the nation's spent nuclear fuel disposal dilemma.

By John Dobken



Imagine it's January 1998. A specially equipped train from the Department of Energy rolls up to the San Onofre Nuclear Generating Station (SONGS) to pick up spent nuclear fuel and take it to the Yucca Mountain repository in Nevada. This scene is repeated thousands of times at nuclear plant sites across the U.S. over the ensuing decades. The solution to permanent spent fuel disposal as outlined in the Nuclear Waste Policy Act (and its amendments) is working as intended. The nation's commercial spent fuel is safely isolated deep underground for the long term.

But that is not what happened. Work on Yucca Mountain has been stalled for a full decade, and the organization within the DOE that by law is responsible for managing the spent fuel program has been defunded and disbanded.

Today, the nation's spent fuel remains at operating and decommissioned nuclear plant sites in temporary storage facilities. In 2003, plant owner Southern California Edison (SCE) began storing spent fuel at SONGS in dry cask storage—robust stainless steel canisters that are designed for on-site storage and off-site transportation. To date, 123 such canisters are at SONGS as part of a system that cools the fuel and protects it in reinforced concrete structures.

While still completely safe, these storage sites at decommissioned plants prevent the land on which they sit from being repurposed for other uses. In the case of SONGS, that means use by the U.S. Marine Corps at Camp Pendleton. In a March 2021 letter, Brig. Gen. Dan Conley called perpetual storage of spent fuel at SONGS "inconsistent with the Marine Corps' national defense mission."

Twenty-three years on from January 1998, the questions remain: When will the spent fuel be relocated, and to where?

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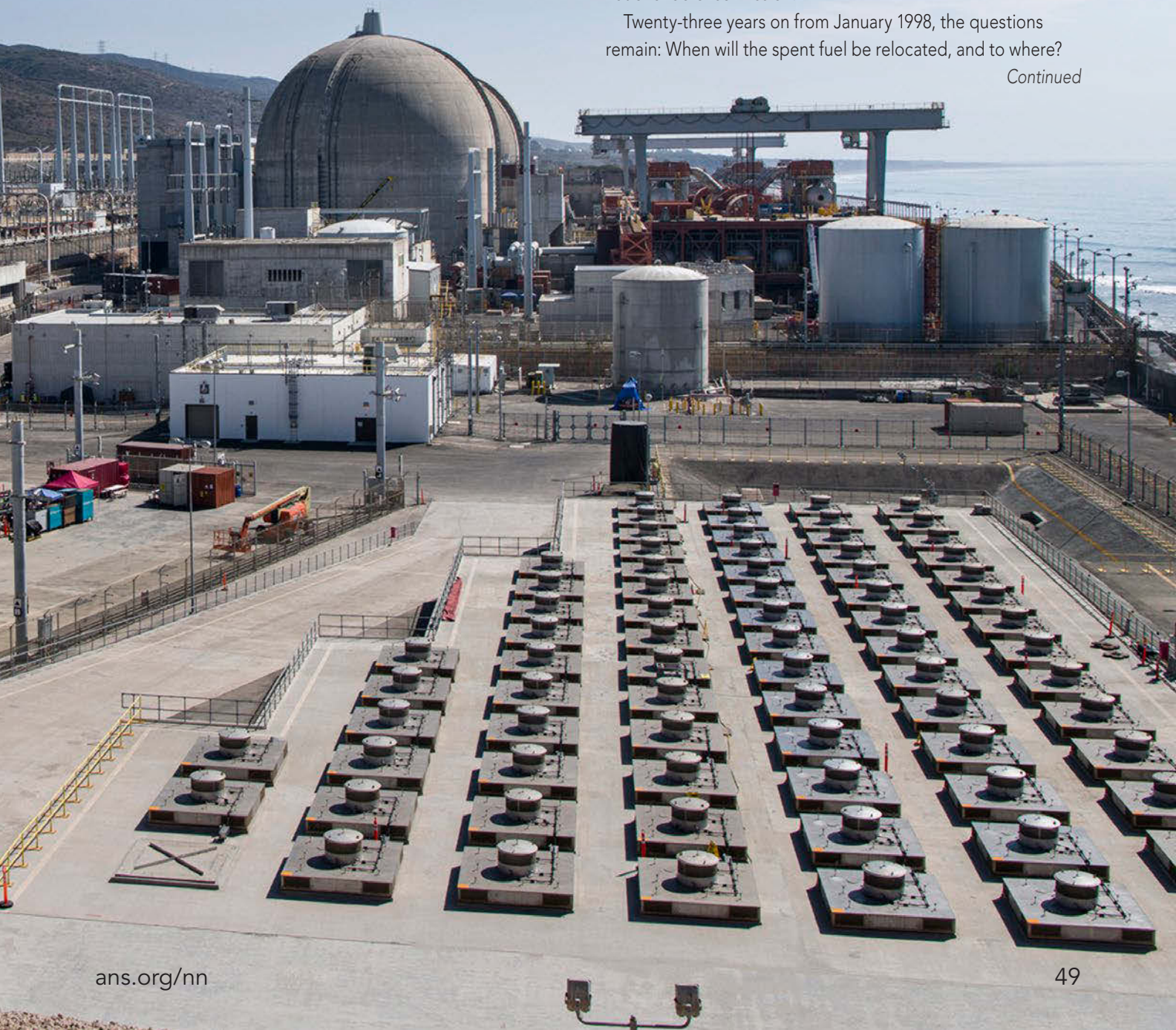


Decommissioning and dismantlement at SONGS

On June 12, 2013, SCE formally notified the Nuclear Regulatory Commission that it had permanently ceased operation of SONGS Units 2 and 3 five days prior. The notification, called a certification of permanent cessation of power operations, set the stage for SCE to begin preparations for decommissioning and dismantling the plant.

Decommissioning is a well-defined NRC process that involves safely transferring the spent nuclear fuel into storage, followed by the eventual removal and disposal of radioactive components and materials from the site. Any residual radioactivity is to be reduced in a manner and to a level that is safe for unrestricted use by site employees and the public.

For SONGS, this effort will support the termination of SCE's NRC license and the return of the site to its owner, the U.S. Navy. Dismantlement began in the first quarter of 2020 and will involve the deconstruction of above-grade structures associated with Units 2 and 3 in compliance with NRC requirements, as well as the partial removal of offshore undersea conduits (large pipes) and offshore buoys and anchors. SONGS Decommissioning Solutions is the decommissioning general contractor. The project is expected to create about 600 jobs during the 8- to 10-year dismantlement phase, and the majority of the labor force will be hired locally from the San Diego region.

Water is used for dust suppression as an excavator works to demolish the Unit 2 diesel generator building at SONGS.

A fresh approach

In March, SCE distributed a three-volume set of plans with the intent not just to address the SONGS decommissioning, but possibly to help kick-start the process of solving the entire nation's spent fuel disposal dilemma.

"These plans provide the opportunity to analyze three broad areas related to spent fuel removal," said Doug Bauder, SCE vice president and chief nuclear officer. "First, identifying the pathways, options, and feasibility, both near term and long term, to relocate the fuel off site. Second, the transportation considerations to safely get [spent fuel] from point A to point B. And third, the steps SCE will take to be prepared when the opportunity arises."

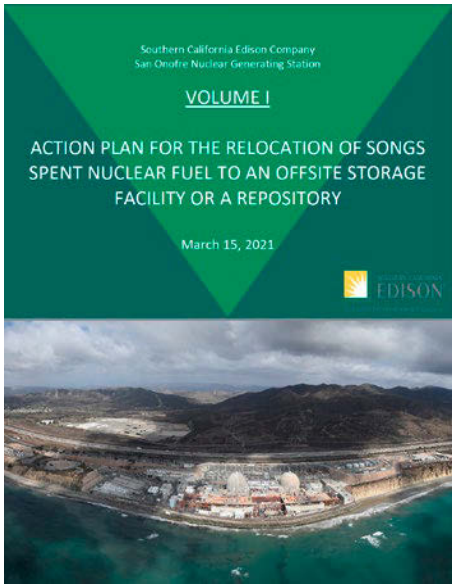
To accomplish the task, SCE consulted some of the country's leading subject matter experts. In June 2019, SCE retained North Wind, Inc., which worked with SCE and its experts team to support the assessment of off-site alternatives and author the plans. The experts team included chair Tom Isaacs, a former director of the DOE's Office of Policy, and Allison Macfarlane, a former NRC chairman. In addition, dozens of stakeholders from the local community and region were interviewed as part of the process.

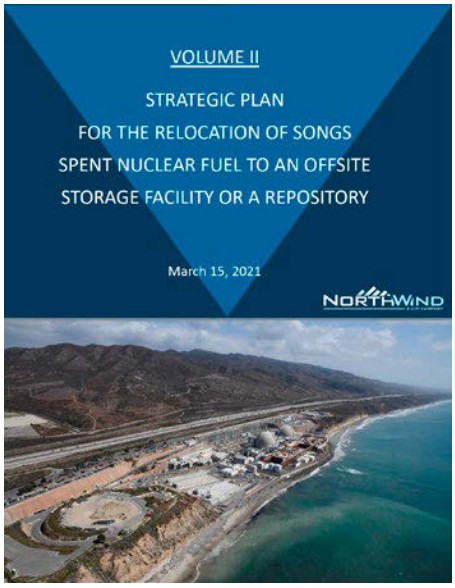
"The team members brought together a variety of experiences in dealing with the challenges of nuclear waste management," said Joe Hezir, principal of EJM Associates, an energy industry advisory group founded by former energy secretary Ernest Moniz. "They worked intensively to apply their respective areas of expertise and experience to create a viable and durable blueprint for disposition of the SONGS spent fuel."

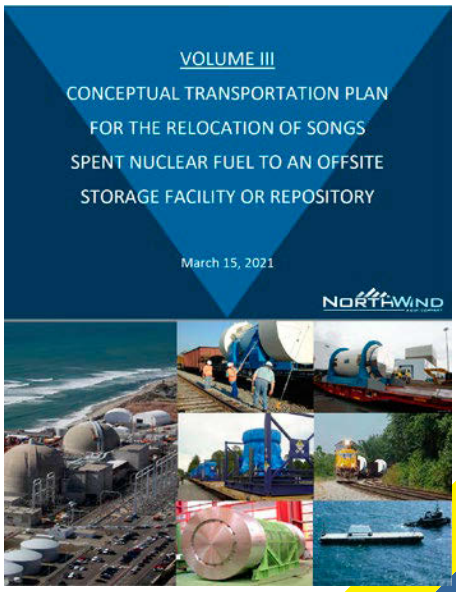
The team created three plans: the Action Plan, the Strategic Plan, and the Conceptual Transportation Plan.

The Action Plan lays out near-term measures that SCE and San Onofre's co-owners will take to advance off-site relocation of the spent fuel and to be prepared to move the fuel should an opportunity arise. The Strategic Plan identifies and analyzes a range of alternatives for spent fuel removal while making clear the challenges and needed actions for those alternatives to be realized. The Conceptual Transportation Plan focuses on specific steps and strategic considerations in planning for and executing the shipment of spent fuel from San Onofre to an off-site location, assumed to be in the southwestern United States.

These plans were developed to be flexible and can be adopted by other nuclear power plants. "SCE's commitment to act on the analysis in the Strategic Plan and accompanying Conceptual Transportation Plan may very well be the catalyst needed for this country to finally solve its dilemma around the storage and disposal of spent nuclear fuel," Hezir said.







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A two-pronged approach

In coming up with the three plans, the SCE experts team found that the most viable solution to the nation's spent fuel problem is the development of a federally supported interim storage site, coupled with the development of a permanent repository. The reason for this is timing. Even if Congress acts soon to restart work on a permanent repository—at Yucca Mountain or elsewhere—it will take several decades before a site is licensed and ready to receive spent fuel. An interim ground-level storage facility can be sited, licensed, and constructed in much less time than a deep geologic repository. This allows for spent fuel to be moved from multiple decommissioned sites such as SONGS decades sooner and co-located for greater efficiency.

Hezir explained that there are other reasons for a two-pronged approach as well, such as trust. "Any community, state, or tribe considering hosting a consolidated interim storage facility wants to ensure their site does not become a de facto permanent facility," he said. "If work is progressing toward a permanent repository, it is likely to reassure a potential host that [their] site is indeed an interim one."

Any attempt to force a top-down, federally mandated solution over the objections of a state or community—far from being more efficient—will take longer, cost more, and have lower odds of ultimate success.

Working toward building community consent for such a facility is also an important aspect of the challenge ahead. The 2012 report from the Blue Ribbon Commission on America's Nuclear Future summed it up this way: "Any attempt to force a top-down, federally mandated solution over the objections of a state or community—far from being more efficient—will take longer, cost more, and have lower odds of ultimate success."

Tom Isaacs, who helped develop the Blue Ribbon Commission report and served as chair of the SCE experts team, said that a win-win-win situation is possible where the interests of the local host community, the state, and the federal government can align to the benefit of each constituency.

"It has to be a relationship that can stand the test of time as it will be many decades for such a facility to be sited, licensed, built, operated, and ultimately closed," Isaacs said. "Politics, values, economics, and more will change over such time frames. So, it won't be easy, straightforward, or quick."

Changes needed

To make both an interim facility and a permanent facility a reality, Isaacs and Hezir say that structural changes are needed at the federal level, primarily through the legislative process.

"We need federal legislation to establish a new single-purpose, preferably independent, waste management organization responsible for managing the U.S. spent nuclear fuel and high-level radioactive wastes with reliable funding," Isaacs said. "Nuclear utility customers have prepaid more than $40 billion for the disposal of spent fuel, and they deserve a solution."

Hezir said that can happen, but there needs to be a groundswell of voices demanding change. "New national policy and legislative action is clearly needed," he said. "If the local governments, communities, nuclear utilities within California, and the state itself can join what we see as a growing motivation for action nationwide, it could result in a national legislative agenda to restart the federal waste management program."

A coalition for action

What became clear to SCE during development of its plans is that SCE cannot solve this problem alone. Thus, along with the distribution of the plans, SCE announced the formation of a coalition, Action for Spent Fuel Solutions Now.

Members of the coalition have joined forces to advocate for federal legislation, appropriations (funding), administration policies, and programs that can advance both federal permanent disposal and federally supported off-site interim storage.

The coalition is cochaired by Orange County supervisor Lisa Bartlett and San Diego County supervisor Jim Desmond. Members from the business, labor, Native American, and environmental communities, as well as local governments and local residents, have signed on to support the coalition's mission.

Bartlett led an effort in April to bring a resolution of support for the coalition before the Orange County Board of Supervisors. The vote was unanimous in favor. The same was true for the San Diego County Board of Supervisors, which passed a support resolution by a 5–0 vote in August. The City of Riverside, the City of San Clemente, and the Capistrano Unified School District Board of Trustees have passed similar resolutions.

"I am honored to serve as cochair of Action for Spent Fuel Solutions Now, and proud to have the support of my colleagues on the Orange County Board of Supervisors, as we take on the monumental task of breaking through the stalemate and stimulating action by the federal government to fulfill its obligation and deliver a solution," Bartlett said.

Bartlett and cochair Desmond sent a letter to energy secretary Jennifer Granholm in May, seeking the opportunity to partner on solutions and thanking the secretary for prioritizing the spent nuclear fuel storage issue. During Congressional testimony in early May, Granholm said that the DOE was "moving forward" to develop an approach to find a consent-based interim storage facility with hopes to announce next steps "in the coming months."

Like other complex policy issues, the process will take time. SCE and coalition members urge action now to eventually bring about needed change. Hezir said the signs are there that momentum on the issue is growing, including new legislation, Congress appropriating funds to the DOE for interim storage work, and encouraging comments from Granholm on the issue.

"These initial actions create an opportunity for a coalition effort to step up action by the federal government," Hezir said, "and there is no time to lose as any pathway is likely to take decades to implement."

Homefield advantage

While the coalition is gaining support from area organizations, local residents can also play a key role in making sure the issue stays top of mind with federal officials by joining the effort.

"It's those community voices that we really believe will be powerful, and effective, in drawing attention to this issue at the Congressional level," said Caroline Choi, Edison International and SCE senior vice president for corporate affairs and Edison coalition representative. "Local communities can generate the momentum needed to help us all realize the vision of trains rolling off site with canisters of spent fuel."

Learn more about how spent nuclear fuel is stored safely at SONGS by visiting SONGScommunity.com.

John Dobken (john.dobken@sce.com) is the public information officer for SONGS.

Representative Mike Levin:

The spent fuel caucus and SONGS

On July 21, Rep. Mike Levin (D., Calif.), whose district includes the San Onofre Nuclear Generating Station (SONGS), announced with Rep. Rodney Davis (R., Ill.) the formation of the bipartisan House Spent Nuclear Fuel Solutions Caucus. The caucus, according to its members, seeks to address the challenges associated with stranded U.S. commercial spent fuel and to serve as a forum for those who want to make progress on the issue, regardless of whether they have a preferred solution.

Rep. Levin talked with *Nuclear News* staff writer Tim Gregoire about his goals for the caucus and finding an answer to the country's spent nuclear fuel dilemma.

Short of finding a permanent solution to the spent nuclear fuel issue, what do you hope the caucus can accomplish?

I represent a district in Southern California with the San Onofre Nuclear Generating Station, where decommissioning began a handful of years ago and is still in the process. It is a unique site in that our region has a history of earthquakes, there are fault lines nearby, and it is surrounded by millions of people who live and work in San Diego and Orange Counties. Then we have the roughly 1,600 tons of spent nuclear fuel that is sitting there, and it has been my commitment as long as I have been in Congress to get that waste off the coast as quickly and as safely as possible.

Of course, getting that waste off the coast isn't really the problem; it's the symptom. The real problem is, there is nowhere for us to send it. When I first got into Congress I created a task force of local stakeholders, cochaired by a retired Navy admiral [Leendert "Len" Hering Sr.] and by a former chair of the Nuclear Regulatory Commission [Gregory Jaczko]. In 2020, they came out with a report that included a number of recommendations related to federal action, and one of those recommendations was for us to create a spent nuclear fuel caucus, and that's exactly what we've done.

Continued

My hope is that, along with Rep. Rodney Davis of Illinois, it is a bipartisan group that can amplify the mutual goal of driving progress on safe nuclear storage, nuclear fuel transportation, and ultimately disposal of spent nuclear fuel across the country. As I'm sure you know, decommissioning and inactive nuclear sites are a nationwide problem. There are about 80 locations in 34 states across the country where spent nuclear fuel is stored, and about 25 are co-located with nuclear power plants that are not in use anymore, some of which have even been completely dismantled.

The caucus is ultimately a forum for members who care about solving commercial spent fuel issues to come together and to make progress regardless of their party affiliation, and we are going to be inviting experts to come and speak before the group. We hopefully can spur some productive conversation about policy that we can all get behind to address the spent fuel challenges that we face.

As you mentioned, there are numerous sites where spent nuclear fuel is stranded, increasing public pressure to find a solution. Is this caucus a result of that pressure, and do you feel there is enough political will to move forward on a permanent solution?

Well, the idea behind the caucus is to help build the political will. To build a group of members, Republicans and Democrats alike, who are committed to solutions to this issue and who are going to dedicate sufficient time and effort to make sure that we are doing all we can to push legislation and to aim for solutions.

I think it is important to note that there is action happening already. There are signs for optimism with what is happening with the Biden administration. We were able to secure $20 million at the Department of Energy for interim storage, and that's a good step. I know that the DOE is going to be coming out with their request for information, RFI, for interim storage to see if there are parties out there that are interested in the economic opportunity that interim storage would provide. But my great hope is that this caucus can really foster collaboration at the federal level, really amplify the issue, and prepare for eventual storage and disposal.

We are also going to be talking about things like safety, because not all areas are the same. We are obviously in a higher risk situation at SONGS, just because of the millions of people and the earthquake risks and sea-level rise and all the rest of it. We will be doing all we can to highlight safety concerns as we try to address these problems.

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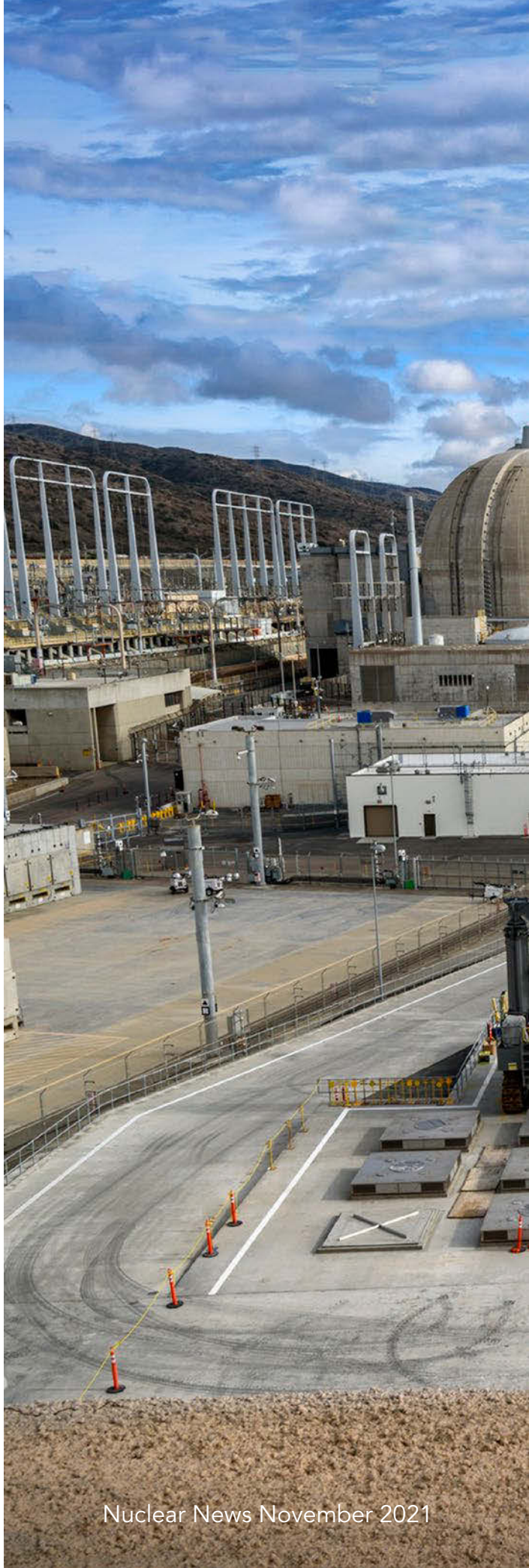
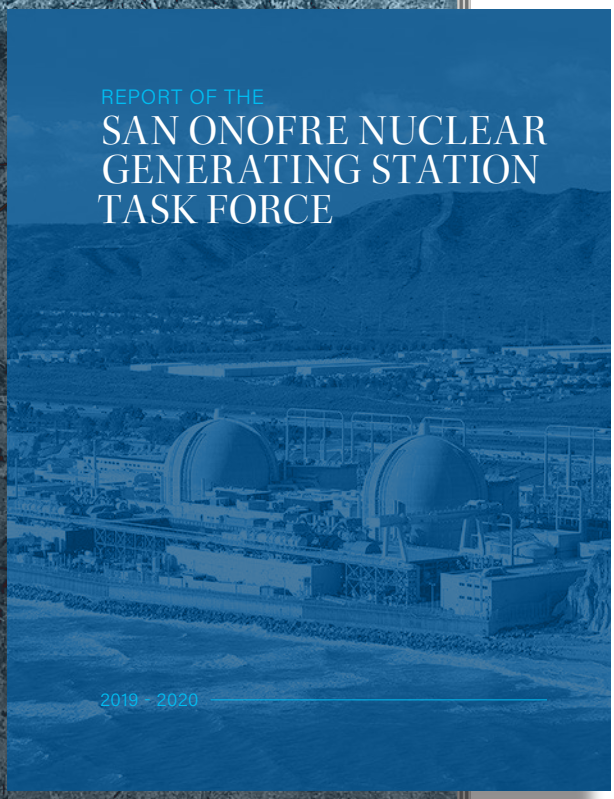


The independent spent fuel storage installation at SONGS in Southern California.
(Photo: Southern California Edison)



When it comes to SONGS, there has been a lot of misinformation regarding the spent fuel being "buried" there and being an explosive hazard. Do you feel that that type of rhetoric is counterproductive to finding a willing host for a repository?

I think concern is a good thing, but we do need to stick to the facts whenever possible. But the simple answer is we need to move the waste there to a safer location—I don't think anybody would disagree—whether that's a consolidated interim storage facility or a permanent repository. That's my focus. Obviously it is a very complicated challenge, but leaving the waste on the beach indefinitely is clearly not a good idea, and I don't think anybody from industry would disagree.

What is the longer-term plan of Congress to "fix" the nuclear waste laws, such as the Nuclear Waste Policy Act, that have been passed but are not being implemented?

That certainly is going to be a topic for robust discussion in the caucus. President Obama came forward with the Blue Ribbon Commission report in 2012, and there have been other subsequent reports about what congressional action is warranted and necessary to have a better disposition for spent nuclear fuel. But I don't want to get in front of those conversations with my colleagues. I think it's important that I do what I can to try to build trust and confidence between us so that we can work toward solutions without getting ahead of ourselves in trying answer all of the questions before we've had an opportunity to really dig into the issues.

Do you see signs of optimism, in this still very polarized political climate, for collaboration on the spent fuel issue?

Spent nuclear fuel impacts many districts across the country—Republican districts, Democratic districts—nuclear waste does not discriminate on the basis on one's party, and I would certainly hope that we can all agree on the need for solutions. We may have many differences of opinion on a variety of issues, but I hope that this is truly a bipartisan endeavor to whatever extent possible. And as long as I am involved that is certainly going to be the case.

The optimism for movement on this issue is bearing out. After this interview was conducted, Levin, along with Sen. Edward Markey (D., Mass.), introduced the Nuclear Waste Task Force Act on September 28. The bill is intended to jump-start a consent-based siting plan by removing exemptions from environmental laws for nuclear waste. Read more on ANS's Nuclear Newswire *at ans.org/news/article-3294.*

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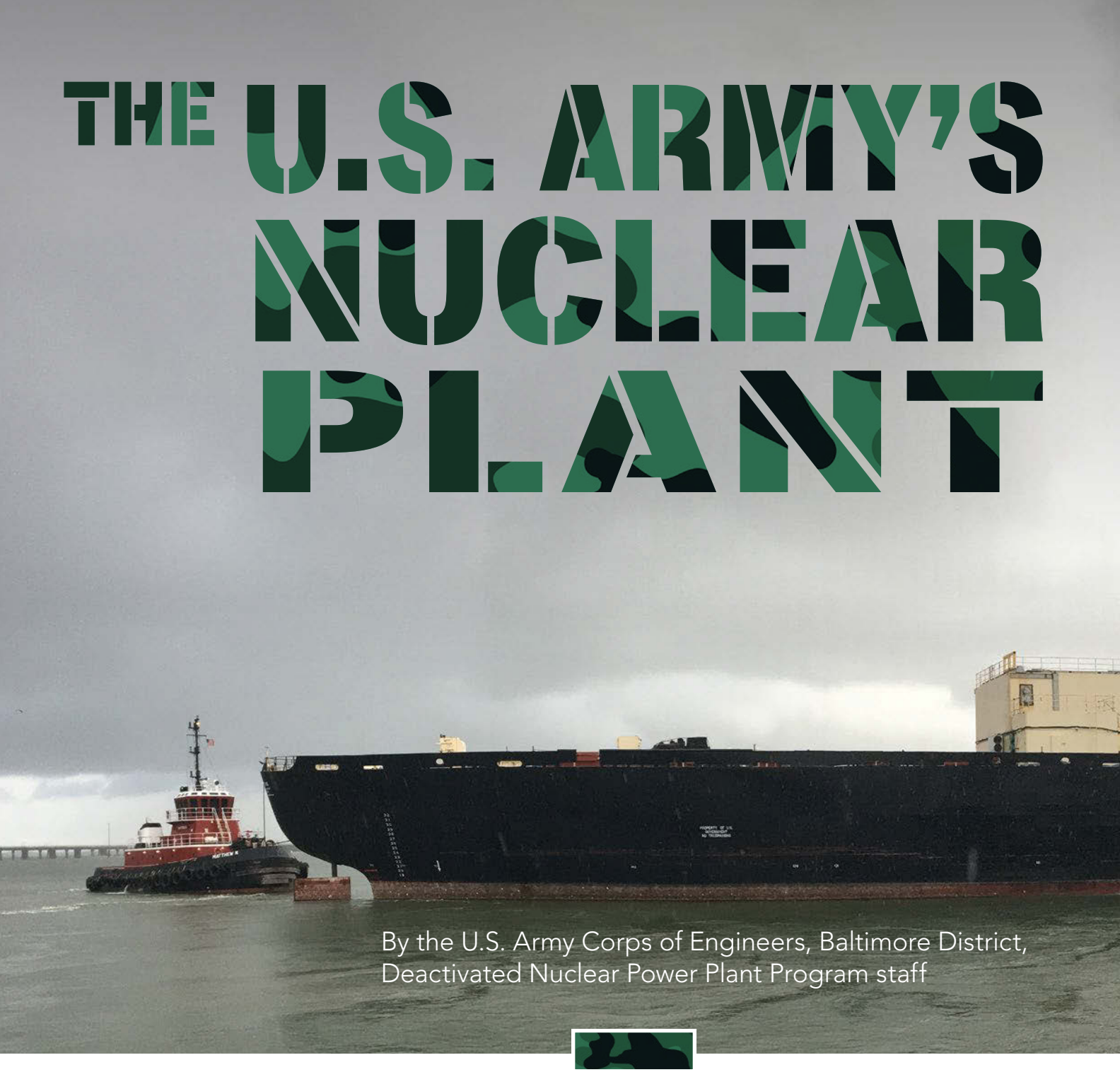


By the U.S. Army Corps of Engineers, Baltimore District, Deactivated Nuclear Power Plant Program staff

The *Sturgis* is towed from the Galveston, Texas, pier to the shipping channel on September 25, 2018, as it heads toward Brownsville, Texas, for final shipbreaking and recycling. Over the past three years in Galveston, the U.S. Army Corps of Engineers has been implementing the challenging and complex effort to decommission the MH-1A—the deactivated nuclear reactor that was onboard the *Sturgis* vessel.

The U.S. Army Corps of Engineers (USACE), Baltimore District, is home to the North Atlantic Division's Radiological Health Physics Regional (RHPR) Center of Expertise, which is leading the decommissioning of Army reactors.

From 1956 to 1976, the Army's nuclear power program operated several small nuclear reactors to confirm the feasibility of their meeting military power needs on land. Three Army reactors were deactivated in the 1970s and placed into safe storage awaiting future decommissioning.

The U.S. Army regulates the Army reactor program,

DEACTIVATED POWER PROGRAM

and the Army Reactor Office issues permits to USACE to manage the decommissioning of deactivated plants, which is done by the Deactivated Nuclear Power Plant Program (DNPPP). Within the DNPPP, the Baltimore District's team is managing the decommissioning of the Army's two remaining deactivated nuclear reactors—the SM-1 at Fort Belvoir in Virginia and the SM-1A at Fort Greely in Alaska. The team recently completed the decommissioning of the *Sturgis* barge reactor.

"Our team of experts has a combined total of over 60 years of experience in radiological project support and management," said Dave Watters, chief of the RHPR Center of Expertise. "We have demonstrated our experience at a variety of sites throughout the United States and internationally. Our team can provide all types of radiological services to our various stakeholders."

Decommissioning includes the removal of all reactor components, transportation and disposal of material, site cleanup, and restoration. The USACE team works hand in hand with the decommissioning contractor to ensure that all aspects of the project are done with safety as the top priority.

Continued

The reactor pressure vessel aboard the *Sturgis*, the Army's retired floating nuclear power plant, was lifted and placed in the specially designed shielded shipping container (bottom) at the end of May. Once in the container, the pressure vessel was loaded onto a transport vehicle to be delivered to Waste Control Specialists' disposal facility in Andrews County, Texas, for disposal. With the removal of the *Sturgis*'s reactor pressure vessel, approximately 98 percent of the radioactivity from the *Sturgis* and a total of 850,000 pounds of radioactive waste have been safely removed and disposed of.

MH-1A *Sturgis*

In 2019, USACE completed the decommissioning and dismantling of the historic *Sturgis* barge, which was the world's first floating nuclear power plant. The completion of the project was achieved when the final section of the former vessel was brought ashore for processing and recycling at the International Shipbreaking facility in Brownsville, Texas.

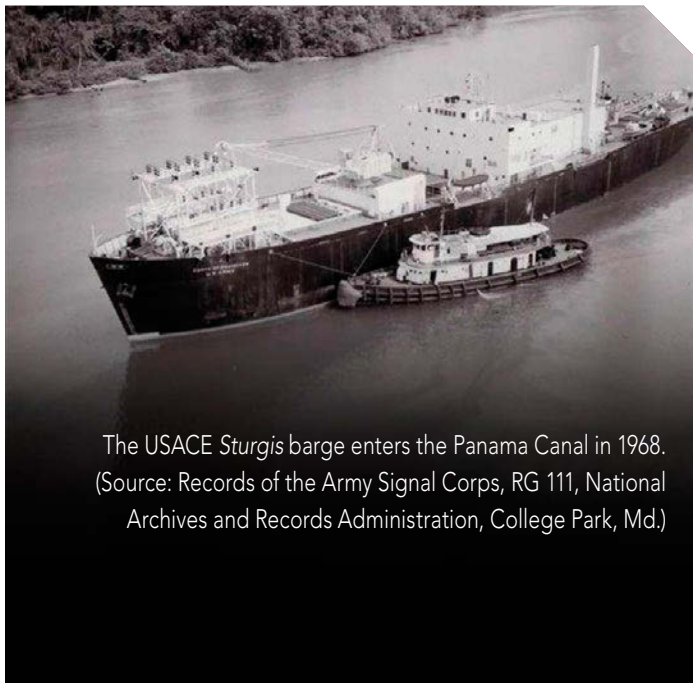
Background

The *Sturgis* had a unique life since it was built in the 1940s as a World War II Liberty Ship, the SS *Charles H. Cugle*. In the 1960s, the ship was converted into the world's first floating nuclear plant, housing the MH-1A (Mobile High-Power Model 1A) nuclear reactor. The MH-1A was used to generate electricity in the Panama Canal Zone from 1968 to 1976.

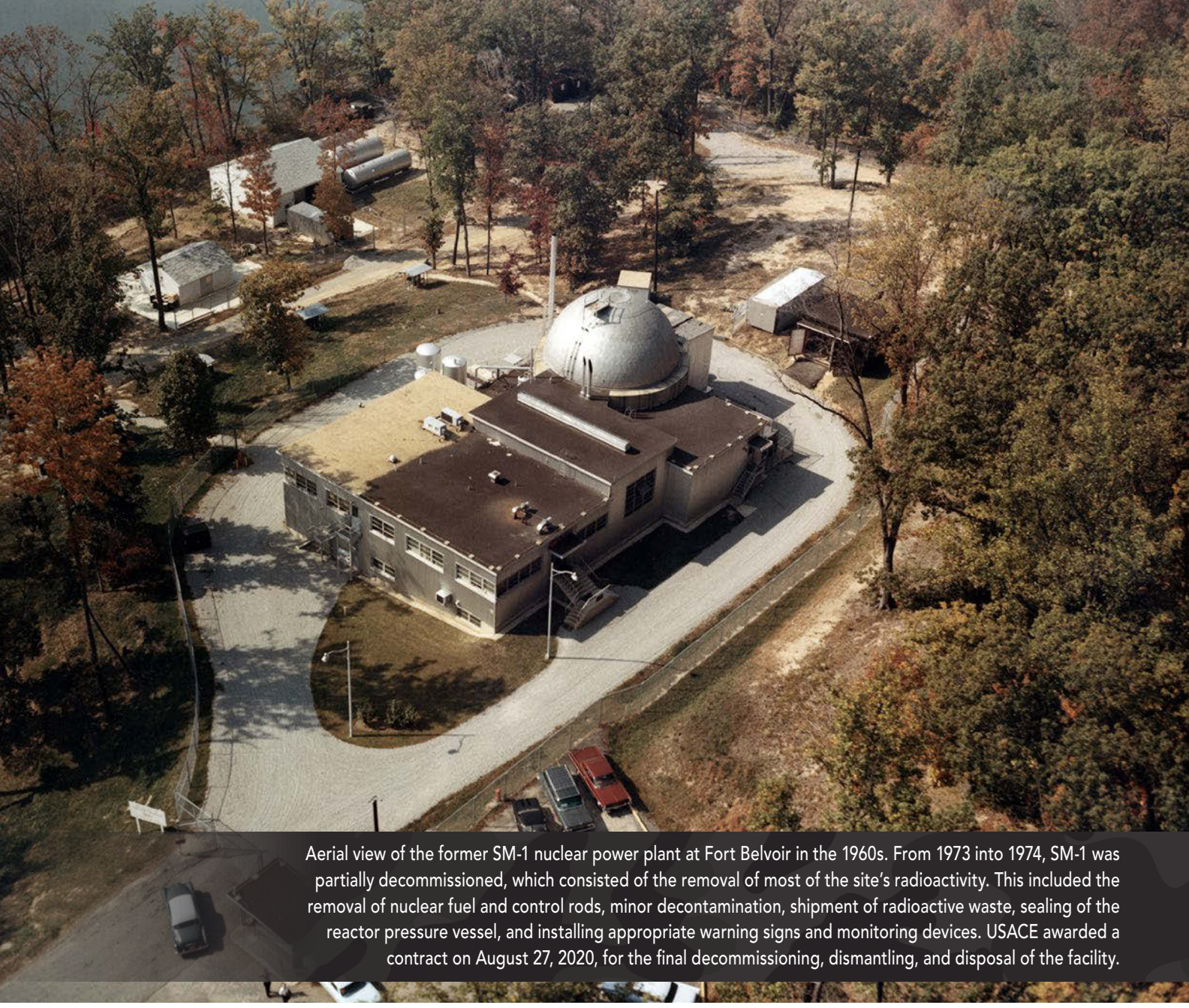
In 2012, the reactor's formal decommissioning began as part of a broader effort to decommission the Army's retired nuclear reactors through the DNPPP. After the awarding of the decommissioning project contract, in April 2015, the *Sturgis* was towed 1,750 miles from Virginia to Galveston, Texas, for its final decommissioning.

That decommissioning effort was completed in the summer of 2018 with the removal of all components of the deactivated reactor and the associated radioactive waste, in close coordination with the USACE Galveston District, the Marine Design Center, and vendor APTIM Federal Services. The vessel was towed to Brownsville for final traditional shipbreaking, which was completed in March 2019.

"The project to decommission and dismantle a floating nuclear power plant was truly unprecedented," said Brenda Barber, project manager. "This unique, one-of-a-kind, historical power plant was never designed to be taken apart, and the available information about its construction was lacking in many details. The hazards that required mitigation dictated a painstaking and deliberate process to avoid any release to the environment and the community and to protect the health and safety of the workers involved."



The USACE *Sturgis* barge enters the Panama Canal in 1968. (Source: Records of the Army Signal Corps, RG 111, National Archives and Records Administration, College Park, Md.)



Aerial view of the former SM-1 nuclear power plant at Fort Belvoir in the 1960s. From 1973 into 1974, SM-1 was partially decommissioned, which consisted of the removal of most of the site's radioactivity. This included the removal of nuclear fuel and control rods, minor decontamination, shipment of radioactive waste, sealing of the reactor pressure vessel, and installing appropriate warning signs and monitoring devices. USACE awarded a contract on August 27, 2020, for the final decommissioning, dismantling, and disposal of the facility.

SM-1

On the western shore of the Potomac River within the boundaries of Fort Belvoir in Fairfax County, Va., is the Stationary Medium Power Model 1 nuclear power plant (SM-1), the Army's first nuclear reactor and the first in the country to provide nuclear-generated pow-er to the commercial grid for a sustained period. In 2020, the Baltimore District awarded a $71.7 million contract to joint venture APTIM AECOM Decommissioning LLC for the decommissioning, dismantling, and disposal of SM-1.

The team achieved entry into the vapor containment structure in June 2021, which allowed it to perform initial safety and structural inspections to facilitate mobilizing crews to the site in fall 2021. The remainder of 2021 and most of 2022 will focus on site preparation, in close coordination with Fort Belvoir and the local communities. Decommissioning is scheduled to begin in 2022 and to continue for two to three years. From there, the work will focus on site restoration and final documentation, with an estimated project completion date in 2025.

"The team is really excited to build on our record of success and safety with the *Sturgis* decommissioning project as decommissioning moves forward for the SM-1," said project manager Rebecca Yahiel.

Continued

Undated file photo showing U.S. Army, Air Force, and Navy personnel in the control room of the former SM-1 nuclear power plant at Fort Belvoir. In addition to providing power to Fort Belvoir, the SM-1 served as a training facility for nuclear technicians from all branches before being deactivated in 1973 and partially decommissioned.

Background

The construction of SM-1 at Fort Belvoir was completed in March 1957. The reactor achieved criticality in April 1957 and operated until March 1973. The SM-1 was a single-loop, 10-MWt pressurized water reactor delivering a net 1,750 kilowatts of electrical power. Developed by the Army as part of a movement to harness atomic energy for power generation, SM-1 was the Army's first functioning nuclear power plant and served as a basis for the development of more reactor facilities in the years following.

Over the next several years, SM-1 provided partial power to Fort Belvoir but was primarily a training facility for approximately 800 nuclear power plant technicians from all military branches before being deactivated in 1973 and partially decommissioned.

The partial decommissioning consisted of the removal of most of the site's radioactivity, which included the removal of nuclear fuel and control rods, minor decontamination, shipment of radioactive waste, sealing of the reactor pressure vessel, and installing appropriate warning signs and monitoring devices. The majority of SM-1's remaining low-level radioactivity is within activated metals and components of the reactor system, which are all secured within the walls of the facility's containment vessel, greatly reducing any potential risks to human health or the environment.

"With the fuel and radioactive waste all removed in the 1970s, at this point our team will be dismantling and removing activated metals and components, so this is likely not what people think of when they think of radiological work," Yahiel explained. "There are no drums of liquid waste, no control rods, or anything like that. With the activated metals and large pieces of the old reactor, there's also minimal risk of any sort of a release into the air or a spill of waste during the project. We will be working in a containment area to carefully dismantle, securely package, and remove large components of the old system that have low-level residual radioactivity."

Continued

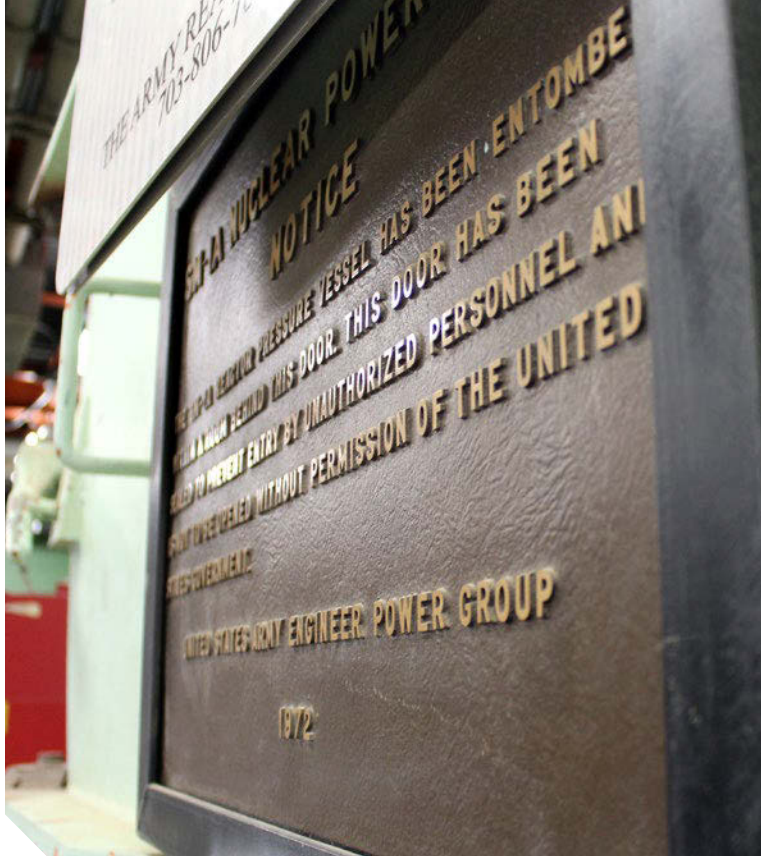
SM-1A

Located at Fort Greely, in Alaska, approximately 100 miles southeast of Fairbanks and 225 miles northeast of Anchorage, the Stationary Medium Power Model 1A nuclear power plant (SM-1A) was designed based on the concept of SM-1. The "1A" moniker designated it as the first field plant of its type.

The project team is nearing the completion of decommissioning planning, and in July 2021, the team finalized the environmental assessment and the finding of no significant impact for the decommissioning and dismantlement of the deactivated SM-1A. Also, in a joint effort, USACE, the Alaska State Historic Preservation Office, the City of Delta Junction, and *Nuke Digest* have finalized a National Historic Preservation Act, Section 106, memorandum of agreement that outlines how the history of SM-1A and its unique arctic mission will be preserved.

The project team is working toward the completion of the decommissioning planning documents while focusing on the decommissioning contract acquisition to support an award in 2022. In late 2021, the team will begin working with the Defense Logistics Agency, Fort Greely staff, and Doyon Utilities to implement the separation of utilities between the north and south end of the facility that houses the reactor systems, which will allow for the safe implementation of future decommissioning activities. The project team is also working on selection of a contractor for the decommissioning and dismantlement of the site.

Visitors to the SM-1A reactor listen to an Army guide's comments during a tour.



A plaque signifying the SAFSTOR of the containment vessel of the SM-1A deactivated nuclear power plant is featured during a site tour on April 24, 2019. Located at Fort Greely, the SM-1A deactivated nuclear power plant is in the planning stage of being decommissioned and dismantled. Part of this effort will involve segregating components of the co-located, still operational steam plant. USACE, Baltimore District, with its Radiological Center of Expertise, and Alaska District personnel are working in partnership on the SM-1A decommissioning.

Background

Based on the design of SM-1, construction of the SM-1A reactor facility at Fort Greely began in 1958 and was completed in 1962, with first criticality achieved on March 13, 1962. SM-1A was a single-loop, 20.2-MWt PWR that used high-enriched uranium dioxide fuel to generate 2,000 kilowatts of electrical power and 37,850 pounds of extraction steam per hour. SM-1A's primary mission was to supply electrical power and heating steam for on-post buildings and facilities at Fort Greely. It was also used as an in-service test facility to determine how the equipment would function in an arctic environment. The secondary mission was to study the economics of operating a nuclear electric power plant as compared to a conventional oil-fired system in a remote setting where fuel costs are high and refueling logistics are challenging.

In 1970, the chief of engineers decided that the SM-1A reactor would be shut down for the last time following the normal end of life of its fourth core. The final shutdown, which included deactivation and initial decommissioning, was performed in March 1972, when the facility was effectively placed into SAFSTOR. Most of the reactor's primary system components were dismantled, and components inside the vapor containment were encased in concrete and a grout-sand-soil mixture. Waste generated during the initial deactivation activities was placed in the spent fuel pit and waste tanks pit. These pits were then filled and capped with reinforced concrete.

"This will be the third and final reactor that our team will be decommissioning," said Jeffrey Hillebrand, project manager. "We will be bringing a wide variety of expertise and lessons learned from MH-1A and SM-1 to this project to ensure success. Additionally, we are partnering with our counterparts at Alaska District to gain their expertise on working in this remote, interior Alaska location."

Both remaining decommissioning efforts are slated to be completed by 2028.

Contact CENAB-CC@usace.army.mil with comments or questions.


UCOR
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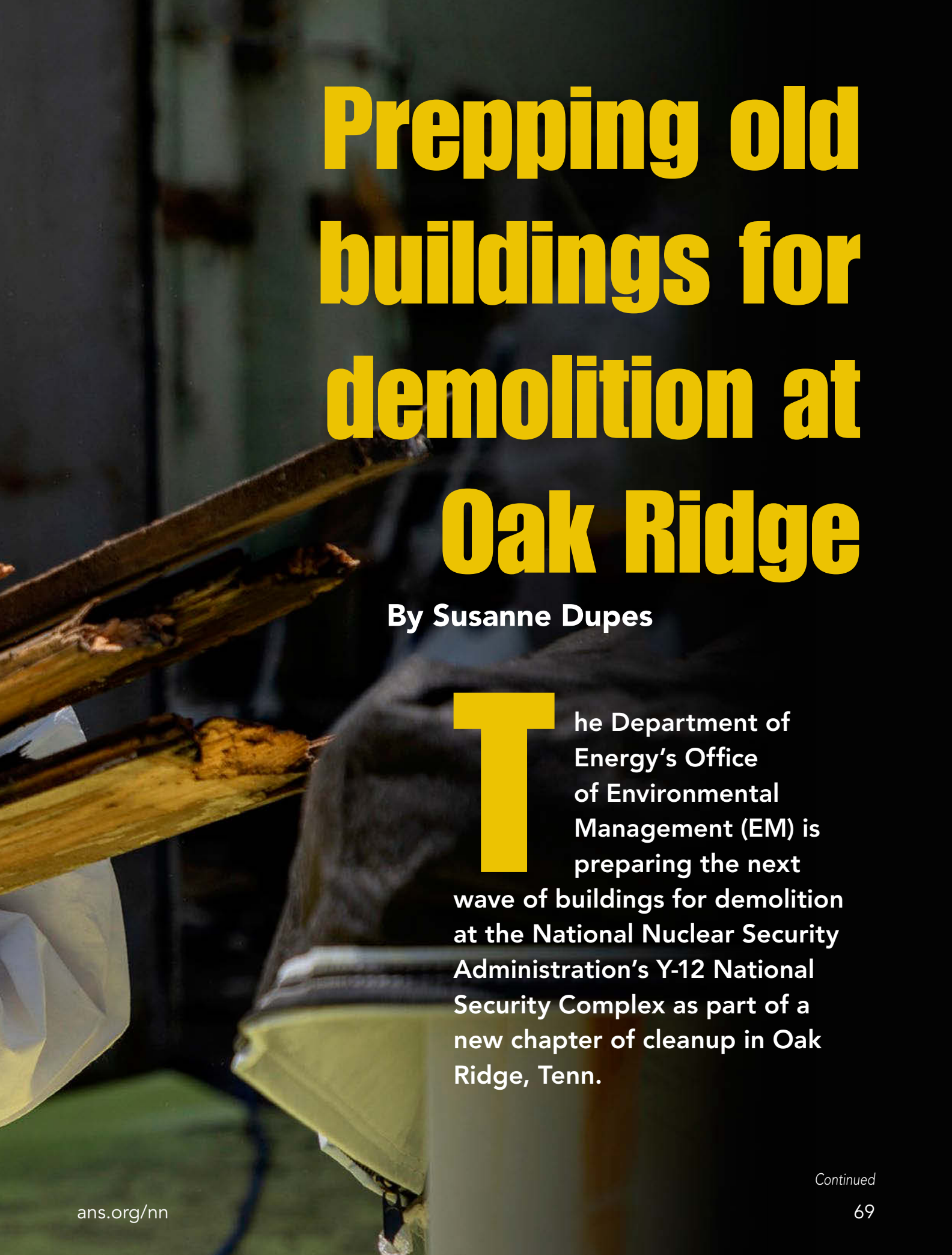


Prepping old buildings for demolition at Oak Ridge

By Susanne Dupes

The Department of Energy's Office of Environmental Management (EM) is preparing the next wave of buildings for demolition at the National Nuclear Security Administration's Y-12 National Security Complex as part of a new chapter of cleanup in Oak Ridge, Tenn.

Continued

Crews have been deactivating three contaminated facilities at Y-12 after transitioning them to a "cold and dark" status in which all potential hazardous energy sources are isolated, which means that all utilities (electric, steam, and water) into and out of the buildings are completely disconnected. This action removes a major risk for crews conducting many assorted activities in the buildings. Workers use temporary power for lighting and other needs in the workspace during the deactivation stage.

Workers are addressing vacant 1940s-era buildings that do not support current-day Y-12 missions. EM and its contractor, UCOR, are focusing their efforts on three structures—Alpha-2, the Old Steam Plant, and the Old Criticality Experiment Laboratory. The latter is the only building of the three that was not built as part of the Manhattan Project.

UCOR is working simultaneously in all three buildings. Some team members have isolated utilities and equipment while others performed early deactivation tasks such as abating asbestos and removing waste. Oak Ridge's highly experienced workforce has made it possible to conduct this work in tandem.

"These crews were part of the team that completed the first-in-the-world removal of a gaseous diffusion complex last year, and they also completed demolition prep for the Biology Complex at Y-12," said Dan Macias, UCOR Oak Ridge Reservation environmental cleanup manager. "The skills and training these workers bring to each project allow them to successfully complete our work safely and efficiently."

More than 50 percent of the facilities throughout the National Nuclear Security Administration complex, which includes Y-12, are more than 40 years old, and 30 percent of them were built in the Manhattan Project era. EM's work at Oak Ridge is to remove this deteriorating infrastructure to enable modernization and provide land for national security missions.

(Above) A worker takes samples inside Alpha-2 to characterize any risks and hazards in the building so that EM can safely plan and perform deactivation efforts.

Workers remove waste from Alpha-2 as part of deactivation work at the Y-12 National Security Complex at Oak Ridge.

The Old Steam Plant dates back to 1943. It has had multiple uses over the years, but today it is in a deteriorated state and does not support any current missions.

Buildings coming down

Alpha-2, also known as Building 9201-2, is the largest building where deactivation is underway at the site. The three-story, 325,000-square-foot facility was constructed to enrich uranium using an electromagnetic separation process; however, this work ended in 1946. Then, the facility was used for a variety of other missions until it was shut down in the 1990s.

The Old Steam Plant, also known as Building 9401-1, is a single-story, 13,454-square-foot facility built in 1943. This building has had multiple uses over the years. In the 1960s and 1970s, it was used to develop a dipping process for uranium parts. Subsequently, Oak Ridge National Laboratory used the facility to test fuels, and it later became a maintenance and storage facility.

The Old Criticality Experiment Laboratory, also known as Building 9213, was built in 1949. The two-story, 24,000-square-foot facility was home to more than 9,700 experiments from 1950 through 1961. It was later used to support ORNL's High-Flux Isotope Reactor program. The building has been closed since 1992.

Continued

An exterior view of the Old Criticality Experiment Laboratory. It was built in 1949 and was home to more than 9,700 experiments from 1950 through 1961. The building has been closed since 1992.

Crews at the headworks site of the Outfall 200 Mercury Treatment Facility excavating for the construction of foundations.

A bit of history

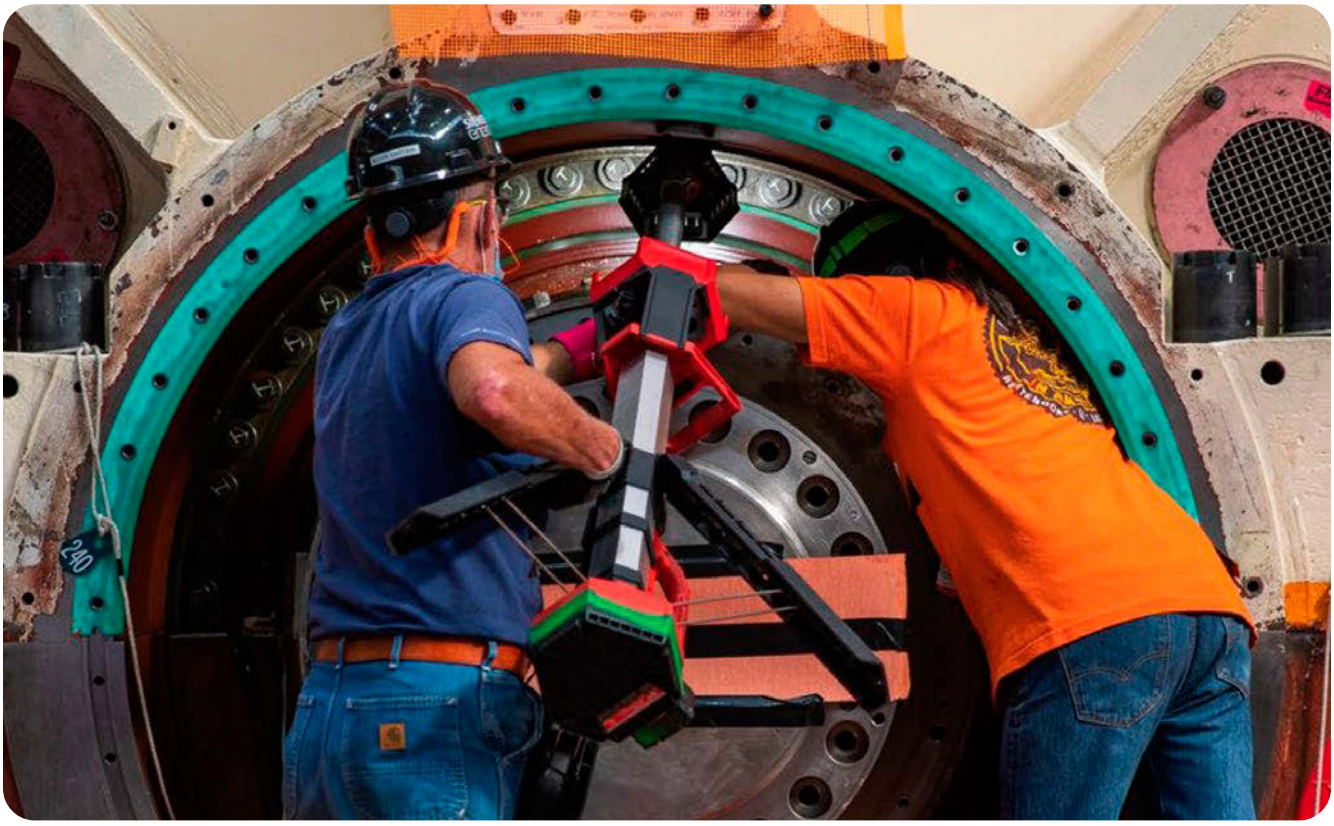
The Y-12 National Security Complex has three primary national security missions: maintaining the U.S. nuclear stockpile, reducing global threats through nonproliferation, and fueling the U.S. nuclear navy. The site was constructed in 1943 as part of the World War II–era Manhattan Project. Early missions there included uranium and lithium separations and manufacturing nuclear weapons components.

The Cold War brought change to Y-12 as new processes for separating lithium were added and uranium enrichment missions shifted to being conducted elsewhere. During the 1950s and early 1960s, Y-12 used large amounts of mercury in the lithium separation process, and an estimated 700,000 pounds were lost in the buildings and surrounding environment.

Mercury is the highest environmental cleanup priority at Y-12, and EM is working to address the mercury that migrated into the environment. The linchpin of EM's cleanup strategy is the Outfall 200 Mercury Treatment Facility, which is now under construction and scheduled to begin operations in the mid-2020s. This infrastructure will enable the demolition of Y-12's large, mercury-contaminated facilities and subsequent soil remediation by providing a mechanism to prevent mercury from entering the nearby Upper East Fork Poplar Creek. When operational, the facility will be able to treat up to 3,000 gallons of water per minute and will help Oak Ridge meet regulatory limits.

In addition to mercury cleanup, EM is ramping up work to address the large inventory of excess, contaminated facilities at Y-12. Many of these Manhattan Project and Cold War–era facilities are categorized as high risk due to their structural condition or contamination levels. While demolition is underway on some, crews are inside others performing characterization and deactivation activities. Their efforts include reducing risks, stabilizing the facilities, and paving the way for large-scale demolition that will enhance safety, enable modernization, and provide land for future national security missions at Y-12.

Susanne Dupes (Susanne.Dupes@orcc.doe.gov) is a senior communications specialist for the Department of Energy.



Byron, Dresden to receive nine-digit investments

Exelon Generation is investing more than $300 million in capital projects at its Byron and Dresden nuclear plants in Illinois over the next five years and filling some 650 vacant positions across the state. The moves are in direct response to Illinois Gov. J.B. Pritzker's September 15 signing of S.B. 2408, the hard-won clean energy legislation that rescued those nuclear facilities from premature retirement.

"With this landmark legislation in place, we are moving quickly to restaff and refuel all of our nuclear plants for 24/7 operation, producing carbon-free, baseload electricity for more than 10 million homes and businesses," said Dave Rhoades, Exelon Generation's chief nuclear officer. "These plants are not only important for the clean energy they produce, but they are massive economic engines for their local communities, contributing more than $1.6 billion to Illinois's GDP each year."

Exelon said it plans to invest more than $140 million in projects at Byron—which began its fall refueling outage following the passage of S.B. 2408—including overhauling a main generator, replacing large transformers, upgrading a fiber optic control system, and replacing various pumps, motors, and piping in the plant. Most of the projects will be carried out during refueling outages starting next year and will include more than 1,500 electricians, pipe fitters, welders, carpenters, and other tradespeople, according to Exelon.

Nearly $170 million in capital projects are planned for Dresden, including upgrades to six feedwater heat exchange vessels, significant refurbishment of a main generator, electrical component overhauls, replacement of closed cooling piping, and the revamping of nuclear instrumentation circuit components.

Above: Workers perform maintenance in September during Byron's refueling outage. (Photo: Exelon)

POLICY

PJM-modified MOPR takes effect, boosting nuclear's competitiveness

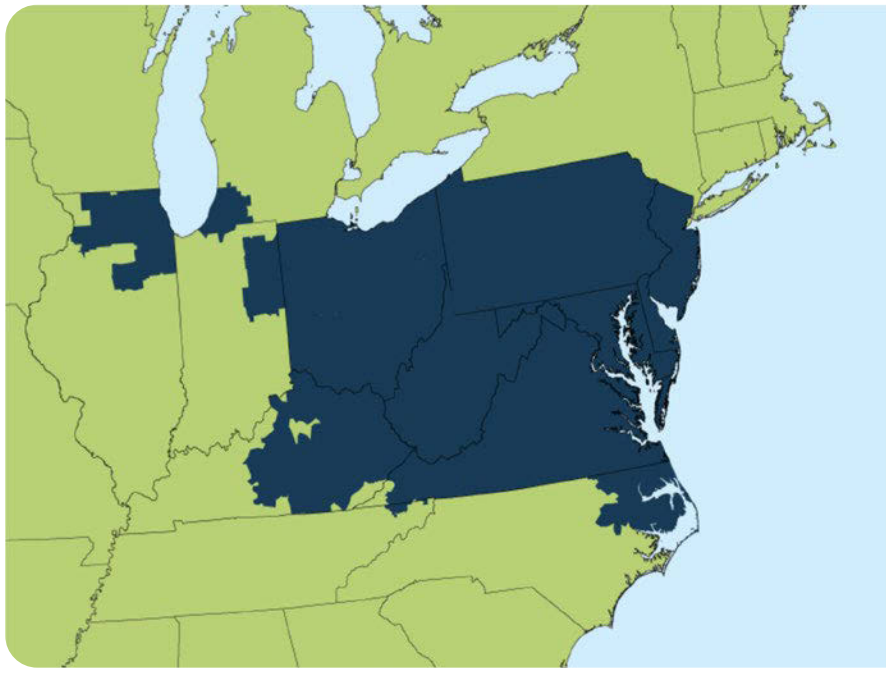
A proposal by PJM Interconnection to revise the Federal Energy Regulatory Commission's contentious minimum offer price rule (MOPR) order went into effect by default September 29 after the commission failed to take action on it.

According to a notice from the FERC secretary, "In the absence of commission action on or before September 28, 2021, PJM's proposal became effective by operation of law. Accordingly, the effective date of the proposed tariff sheets is September 29, 2021. The commission did not act on PJM's filing because the commissioners are divided two against two as to the lawfulness of the change."

Although the notice did not clarify the individual commissioners' positions—FERC is currently composed of two Democrats, chairman Richard Glick and Allison Clements, and two Republicans, James Danly and Mark Christie—most observers believe the divide fell along party lines. Glick, for instance, has been an outspoken critic of the order since it was issued in December 2019.

The FERC order instructed PJM to dramatically expand its MOPR to cover new and existing energy sources, including renewables and nuclear, which receive "out-of-market" state subsidies, effectively raising the bidding price for those sources in PJM's forward-looking capacity auctions.

But under PJM's altered MOPR, filed with FERC on July 30, state policies providing out-of-market payments to generating resources are recognized as a legitimate exercise of a state's authority over the electric supply mix. Those policies would not be subject to the MOPR "so long as the policy does not constitute the sale of a FERC-jurisdictional product that is conditioned on clearing in any RPM [Reliability Pricing Model] auction," PJM said in a proposal summary.



Map of the PJM Interconnection territory in dark blue. (Image: PJM)

PJM is planning to incorporate the MOPR changes into the 2023–2024 delivery year base residual auction, which is currently scheduled to be held on December 1. In a separate proceeding, however, PJM asked for that date to be pushed back to January 25, 2022. At this writing, the commission has not addressed that request.

While the new MOPR is likely to be in effect for the upcoming auction, some experts are warning that it faces legal uncertainty further down the road, given the lack of a formal order.

Power & Operations continues

Snow covering the grounds of the Texas Capitol on February 15, 2021.

Agencies assess power system performance during February freeze

To prevent future winter storms from causing the kind of widespread, lethal power outages wrought by February's frigid blast through Texas and other states, the electric and natural gas industries need to bolster their winterization and cold weather preparedness and coordination, a just-released preliminary report from the Federal Energy Regulatory Commission and North American Electric Reliability Corporation concludes.

The two agencies had announced February 16 that they planned to open a joint inquiry to identify problems with the performance of the bulk power system during the storm and to offer solutions. A team of FERC and NERC staff members presented the report at a FERC meeting on September 23. (A presentation of the report, *February 2021 Cold Weather Grid Operations: Preliminary Findings and Recommendations*, is available on the FERC website.)

FERC/NERC findings

Unofficially dubbed Winter Storm Uri, the mid-February arctic assault—the costliest U.S. winter storm event on record, at $20.4 billion—triggered the loss of 61,800 MW of electric generation, as 1,045 individual generating units experienced 4,124 outages, derates, or failures to start, according to the report. Natural gas production was severely reduced, with the largest effects felt in Texas, Oklahoma, and Louisiana, where combined daily production declined to an estimated 20 billion cubic feet per day—a drop of more than 50 percent compared to average production from February 1 to 5.

The report points to the freezing of generator components and fuel issues as the top two causes of generator outages, derates, and failures to start. While the causes identified affected generating units across all fuel types, 57 percent of the 1,045 units were natural gas–fired units that primarily faced fuel-supply challenges.

Only one nuclear unit succumbed to Uri: STP Nuclear Operating Company's South Texas Project-1. On February 15, STP reported an automatic trip to the Nuclear Regulatory Commission that was caused, the company said, by a cold weather–induced failure of a feedwater

pressure sensing line.

The preliminary report makes nine key recommendations, including revising reliability standards to require generator owners to take a number of actions, including the following:

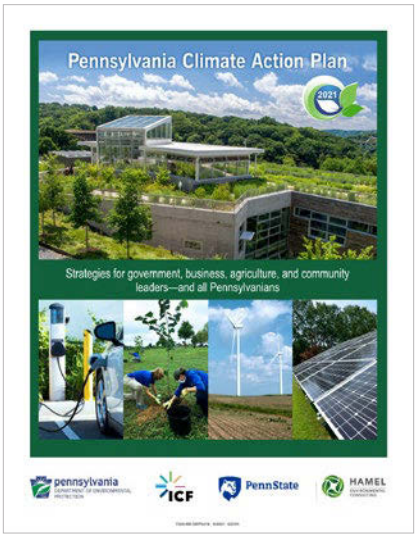
- Identify and protect cold weather–critical components.
- Build new units or retrofit existing units to operate to specific ambient temperatures and weather based on extreme temperature and weather data.
- Account for the effects of wind and precipitation in winterization plans.
- Develop corrective action plans after freeze-related outages.
- Ensure that the system operator is aware of the operating limitations in the generating fleet so that mitigation actions can be planned.

The report also recommends that generator owners be given the opportunity for compensation and recovery of the costs of building or retrofitting to operate to a specific temperature, and that Congress, state legislatures, and jurisdictional regulators require gas facilities to prepare and follow cold weather preparedness plans.

"This is a wake-up call for all of us," declared FERC chairman Richard Glick. "There was a similar inquiry after Texas experienced extreme cold weather in 2011, but those recommendations were not acted on. We can't allow this to happen again. This time, we must take these recommendations seriously, and act decisively, to ensure the bulk power system doesn't fail the next time extreme weather hits. I cannot, and will not, allow this to become yet another report that serves no purpose other than to gather dust on the shelf."

Power & Operations continues

Keep nuclear generation at current levels, says Pennsylvania climate plan



The 2021 *Pennsylvania Climate Action Plan* recommends 18 "strategies" for realizing Gov. Tom Wolf's goal of an 80 percent reduction in the state's greenhouse gas emissions (from 2005 levels) by 2050. Two of the strategies are for the electricity-generation sector: (1) maintain operation at Pennsylvania's nuclear power plants through at least 2050, and (2) achieve a 100 percent carbon-free grid by 2050.

In addition to focusing on electric power generation, the plan includes strategies for other major carbon-emitting sectors in the fossil fuel–heavy state, including transportation, industry, agriculture, and residential and commercial buildings. For each strategy, emission reductions, costs, and benefits in jobs and economic growth are quantified and health and social benefits analyzed.

The 278-page document, issued in September, was prepared by the Pennsylvania Department of Environmental Protection, with support from Penn State University and two consulting firms, ICF and Hamel Environmental Consulting. A 2008 state law requires the DEP to develop a climate plan and impacts assessment every three years.

The new plan notes that only two nuclear reactors in Pennsylvania, Exelon's Peach Bottom units, have been approved for operation past 2050, and that the state's six other units—at Beaver Valley, Limerick, and Susquehanna—will need to apply for either first or second license renewal in order to stay on line through the mid-century mark.

In addition, "maintaining the current nuclear capacity may require the state to subsidize facilities if they face unfavorable economic conditions," the plan states. "Assuming status quo energy and capacity market structures, nuclear facilities may face economic pressure and require Commonwealth intervention to ensure that the facilities do not retire early because of lower wholesale market revenues. One intervention the Commonwealth legislature could make is to pass legislation designating a Commonwealth agency to create and administer a zero emission credit program to subsidize at-risk nuclear plants, as states such as New Jersey, New York, and Illinois have done."

IAEA

Granholm, Grossi prepare for 2022 nuclear ministerial conference

U.S. energy secretary Jennifer Granholm and International Atomic Energy Agency director general Rafael Mariano Grossi met in Vienna September 21 during the agency's 65th General Conference to launch preparations for the next IAEA International Ministerial Conference on Nuclear Power in the 21st Century, slated for October 26–28, 2022, in Washington, D.C.

Originally meant to take place this year but postponed due to COVID, the fifth iteration of the conference will feature ministerial-level participants delivering statements on their national energy strategies and visions for nuclear energy, as well as on the challenges for introducing, maintaining, or expanding nuclear, according to the IAEA.

Also scheduled are panel discussions, covering topics such as the role of nuclear energy in the transition to net-zero energy systems; fostering policy support and stronger conditions for investment in nuclear; the role of government and the need for an appropriate infrastructure for new nuclear programs; sustaining and improving the performance of the existing reactor fleet in

changing economic, climate, and political environments; and advanced nuclear technologies.

The ministerial conference is organized in partnership with the International Energy Agency and in cooperation with the OECD Nuclear Energy Agency. Previous editions were held in Paris (2005), Beijing (2009), St. Petersburg (2013), and Abu Dhabi (2017).

"Nuclear is a key technology for [IAEA] member states as they aim to lower their emissions, grow their economies, and ultimately combat climate change in a truly sustainable way," Granholm said. "It's an incredible honor for the United States to be hosting the 2022 IAEA Nuclear Power Ministerial at such a pivotal time. The U.S. Department of Energy is committed to working with Director General Grossi and the IAEA to ensure a successful conference, and we strongly encourage all countries to send ministerial-level representatives to join us as we unlock the full potential of nuclear."

U.S. energy secretary Jennifer Granholm and IAEA director general Rafael Mariano Grossi pose for a photo before their meeting announcing the next International Ministerial Conference on Nuclear Power in the 21st Century. (Photo: D. Calma/IAEA)

Agency boosts projections for nuclear power's potential growth

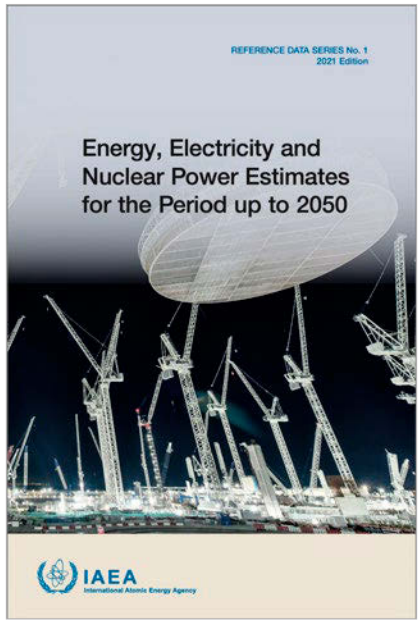
The International Atomic Energy Agency has revised upward its projections regarding the potential growth of nuclear power's capacity for electricity generation over the next three decades. The upward revision is the first by the IAEA since the Fukushima Daiichi accident in 2011.

Released in September, the 148-page *Energy, Electricity and Nuclear Power Estimates for the Period up to 2050* provides detailed glimpses into possible nuclear futures in North America; Latin America and the Caribbean; Northern, Western, and Southern Europe; Eastern Europe; Africa; Western Asia, Southern Asia, and Central and Eastern Asia; Southeastern Asia; and Oceania. Global and regional nuclear power projections are presented as low and high cases.

The report's low-case projections assume that current market, technology, and resource trends will continue without many changes in laws, policies, and regulations affecting nuclear power. The high-case projections, according to the report, "are much more ambitious but are still plausible and technically feasible. Country policies on climate change are also considered in the high case."

In the report's global high-case scenario, nuclear generation capacity slightly more than doubles to 792 GWe by 2050 from 393 GWe in 2020—a rise of just over 10 percent from last year's high-case scenario of 715 GWe by 2050. (The IAEA adds the caveat that a realization of the high-case projection will require significant actions, including the accelerated implementation of innovative nuclear technologies.) The low-case scenario shows world nuclear capacity by 2050 at 392 GWe, essentially the same as it is now.

In percentage terms,



Power & Operations continues

nuclear energy contributes about 12 percent of global electricity by 2050 in the high-case scenario, up from 11 percent in the 2020 report. The low-case scenario was unchanged, with a projected share of 6 percent for nuclear in total electricity generation. Nuclear power generated around 10 percent of the world's electricity in 2020.

"The new IAEA projections show that nuclear power will continue to play an indispensable role in low-carbon energy production," said IAEA director general Rafael Mariano Grossi in a September 16 statement. "The report's findings represent an encouraging sign of increasing awareness that nuclear power, which emits no carbon dioxide during operation, is absolutely vital in our efforts to achieve net-zero emissions."

In Case You Missed It—Power & Operations

Exelon's Byron and Dresden nuclear plants were saved from premature retirement

September 15 when Illinois Gov. J.B. Pritzker signed into law the Climate and Equitable Jobs Act (S.B. 2408). The bill—a sweeping overhaul of the state's energy policies aimed at phasing out fossil fuel generation and placing Illinois on a path to 100 percent carbon-free energy production by 2050—includes $694 million in assistance to Byron, Dresden, and the similarly struggling Braidwood facility.

Pritzker appreciates applause at the signing event for Illinois's new energy bill.

S.B. 2408 passed the Illinois legislature September 13 by a 37–17 vote in the Senate. The Illinois House had passed the measure 83–33 the previous week.

A revitalized U.S.-India Strategic Clean Energy Partnership (SCEP) was launched

September 9 in a virtual ceremony presided over by energy secretary Jennifer Granholm and India's minister of petroleum and natural gas, Hardevep Singh Puri. The SCEP is part of the U.S.-India Climate and Clean Energy Agenda 2030 Partnership, a collaborative effort launched in April by President Biden and India's prime minister, Narendra Modi, at the Leaders Summit on Climate. According to a Department of Energy press release, the revamped SCEP "places greater emphasis on electrification and decarbonization of processes and end uses, scaling up and accelerating deployment of emerging clean energy technologies, and finding solutions for hard-to-decarbonize sectors."

Granholm and Singh Puri remotely meet (with others in the background) during the virtual launch of the revamped SCEP.

Among other commitments, the United States and India have agreed under the SCEP to continue cutting-edge research and development through the U.S.-India Partnership to Advance Clean Energy–Research, prioritizing research on emerging clean energy technologies; to continue to advance innovation in civil nuclear power as a net-zero solution through different collaborative programs, including the long-standing Civil Nuclear Energy Working Group; and to engage the private sector and other stakeholders to help deploy clean technologies to accelerate a clean energy transition.

For in-depth coverage of these stories and more, see ANS's* Nuclear Newswire *at ans.org/news.

Industry joins agency to form panel to address global challenges

More than a dozen of the world's leading nuclear industry executives have teamed up with the International Atomic Energy Agency to form the Group of Vienna, with the aim of using nuclear technologies to address global challenges, including climate change, disease, and hunger.

The group—an initiative of the IAEA's director general, Rafael Mariano Grossi—held its inaugural meeting in Vienna in September on the margins of the agency's annual General Conference. According to a joint statement, the Group of Vienna will support the IAEA in its mission to accelerate and enlarge the contribution of nuclear technologies to meet environmental, social, and economic goals and to improve the health and well-being of people. Annual roundtable meetings will be convened, with the possibility of inviting additional stakeholders depending on the topics to be discussed.

"Today's meeting marks a milestone that in the coming years and decades will yield many substantive benefits," Grossi said in a September 22 IAEA announcement. "The existential threats of our time require all actors to work together in order to secure a better future for coming generations. Respecting our different roles and responsibilities, there is much we can accomplish together."

In addition to nuclear's role in dealing with climate change, the announcement noted, the science can be applied to such areas as food security, human health, water and soil management and protection, plastic pollution, and disease-carrying insect pests. "In these and many other areas, nuclear technologies have much more to offer a world that is struggling to respond to the climate emergency and other urgent problems," Grossi said. "I'm determined to do everything I can do as head of the IAEA to increase their contribution to meeting such challenges. The Group of Vienna will be a key pillar to expand these concerted efforts."

Founding members of the Group of Vienna, along with the IAEA, include China National Nuclear Corporation, Électricité de France, Eletronuclear, NAC Kazatomprom JSC, Mitsubishi Heavy Industries, Nucleoeléctrica Argentina, NuScale Power, Rolls-Royce SMR, Rosatom, SNC-Lavalin Group, Teollisuuden Voima Oyj, Urenco, and Westinghouse Electric Company.

TVA

Request to extend construction permits for Bellefonte units withdrawn

Nearly 47 years after being issued construction permits for two reactors at the Bellefonte site in northeast Alabama, the Tennessee Valley Authority has decided against renewing them, essentially extinguishing any remaining hope for the project, on which the utility has reportedly spent more than $5 billion.

On September 10, TVA submitted a letter to the Nuclear Regulatory Commission withdrawing its request for an extension of the permits for the plant's pair of unfinished Babcock & Wilcox pressurized water reactors. The permits expired October 1. (Had the request been pursued and granted rather than withdrawn, the Bellefonte permits would have been extended through September 2022.)

TVA has reportedly maintained some 30 employees at Bellefonte and spent approximately $5.8 million per year over the past five years to preserve the permits during its ultimately unsuccessful effort to sell the plant to Nuclear Development LLC.

No sale

A federal court in August sided with TVA in its legal dispute with Nuclear Development over the proposed sale of Bellefonte. The court, however, also ordered the utility to refund millions to Nuclear Development over the aborted transaction.

Power & Operations continues

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"The court finds that TVA did not breach its obligations under the PSA [purchase and sale agreement]," wrote U.S. District Judge Liles Burke in an August 26 filing. "With no breach, Nuclear Development is entitled neither to specific performances nor to damages, and because Nuclear Development's claims fail, its request for a preliminary injunction must be denied. However, Nuclear Development is entitled to relief expressly contemplated by the PSA."

That relief, according to the ruling, includes the return of Nuclear Development's $22.2 million down payment for Bellefonte and $750,000 in compensated costs, plus prejudgment interest at an annual rate of 7.5 percent dating back to December 2018.

TVA in November 2016 agreed to sell the partially completed Bellefonte plant to Nuclear Development for $111 million, concluding a six-month competitive auction process for the facility. (When TVA ceased construction at Bellefonte in 1988, Unit 1 was about 88 percent complete and Unit 2 about 58 percent complete.)

Nuclear Development—owned by Franklin Haney, a Chattanooga, Tenn., developer—was formed in 2012 for the specific purpose of acquiring, financing, completing, and operating the two Bellefonte reactors. At the time, the company said it intended to finish construction of the plant with an additional investment of $13 billion.

On November 13, 2018, Haney's company submitted its construction permit transfer application for the reactors to the Nuclear Regulatory Commission. Some two weeks later, however, just days before the deal's scheduled closing, TVA announced that it did not intend to go through with the sale, saying that Section 101 of the Atomic Energy Act required that the construction permits be approved by the NRC before the transaction could be completed. Nuclear Development proceeded to file suit against TVA, and in response, the utility filed a motion to dismiss.

MIT ramps 10-ton magnet up to 20 tesla in proof of commercial concept

Above: Team members work on the large-bore, full-scale HTS magnet designed and built by Commonwealth Fusion Systems and MIT's Plasma Science and Fusion Center. (Photo: Gretchen Ertl, CFS/MIT-PSFC)

A high-temperature superconducting (HTS) magnet reached and maintained a magnetic field of more than 20 tesla in steady state for about five hours on September 5 at the Massachusetts Institute of Technology's Plasma Science and Fusion Center. Not only is the magnet the strongest HTS magnet in the world by far, it is also large enough—when assembled in a ring of 17 identical magnets and surrounding structures—to contain a plasma that MIT and Commonwealth Fusion Systems (CFS) hope will produce net energy in a compact tokamak device called SPARC in 2025, on track for commercial fusion energy in the early 2030s.

Bob Mumgaard, chief executive officer of CFS, said in a September 8 conference call with reporters that the development is "the key to unlocking a net energy fusion at a commercially relevant scale on a very fast timeline, and this could put the unlimited fusion energy that we've all hoped for into the mix for energy in the nearer term.

"If you go back three years ago when we started this particular endeavor, we said that our goal was by 2025 to build a machine, a fusion machine, that would be the first to make more energy out than it took to heat the plasma. That's a big Kitty Hawk moment," Mumgaard said. "In order to get to that time in 2025, we first needed to invent an entirely new type of magnet that could go to a much higher

magnetic field. We said, 'Give us three years to do that.' We're now at the three-year mark, and we've done that."

The large-bore HTS magnet was designed to the scale of SPARC, a demo plant now under construction in Devens, Mass., that is about half the size of a planned commercially viable fusion power plant, called ARC. CFS is aiming for a commercial system in the early 2030s, "maybe even 2030," Mumgaard said. "This is the fastest path to commercialization of affordable fusion energy across the globe."

The idea arose from a nuclear engineering class taught by MIT professor Dennis Whyte, director of the Plasma Science and Fusion Center and a cofounder of CFS. The idea was deemed promising and was developed over the next few iterations of the class, leading to the ARC power plant design concept in early 2015.

Whyte explained that the recent achievement proved concepts that were outlined in a series of scientific papers published last year on the physical basis of the new fusion device. "This is peer-reviewed science, but the technology was not available until Sunday," he said. "To put it into context, the scale and performance of this magnet is similar to a non-superconducting magnet that was used in MIT experiments five years ago. The difference in terms of energy consumption is rather stunning: That magnet, because it was a normal copper conducting magnet, consumed approximately 200 million watts of energy. To produce the confining magnetic field, this magnet was around 30 watts." That decrease—a factor of around 10 million—"makes it obvious why going to a high-field superconducting device or magnet now brings into bear net energy from fusion," Whyte said.

The magnet contains about 270 kilometers of superconducting tape wrapped in a spiraling pattern in 16 separate layers that are stacked together and sealed within a metal case. The finished magnet weighs about 10 tons and is 10 feet tall and about half as wide.

Rather than simply a swapping out low-temperature superconducting material for HTS and using the same cable configuration, the magnet design took advantage of the inherent flexibility of ribbon-like HTS tape. That tape is made from a material called REBCO, which stands for three constituent materials: rare earth, barium, and copper oxide. Its optimal operating temperature is a frigid 20 K, but relative to low-temperature superconductors, which require temperatures of a few degrees above absolute zero, HTS magnets require significantly less energy for cryogenic control.

Principal investigator Zach Hartwig, an assistant professor in the MIT Department of Nuclear Science and Engineering, explained that it took about a week to cool the magnet to superconducting temperature and another few days to ramp the magnetic field up to full performance. The magnet was held in steady state for about five hours before the researchers ramped down the power.

"The timescale of just a few hours even is sufficient data to lock in the knowledge that the magnet is in steady state. It's performing exactly as we thought it would, and that's sufficient to demonstrate the metrics," Hartwig said.

MOBILE DEMO

Draft EIS released for Project Pele microreactor at INL

Plans to test a prototype mobile microreactor designed to military requirements are moving ahead. The Department of Defense (DOD), acting through its Strategic Capabilities Office and with the Department of Energy serving as a cooperating agency, announced the availability of a draft environmental impact statement for the construction and demonstration phase of Project Pele on September 16.

Mobile military microreactors have been suggested as an alternative to the diesel generators often used to supply electricity to Army

Research & Applications continues

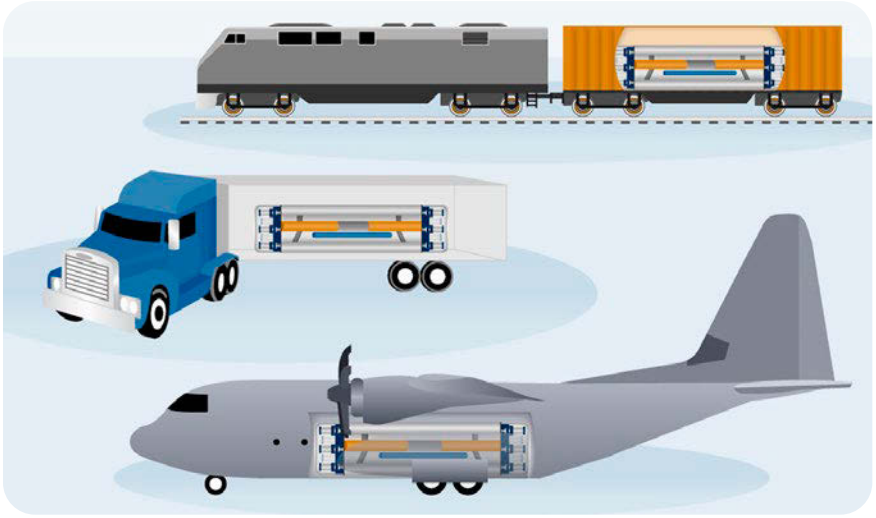
operations because they could eliminate the need for expensive and hazardous transports of diesel fuel to remote locations or forward operating bases. The draft EIS describes the 2016 findings of a Defense Science Board report commissioned by the DOD, saying that the board "evaluated available energy technologies before concluding that electrical generating capability for forward operating bases, remote operating bases, and expeditionary bases can best be met by a less than 10-MWe microreactor system that can be safely and rapidly moved by road, rail, sea, or air for quick setup and shutdown."

In March 2021, the DOD announced that it had selected two of three teams from a preliminary design competition to move ahead with the development of a final design of a prototype mobile microreactor capable of producing 1–5 MWe (a reduction from the initial project specs, which called for a reactor producing 1–10 MWe). The designs—submitted by BWXT Advanced Technologies and X-energy—are both for small, high-temperature gas-cooled reactors using high-assay low-enriched uranium TRISO fuel produced from DOE stockpiles of high-enriched uranium located at the Y-12 Plant in Oak Ridge, Tenn.

Both designs would consist of a microreactor module, a power conversion module, and a control module, each housed in a 20-foot-long CONEX shipping container ready for air, sea, or ground transport. A fourth CONEX container could be used for ancillary equipment, such as pipes, cables, and connectors. Following a final design review in early 2022, one of the two companies may be selected to build a prototype reactor during a 24-month construction and demonstration phase.

As described in the draft EIS, demonstration at Idaho National Laboratory would go beyond simply starting up and operating the reactor. After initial testing, the reactor would be shut down, transported to a second test location at INL, and restarted. At the second testing location, the mobile microreactor system would be connected to a small, isolable microgrid with diesel generators and load banks attached.

The Army requires reliable electricity at large domestic and international bases as well as forward operating bases. A report published in June by a National Academies committee (also commissioned by the DOD), titled *Powering the U.S. Army of the Future*, examines multiple energy sources used by the Army. In a brief discussion of Project Pele, the report states that the program "may prove appropriate for domestic and permanent overseas bases. It will not, however, adequately meet the needs of expeditionary and defensive operations due to its limited power rating and mobility concerns." The report recommends that "the detailed safety and regulatory requirements of a nuclear power plant be clearly defined and agreed to by all appropriate government agencies before prototype definition proceeds further."



Potential transport modes for nuclear microreactors. (Image: Government Accountability Office, GAO-20-380SP)

The publication of the draft EIS by the Environmental Protection Agency in the *Federal Register* on September 24 marked the opening of a 45-day public comment period that will end on November 9. According to the DOD's schedule, the notice of availability of the final EIS is expected in January 2022, and a record of decision on the project is expected in March 2022. Additional information about the project and the public hearings can be found at mobilemicroreactoreis.com.

MEDICAL RADIOISOTOPES

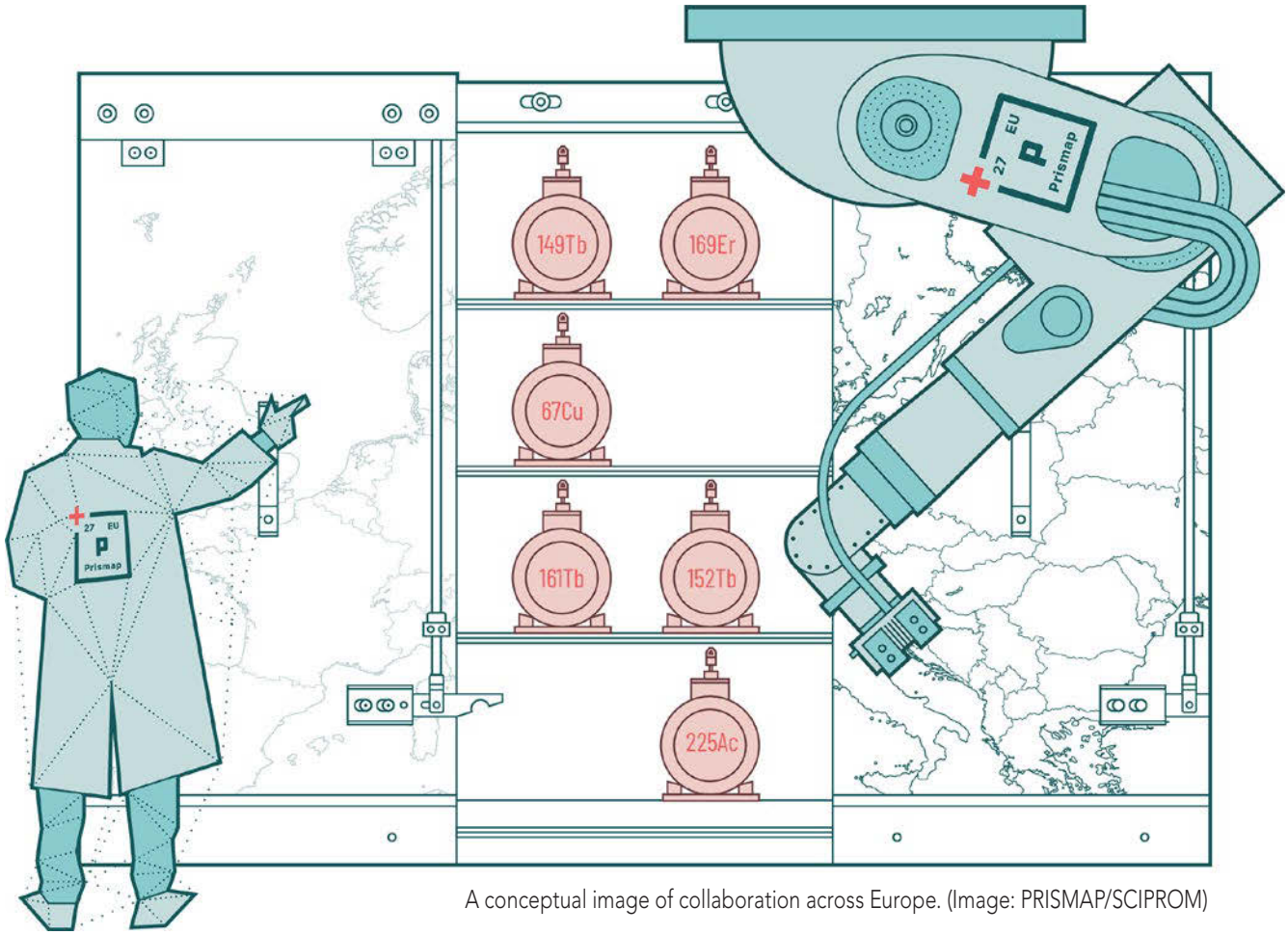
PRISMAP: A European network for medical radioisotope production and research

Only a few of the more than 3,000 different radioisotopes that scientists have synthesized in the laboratory are regularly used in diagnostic or therapeutic medicine. One significant barrier to the development of new medical radioisotopes is reliable access throughout the early stages of development and research. PRISMAP is a new medical radionuclide program designed to streamline that access for medical research within the European Union and the U.K.

PRISMAP will unite a fragmented user community to study novel production technology, new purification methods, and proof-of-concept investigations to develop new treatments from test bench to patient care. PRISMAP will serve a consortium of 23 beneficiaries from 13 countries, providing access to intense neutron sources, isotope mass separation facilities, and high-power accelerators and cyclotrons to the biomedical and healthcare research institutes putting those radioisotopes into use in medical diagnosis and treatment. The program has support from the European Association of Nuclear Medicine and the International Atomic Energy Agency.

According to a PRISMAP press release, "Nuclear therapy and molecular imaging are widely used at hospitals for new promising medical procedures. They can drastically improve

Research & Applications continues



A conceptual image of collaboration across Europe. (Image: PRISMAP/SCIPROM)

the outcome for many medical conditions and enable treating disseminated cancer in particular. However, effective development has long been limited by the difficult access to radionuclides not yet commercially available. With PRISMAP—the European medical radionuclides program—this is about to change."

Novel radioisotopes that have yet to prove their clinical potential typically must be produced using research reactors or laboratory-scale particle accelerators. They also must be highly purified to ensure quality patient care and reliable research results and to minimize waste management issues in a hospital environment.

Researchers and clinicians will be able to visit PRISMAP (prismap.eu) for a single-access platform of production and support capabilities and can submit a proposal through the platform. In some cases, traveling researchers from remote European laboratories may be hosted at biomedical research facilities located near a production site if, for example, the isotope being researched has a half-life that would not permit long transport routes.

Access to radioisotopes and associated facilities will be granted competitively by a selection panel consisting of experts in the fields of radioisotope production, molecular imaging, and radionuclide therapy. The first call for proposals will be launched before the end of 2021 for applications in the first quarter of 2022. PRISMAP is funded under the European Union's Horizon 2020 research and innovation program until April 2025.

Bruce Power will produce medical Lu-177, a power reactor first

Bruce Power has received approval from the Canadian Nuclear Safety Commission (CNSC) to begin the production of lutetium-177, becoming the first power reactor globally to commercially produce the medical radioisotope. Isogen, a joint venture between Framatome and Kinectrics, will produce Lu-177 at Bruce's eight-unit CANDU nuclear power plant in Ontario, Canada, using Isogen's isotope production system (IPS).

The Bruce nuclear power plant in Ontario, Canada. (Photo: Bruce Power)

Lu-177 allows for targeted and precise treatments, destroying cancer cells while limiting damage to surrounding healthy tissue and organs. The Lu-177 will be produced by irradiating ytterbium-176 targets sealed in special containers and placed in the IPS in one of Bruce's CANDU reactors for about two weeks.

Once irradiated, the ytterbium targets will be processed by the German-based radiopharmaceutical company Isotopen Technologien München (ITM), which will produce highly pure, no-carrier-added Lu-177 in pharmaceutical quality. The medical isotope will be marketed globally by ITM under the brand name EndolucinBeta.

The installation of the IPS is part of the ongoing life-extension program at the Bruce Power site that began in 2016. According to Bruce Power, as the IPS commissioning process continues, there will be additional regulatory hold points to allow CNSC staff to confirm operational readiness of the system prior to the start of Lu-177 production.

In Case You Missed It—Research & Applications

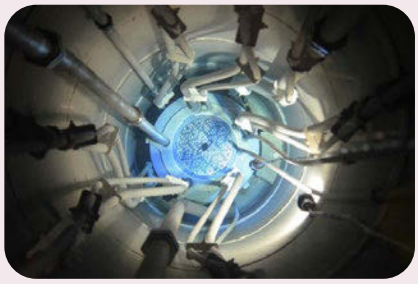
Canada's Darlington station will produce helium-3 from tritium stored at the Ontario Power Generation site with the help of Laurentis Energy Partners, a subsidiary of OPG. The four-unit CANDU station houses one of the world's largest reserves of tritium, a by-product of the heavy water used in CANDU reactors. He-3 can be used as a medical isotope for imaging of airways, in border security, in neutron research, and as a supercoolant in cryogenics.

Workers examine the He-3 extraction tool at Darlington. (Photo: Laurentis)

The IAEA sent an expert team to Lebanon in the aftermath of a devastating explosion in the port of Beirut in August 2020 to confirm that radiation levels had not increased after the blast. Recently, a different team of experts has traveled to Beirut with a new mission: to assist the nation in the use of non-destructive testing (NDT) to check the structural soundness of buildings that were impacted by the explosion. During the week-long mission, the International Atomic Energy Agency team—including three experts from Italy, Malaysia, and Spain, as well as one IAEA staff member—trained national authorities and professionals in the practical application of NDT.

The IAEA team used specialized equipment to carry out NDT training. (Photo: Abel Domato/BAC)

Ontario's SLOWPOKE-2 research reactor has been refueled after over three decades in operation at the Royal Military College of Canada (RMC), providing access to training, research, neutron activation analysis, and other applications for RMC students, Canadian Armed Forces personnel, and the Department of National Defense. Canadian Nuclear Laboratories announced on September 23 that it had refueled the SLOWPOKE-2 research reactor by removing the old reactor core, commissioning the reactor with a new core manufactured at CNL's Chalk River Laboratories, and transferring the spent core to a nuclear waste management facility.



The core of SLOWPOKE-2. (Photo: CNL)

For in-depth coverage of these stories and more, see ANS's* Nuclear Newswire *at ans.org/news.

Research & Applications continues

Bruce Power is also collaborating with Canada's Saugeen Ojibway Nation (SON) in jointly marketing new isotopes while working together to create economic opportunities within the SON territory by establishing new isotope infrastructure. The partnership includes an equity stake and a revenue-sharing model for SON.

"This project is an innovative partnership between Bruce Power, Isogen, Saugeen Ojibway Nation, and ITM and is a game changer for the supply of medical isotopes and the global medical community in the fight against cancer," said James Scongack, Bruce Power's chief development officer and executive vice president of operational services.

EDUCATION AND OUTREACH

NuScale simulator installed at new Idaho laboratory

The Center for Advanced Energy Studies (CAES) has announced the opening of a Small Modular Reactor Simulator Laboratory featuring NuScale Power's Energy Exploration Center at its headquarters in Idaho Falls, Idaho. The new lab will increase CAES's capabilities to train future scientists, engineers, and members of the energy workforce and will be used to educate the public about nuclear energy and reactor technology, according to a CAES press release.

The new lab features a virtual nuclear power plant control room that allows users to assume the role of operator to learn about NuScale's SMR technology. Plans call for the first NuScale modular light water reactor power plant to be constructed on Idaho National Laboratory's 890-square-mile desert site west of Idaho Falls as part of the Utah Associated Municipal Power Systems' Carbon Free Power Project.

"The new lab provides a platform for communicating the importance of carbon-free nuclear power for attaining a safe, clean, and secure energy future for the U.S. and the world," according to the CAES announcement. "The lab will enhance CAES's community outreach efforts through demonstrations, tours, and education to community leaders, K–12 students, and interested citizens."

Department of Energy grants supported the installation of the NuScale simulator—and two others like it at Oregon State University and Texas A&M University. Those grants were obtained through the DOE's Nuclear Energy University Program and announced in August 2019. Oregon State's simulator installation was completed in November 2020, according to NuScale.

CAES is a research, education, and innovation consortium consisting of Idaho National Laboratory and Idaho's public research universities: Boise State University, Idaho State University, and the University of Idaho. Headquartered in a 55,000-square-foot facility in Idaho Falls, CAES uses a hub-and-spoke model to connect more than 7,000 researchers, engineers, and university faculty and more than 50,000 students.

A NuScale representative conducts training on the nuclear power plant control room simulator for students and faculty at CAES. (Photo: CAES)

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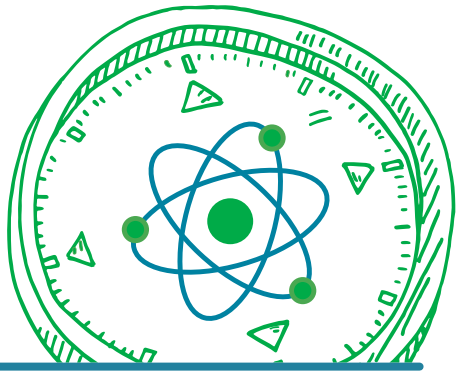

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SNF facility granted license days after Texas moves to ban it

The Nuclear Regulatory Commission has issued a license to Interim Storage Partners (ISP), a joint venture of Waste Control Specialists and Orano USA, to construct and operate a consolidated interim storage facility for spent nuclear fuel in Andrews, Texas. Issued on September 13, the license comes just four days after Texas Gov. Greg Abbott signed a bill to block such a facility from being built in the state.

The license is the second one issued by the NRC for a consolidated storage facility for spent nuclear fuel. The first was issued in 2006 to Private Fuel Storage for a site in Utah, but that facility was never constructed. The NRC is currently reviewing an application from Holtec International for a similar facility proposed for Lea County, N.M. A decision on that application is currently expected in January 2022.

ISP intends to build its storage facility on property adjacent to Waste Control Specialists' low-level radioactive waste disposal site already operating under a Texas license. The NRC license authorizes ISP to receive, possess, transfer, and store up to 5,000 metric tons of spent fuel and 231.3 metric tons of greater-than-Class C low-level radioactive waste for 40 years.

The company has said that it plans to expand the facility in seven additional phases, up to a total capacity of 40,000 metric tons of fuel. Each expansion would require a license amendment, with additional NRC safety and environmental reviews.

Above: A rendering of ISP's proposed consolidated interim storage site for spent nuclear fuel in Texas. (Photo: ISP)

ISP submitted a revised license application to the NRC in July 2018. Waste Control Specialists had previously submitted an application for an interim storage facility in conjunction with Areva and NAC International but withdrew that application in 2017.

Along with the license, the NRC is issuing a safety evaluation report, documenting the agency's technical review of the facility. Information about the license application and the NRC staff's reviews is available on the NRC website at nrc.gov. The NRC said that licensing documents will be made available on the NRC site, as well.

State reaction

Texas House Bill 7, authored by Rep. Brooks Landgraf (R., 81st Dist.) of Odessa, in whose district ISP's proposed facility would be located, bars the transportation and disposal or storage of high-level radioactive waste in Texas. The bill also prohibits state agencies from issuing construction, storm water, or pollution permits for facilities that are licensed by the NRC to store high-level radioactive waste. Exemptions are made for currently or formerly operating nuclear power reactors and research and test reactors operating on university campuses.

The law went into effect on September 9, immediately upon being signed by Gov. Abbott. On September 23, Gov. Abbott and the Texas Commission on Environmental Quality filed a lawsuit against the NRC in the Fifth Circuit U.S. Court of Appeals, demanding that the court review and ultimately vacate the license.

HIGH-LEVEL WASTE

GAO urges Congress to address spent fuel stalemate

Congress needs to take action to break the impasse over a permanent solution for commercial spent nuclear fuel, according to a report by the U.S. Government Accountability Office. The GAO recommends that Congress amend the Nuclear Waste Policy Act (NWPA) to authorize a new consent-based siting process, restructure the Nuclear Waste Fund, and direct the Department of Energy to develop and implement an integrated waste management strategy.

The GAO also recommends that the DOE finalize the consent-based process it began in 2015 for siting consolidated interim storage and permanent geologic repository facilities.

The GAO report, *Commercial Spent Nuclear Fuel: Congressional Action Needed to Break Impasse and Develop a Permanent Disposal Solution*, sets out actions that experts have identified as necessary to develop a solution for spent nuclear fuel disposal. The GAO said that it reviewed DOE and other agency documents and interviewed 20 experts and 25 stakeholders from industry, nongovernmental organizations, and tribal and state groups. According to the GAO, the experts highlighted concerns about the effect of the continuing spent fuel impasse on environmental, health, and security risks; efforts to combat climate change; and taxpayer costs.

The report notes that about 86,000 metric tons of commercial spent fuel is stored on-site at 75 operating or shut down nuclear power plants in 33 states, an amount that grows by about 2,000 metric tons each year.

The GAO report offers four matters for congressional consideration:

- Congress should consider amending the NWPA to authorize a new consent-based process for siting, developing, and constructing consolidated interim storage and permanent repository facilities for commercial spent nuclear fuel.

Spent nuclear fuel in dry storage at the decommissioned Zion nuclear power plant in Illinois.

Waste Management continues

■ Congress should consider creating a mechanism, such as an independent board, to provide political insulation and continuity of leadership for managing the spent nuclear fuel disposal program.

■ Congress should consider restructuring the Nuclear Waste Fund so that funds used to develop, construct, and operate a permanent repository are based on the commercial spent nuclear fuel program's life cycle costs.

■ Congress should consider directing the DOE to develop and implement an integrated waste management strategy, consistent with any amendments to the NWPA, that includes plans for the transportation, interim storage, and permanent disposal of spent nuclear fuel.

The GAO also recommends that the energy secretary direct the DOE's Office of Nuclear

In Case You Missed It—Waste Management

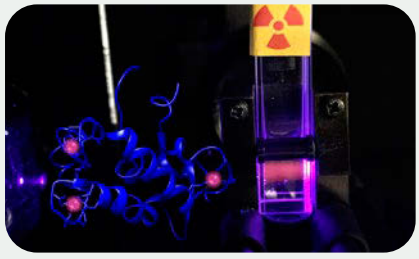
The German government has announced that it is closing the Gorleben salt mine in the Wendland region of Lower Saxony, officially removing the site from consideration as a repository for radioactive waste. Gorleben became a target of antinuclear protests after being proposed as a potential repository in the 1970s.

The headframe and buildings at the Gorleben salt dome in Germany. (Photo: Wikimedia Commons)

Bundesgesellschaft für Endlagerung (BGE), Germany's federally owned company for radioactive waste disposal, removed the Gorleben salt dome from its list of potential radioactive waste storage sites last year. In a joint press release with BGE, the Federal Ministry for the Environment said that after considering the site's fate, it will work with the company to decommission the mine.

"As of today, the Gorleben repository chapter will be closed," said Germany's state secretary for the environment, Jochen Flasbarth, in a September 17 press release. "I hope that the wounds in Wendland can heal now that a decades-long dispute over Gorleben is over."

A new mechanism by which radionuclides could spread in the environment has been uncovered by scientists at Lawrence Livermore National Laboratory, working in collaboration with researchers at Penn State University and Harvard Medical School. The research, which has implications for nuclear waste management and environmental chemistry, was published in the *Journal of the American Chemical Society* on September 20.



In a sample (right), the protein lanmodulin makes curium glow when exposed to UV light. (Photo: LLNL)

"This study relates to the fate of nuclear materials in nature, and we stumbled upon a previously unknown mechanism by which certain radioactive elements could spread in the environment," said LLNL scientist and lead author Gauthier Deblonde. "We show that there are molecules in nature that were not considered before, notably proteins like lanmodulin that could have a strong impact on radioelements that are problematic for nuclear waste management, such as americium, curium, etc."

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Energy to continue its efforts to engage the public and finalize its draft consent-based siting process, which was released for public comment in January 2017.

The GAO said that the draft includes elements that nearly all experts agree are critical for an effective siting process and that finalizing it could help position the department to implement a consent-based process if Congress amends the NWPA to allow for storage and disposal options other than, or in addition to, the Yucca Mountain repository.

In response, Kathryn Huff, the DOE's acting assistant secretary for nuclear energy, said that the department concurs with the recommendation. She noted that the DOE is resuming work to implement a consent-based siting process and expects to publish an updated process in early 2022, pending an initial request for public input to be issued this year.

Congressional action

Following the release of the GAO report, on September 28, Sen. Edward J. Markey (D., Mass.) and Rep. Mike Levin (D., Calif.) introduced the Nuclear Waste Task Force Act, legislation intended to establish a new task force to consider the implications of amending the Atomic Energy Act of 1954 to remove exemptions from environmental laws for nuclear waste. Eliminating this loophole could help enable consent-based siting of long-term storage solutions for spent nuclear fuel and high-level radioactive waste, the lawmakers said.

Markey

Levin

Intended to continue the work of 2012's Blue Ribbon Commission on America's Nuclear Future, the task force would also be responsible for providing a clear explanation of what constitutes "consent-based siting."

"Storing all of our nation's nuclear waste is a hard sell for any state, especially when it's exempt from bedrock environmental laws," said Markey. "Enabling consent-based storage is the key to developing real, practical solutions for the long-term storage of nuclear waste. This nuclear waste task force will play a critical role in determining how to make that happen."

Under the language of the bill, the task force would be established through the Environmental Protection Agency and be composed of no more than 30 members representing federal, state, tribal, and local government agencies; nongovernmental organizations; unions; and the private sector. Federal members would include representatives from the EPA, the DOE, the Nuclear Regulatory Commission, the White House Office of Science and Technology Policy, and the Department of Transportation.

DECOMMISSIONING

Unrestricted release of La Crosse and Zion sites delayed until 2022

The Nuclear Regulatory Commission has extended its orders transferring the licenses for the La Crosse and Zion nuclear power plant sites from EnergySolutions back to the plant owners until late 2022. This is the third time the NRC has extended the effectiveness of the license transfer orders for the decommissioned plants since approving them in 2019.

EnergySolutions, which took over the licenses for the Zion plant in Illinois and the La Crosse boiling water reactor in Wisconsin for expedited decommissioning, requested the 12-month extensions as it works to respond to requests from the NRC for additional information regarding the final status survey reports (FSSRs) for the two sites. The NRC issued the extension orders for La Crosse and Zion on August 30 and published notice in the September 7 *Federal Register*.

Waste Management continues

La Crosse

EnergySolutions subsidiary LaCrosseSolutions acquired the La Crosse site license from the Dairyland Power Cooperative in 2016. On November 12, 2019, the company announced that it had completed the physical work of decommissioning the plant, which was shut down in 1987 and had already been partially decommissioned.

By a September 2019 order, the NRC consented to the transfer of the La Crosse license back to Dairyland Power. Unless good cause could be shown for extending it, the NRC order was to become null and void if the license transfer was not completed within one year.

LaCrosseSolutions twice applied to the NRC to extend the order's September 2020 expiration date for an additional six months, first in June 2020 and again in February 2021. The NRC approved both extensions.

The La Crosse site in 2019 with major decommissioning completed. The coal-fired Genoa plant is in the background. (Photo: EnergySolutions)

In August of this year, the company again requested that the order be extended, this time for an additional 12 months, to September 2022. In requesting the extension, LaCrosseSolutions noted that NRC staff is continuing to review the site's FSSRs. "Based on the current status of the NRC review, it is anticipated that additional time will be needed to address any questions or potential issues identified by the NRC during review of the responses to the request for additional information and the revised FSSRs," the company said.

Zion

Similarly, EnergySolutions subsidiary ZionSolutions requested in August that the transfer of Zion's license back to Exelon Generation be extended by 12 months after previously being granted two six-month extensions, one in October 2020 and the other in May 2021. The NRC first approved the transfer order in November 2019, following ZionSolutions' completion of the majority of decommissioning work at Zion.

ZionSolutions, in requesting the extension, likewise noted that more time was needed to respond to NRC staff requests for information regarding the site's FSSRs. "The extension provides the NRC staff with additional time to assess the responses provided by ZionSolutions and make a final determination regarding the release of land for unrestricted use," the company said.

On August 19, the NRC sent ZionSolutions a 38-page letter with 11 requests for additional information regarding radiological conditions at the Zion site.

NorthStar intervenes in transfer of Kewaunee to EnergySolutions

NorthStar Group Services is being allowed to intervene in Wisconsin's regulatory review of the sale of the Kewaunee nuclear power plant by Dominion Energy to EnergySolutions for decommissioning. An administrative law judge granted NorthStar permission on September 7 to participate in the Public Service Commission of Wisconsin's review of the transaction.

EnergySolutions announced in May that it had entered into an agreement with Dominion to acquire Kewaunee. The single-unit pressurized water reactor was shut down in 2013, and Dominion completed the transfer of the plant's spent nuclear fuel to dry storage in 2017. EnergySolutions is estimating that it will cost about $724 million to decommission and restore the Kewaunee site, not including spent fuel management costs.

Currently, about $780 million is available in the Kewaunee decommissioning trust fund. NorthStar, which petitioned to intervene in the proceeding in June, is claiming that it can decommission Kewaunee for a fixed price of $550 million, with $50 million placed in escrow to cover any cost overruns. NorthStar said that it would return any remaining decommissioning funds to ratepayers.

NorthStar, which is currently decommissioning the Vermont Yankee and Crystal River nuclear plants, is arguing that its "expertise, experience, and willingness to offer substantial protections to the ratepayers should be considered" by PSC Wisconsin in its review.

Noting the company's assertions of experience and expertise, administrative law judge Michael Newmark said in his order, "NorthStar's participation likely will promote the proper disposition of the issues." Newmark added that because the commission has not set a proceedings schedule, its decision will not be delayed by NorthStar's intervention.

NorthStar is challenging the sale of Kewaunee to EnergySolutions. (Photo: Dominion Generation)

Both Dominion and EnergySolutions oppose NorthStar's intervention in the sale proceedings. In its response to NorthStar's petition to intervene, Dominion said, "Although it seeks to cloak its claims in the interests of Wisconsin ratepayers, NorthStar's interest is nothing more than a desire to have a business role in the decommissioning of the Kewaunee Power Station."

Vice president, director candidates nominated for 2022 ANS national election

Adams

Petersen

The ANS Nominating Committee has selected candidates to vie for seven ANS leadership positions with terms beginning in June 2022.

The candidates for a one-year term as vice president/president-elect are Brad Adams and Ken Petersen. Adams, ANS member since 2009, is engineering vice president at Southern Nuclear. Petersen, ANS member since 1989, is the vice president of nuclear fuels at Exelon Generation.

The elected candidate will succeed current ANS vice president/president-elect Steven Arndt in June 2022, when Arndt becomes president.

Additionally, six seats on the ANS Board of Directors are open for June 2022. ANS members elected to the Board of Directors serve three-year terms that begin and end during the ANS Annual Meeting. Five of the six open director seats are for U.S. resident candidates; the remaining seat will be filled by a non-U.S. member.

The 11 candidates who have been nominated to fill five U.S. director-at-large seats are as follows: Chris Perfetti, University of New Mexico; Shaheen Dewji, Texas A&M University; Jamie Coble, University of Tennessee–Knoxville; Sven Bader, Orano Federal Services; Christina Leggett, Booz Allen Hamilton; Chip Martin, Longenecker and Associates; Andrew Worrall, Oak Ridge National Laboratory; Ralph Hunter, Exelon Generation; John Mahoney, High Expectations International; Chris Nolan, Duke Energy; and Dan Stout, Tennessee Valley Authority.

Nominated to run for the international director position are Carlos Gho, a member of the International Atomic Energy Agency's Standing Advisory Group on Nuclear Energy; and Rafal Kasprów, chief executive officer at Synthos Green Energy.

ANS News continues

Perfetti

Dewji

Coble

Bader

Leggett

Martin

Worrall

Hunter

Mahoney

Nolan

Stout

Gho

Kasprów

ANS Winter Meeting & Expo

LIVE: *In-person and Virtual!*

November 30 – December 3, 2021
Washington Hilton
Washington, D.C.

- In-person attendees will have full access to plenary and technical sessions.
- Virtual attendees will be able to present papers and view all plenary and executive sessions, along with selected technical sessions.

Registrations will be convertible to allow flexibility in case plans change.

Register and learn more at answinter.org.

Embedded Topical Meetings

Decommissioning Environmental Science and Remote Technology 2021
November 30 – December 3

14th International Topical Meeting on Nuclear Applications of Accelerators
November 30 – December 4

The directors with terms ending in June 2022 are Mary Lou Dunzik-Gougar, Corey K. McDaniel, Tracy E. Stover, Charles W. Forsberg, Margaret E. Harding, and Olga Cortes Rabelo Leão Simbalista (international board participant).

The Nominating Committee for the 2022 election was chaired by ANS immediate past president Mary Lou Dunzik-Gougar and included Local Sections Committee chair Travis Trahan and Professional Divisions Committee chair Deborah Hill, as well as ANS members Doug True, Jeff Harper, Jess Gehin, Monica Regalbuto, Paul Wilson, and Bob Martin.

Any ANS member may also nominate candidates for officer and director vacancies by petition. Acceptable petitions for this cycle's election must contain the original signature of 200 or more ANS voting members, have the nominee's written consent, and reach ANS headquarters no later than January 10, 2022.

Ballots for the 2022 election will be sent to ANS members electronically on February 22, 2022, and must be submitted by 1:00 p.m. EDT on Tuesday, April 12, 2022.

ANS to honor award recipients at 2021 Winter Meeting

The recipients of ANS awards will be recognized during the 2021 ANS Winter Meeting in Washington, D.C., during the opening plenary and President's Special Session. The national awards will be presented by President Steven Nesbit and Honors and Awards Committee chair H. M. "Hash" Hashemian.

Dwight D. Eisenhower Medal

Presented to **Ernest J. Moniz**, of the Nuclear Threat Initiative, for his leadership in promoting the development of clean energy sources and in reducing the worldwide radiological threat through global nonproliferation efforts.

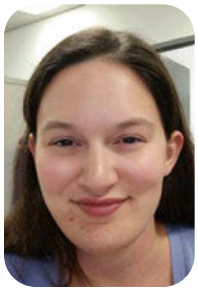
Seaborg Medal

Presented to **John C. Browne**, of Los Alamos National Laboratory (retired), in recognition of a career of research contributions and institutional management and stewardship as well as his dedication toward the recruitment and development of scientists and engineers.

Milton Levenson Distinguished Service Award

Presented to **Robert F. Penn**, of Los Alamos National Laboratory, for his untiring and continued support of the mission of nuclear energy and over 45 years of ANS involvement as a leader, an advisor, a hard worker, a friend, and a visionary.

Darlene Schmidt Science News Award



Presented to **Caroline Delbert**, of *Popular Mechanics*, for her growing coverage of all things nuclear science and technology with a focus on advanced reactor designs, fusion energy, nuclear space technology, and non-energy applications of nuclear technology and radiation. Delbert's writing explains nuclear technology concepts and developments in clear language to the general public.

Alvin M. Weinberg Medal

Presented to **Kenneth L. Peddicord**, of Texas A&M University, for nearly 50 years of contributions to major advances in nuclear technology and education, while providing innovative international experiences to students.

E. Gail de Planque Medal

Presented to **Sara A. Pozzi**, of the University of Michigan, in recognition of her sustained, significant scientific contributions to nuclear nonproliferation and security through a combination of detection system advancement and multi-institutional leadership.

Mary Jane Oestmann Professional Women's Achievement Award

Presented to **Madeline A. Feltus**, of the Department of Energy Office of Nuclear Energy, in recognition of her outstanding personal dedication, leadership, and technical achievements in the fields of nuclear science, engineering, research, and education.

Also presented to **Raluca O. Scarlat**, of the University of California–Berkeley, in recognition of her technical leadership in advancing the knowledge base of high-temperature molten salts and their application to advanced nuclear reactors and in developing a molten salt reactor curriculum.

Social Responsibility in the Nuclear Community Award

Presented to the Tennessee-85 students, in recognition of the outstanding leadership provided by these 85 brave, young students in desegregating the first public school system in the southeastern United States in 1955. Also presented to the secretary of energy of the Department of Energy (then the Atomic Energy Commission), for leadership in that desegregation effort.

Reactor Technology Award

Presented to **Mohamed S. El-Genk**, of the University of New Mexico, in recognition of extraordinary contributions toward advancing space and micro-reactor technologies.

Landis Public Communication and Education Award

Presented to **Joshua L. Vajda**, of Amentum Technical Services, for exemplary outreach efforts domestically and internationally to increase public understanding of nuclear careers and to promote the importance of professional licensure.

Also presented to **Michael W. McCracken**, of Southern Nuclear Operating Company, for exhibiting outstanding communication skills and in recognition of an exceptional ability to inform teachers, K-12 students, and other audiences about nuclear science and technology careers and applications.

Young Members Advancement Award

Presented to **Benjamin Holtzman**, of the Nuclear Energy Institute, for service and commitment to ANS young members everywhere.

Young Member Excellence Award

Presented to **Harsh S. Desai**, of Zeno Power Systems, for advancing the goals of the ANS Young Members Group through exceptional leadership and for remarkable contributions to the Society.

ANS News continues

Tennessee-85 students to receive inaugural Social Responsibility award from ANS

The American Nuclear Society has selected a group of black former students known as the Tennessee-85 to receive the inaugural Social Responsibility in the Nuclear Community Award. The 85 former students are receiving the honor in recognition of their bravery and leadership displayed in desegregating an Oak Ridge school in Tennessee in 1955. A corecipient of the award is the secretary of energy for the leadership displayed by the Atomic Energy Commission (now the Department of Energy) in ordering the all-white Oak Ridge public schools to integrate that year. The awards will be presented at the upcoming ANS Winter Meeting.


Good News

The Oak Ridger

Janu-Winter

LOCAL SCHOOLS INTEGRATE IN FALL

Mid-Air Plane Crash Kills 15

D-Y Compromise Is Ruled Out

100 High, Jr. High Students To Change; AEC, Educators Make Announcement

Lab Heads At

$300 Fire

The front page of the local newspaper the *Oak Ridger* announcing integration. (Photo: Oak Ridge Public Library)

The ANS Honors and Awards Committee, in conjunction with the Diversity and Inclusion in ANS Committee, established the award last year. H. M. "Hash" Hashemian, the H&A Committee chair, said, "This award recognizes an individual, group, or organization for outstanding efforts in social responsibility promoting diversity, equity, and inclusion or inclusive community building in the nuclear community, and it is perfectly suited that the inaugural award recognizes the 85 brave young Tennessee students and the U.S. Department of Energy in desegregating the first public school system in the southeastern United States back in 1955."

Along with a plaque presented at the ANS Winter Meeting, ANS will provide $1,000 to the TN-85 Student Endowment Fund.

Martin McBride, ANS member since 2001 and retired DOE site manager, approached the H&A Committee in July 2020 with the idea of creating the award. He had observed that the 2020–2021 school year marked the 65th anniversary of the desegregation of public schools in Oak Ridge. McBride noted that nuclear pioneers have made important contributions to civil rights, and he highlighted the role that the AEC played in desegregating Oak Ridge schools. At the time, the AEC managed the schools because the town was under federal jurisdiction due to its involvement with the Manhattan Project.

"Our industry has played an amazing role in the social advancement of our culture," McBride said. "In addition to showing respect for fairness and equality, the new ANS diversity award should help attract the best and brightest young people to the nuclear business in the future."

New Members

The ANS members and student members listed below joined the Society in September 2021.

Chenkovich, Robert J., Dominion Energy

Delipei, Gregory K., North Carolina State University
d'Eon, Eugene, NVIDIA
Dietz, Paul, Grant County (Wash.) Public Utility District
Dobken, John, Southern California Edison

Edwards, Jarrod, Sandia National Laboratories

Fishman, Stephanie B., Hogan Lovells
Fundak, Robert, Amentum Technical Services

Gawne-Mark, Sean R., Southern Nuclear Company
Giegel, Sam H., Battelle Energy Alliance

Hanlon, Thomas, Y-12 National Security Complex

Iwashita, Tsuyoshi, ES Technologies (Japan)

Kutsaev, Sergey V., RadiaBeam

McCumber, Joshua

Tierney, Chris F., HKA Global

Williams, Michael S., EnergySolutions

Yin, Liang, General Electric

Zhang, Tian

STUDENT MEMBERS

Binghamton University
Ventresca, John V.

Boise State University
Holloway, Kyle R.

Brigham Young University
Hanson, Hannah
Johnston, Maren
Loose, Justin
Nakamoto, Taggart
Payne, Alex T.
Wagner, Emily M.

Colorado School of Mines
Landy, Drew J.

Excelsior College
Herbert, Tawab
Sloan, Jacob
Zumpano, Charles L.

Georgia Institute of Technology
Cox, Daniel L.
Nunnally, Hugh P.
Shade, Jana A.
Thompson, Kenneth E.

Idaho State University
Ali, Eslam
Jenkins, Ellen F.
Johnson, Brooke
Long, Joseph R.
Merrill, Marissa

McGill University (Canada)
Lamenta, Valerie

Missouri University of Science and Technology
Ashley, Cameron J.
Clark, Ian S.
Coelho Teixeira Barbosa, Ana J.
Crawford, Juniper R.
England, Christopher W.
Franklin, Eric A.
Hook, Samuel D.
Kuhl, Andrew J.
Lipp, Kaeden A.
Martin, Cody L.
McAdams, Isaac T.
Mertens, Nicholas D.
Miller, Hayden J.
Stone, Charles P.
Tusar, Mehedi H.

National Tsing Hua University Institute of Nuclear Engineering and Science (China)
Wang, Ta Chun

New Mexico Institute of Mining and Technology
Santistevan, Geno

Ohio State University
Capito Ruiz, Linda J.
Gordon, Emily J.

Pennsylvania State University
Dziadyk, Alyssa N.
Gillow, Max A.
Kramer, Erek J.
Spallone, Vinnie F.

Purdue University
Bloor, Trent W.
Bolen, Mitchell T.
Brogniart, Sydney
Brown, Jacob A.
Buerke, Cameron J.
Chavez-Duarte, Giezzy E.
Connelly, John P.
Davis, Jacob
Doyle, Paige
Edwards, Wyatt J.
Giacchetti, Mason E.
Heath, Tyler J.
Hermann, Adam J.
Hocking, Seth
Hylen, Trevor G.
Komrska, Allison M.
Lucido, Hanne R.
Meeks, Connor J.
Simonton, Donovan D.
Smith, Morgan K.
Tollett, Nathan R.
Yoder, Chloe E.

Seoul National University (South Korea)
Jae, Seungug
Jeon, Seoyoon
Kim, Seongchan

Texas A&M University
Brauer, Samuel B.
Cashmer, William R.
Dal Colletto, Carlo
English, Ross
Gomulak, John A.
Harris, Zachary A.
Laird, Kyle G.
Mahlen, Caden L.
Moore, Andrew R.
Nair, Tarun
Webb, Wyatt A.

Thomas Edison State College
Rossi, Gino M.

Ulsan National Institute of Science and Technology (South Korea)
Dzianisau, Siarhei

University of California–Berkeley
Kim, Hyunsik
Moreno Guzman, Alejandro

University of Florida
Alwashahi, Hamdan
Martin, Caitlin A.
Salminen, Spencer F.
Sarceno, Aileen N.

University of Idaho
Lanier, Michael E.

University of Illinois–Urbana-Champaign
Albati, Mohammad A.
Brosius, Harrison A.
Fisher, Riley J.
Nicolls, Ethan H.
Roy, Andrea K.

University of Massachusetts–Lowell
Parks, April E.

University of Nevada–Las Vegas
Pak, Sungmin
Williams, Brandon L.

University of Tennessee–Knoxville
Dimmick, Colton A.
Walton, Noah A.

University of Texas–Austin
Gonzalez-Castillo, Francisco J.
Hirji, Rakim
Kaitschuck, Nick

University of Tokyo (Japan)
Li, Hangyu

University of Utah
Jimenez, Jessika

University of Wisconsin–Madison
Bath, Zachariah L.
Hanke, Matthew D.
Kino, Alexander
Lilly, Virginia
Mancheski, Dan
Raza, Toby
Stanke, Grace

U.S. Military Academy (West Point)
Raleigh, Brant D.

Utah State University
Dana, Seth J.
Greener, Carson
Kartchner, Holland

Virginia Commonwealth University
Houston, Jerel W.
Previs, Nathaniel H.

Virginia Tech
Dawson, Laura
Karabacak, Ali H.
Sahin, Elvan

Institution not provided
Eickman, Joey T.
Low, Wei Chen

A view of the UNSW campus

Nuclear education continues in Australia despite the ban on nuclear power

Although Australia has no nuclear power plants, a AUD$1 million (about U.S.$750,000) donation to the country's University of New South Wales will expand that institute's nuclear engineering program by supporting scholarships for about 20 Australian students to obtain master's degrees in nuclear engineering. The funding also will be used for scholarships and research expenses for research students and for supporting work placements with industry partners and other professional development activities.

UNSW offers Australia's only nuclear education program, which was started in 2014.

"By combining our core nuclear courses with others in UNSW Engineering and leveraging existing close partnerships with universities and national laboratories in the United States and United Kingdom, we are well prepared for the challenge of educating a new generation of Australian nuclear engineers," said Edward Obbard, head of the nuclear engineering program at UNSW, on September 22.


Obbard

Nuclear power has been prohibited in Australia since 1998, but the ban can be reversed with an amendment to the Environment Protection and Biodiversity Conservation Act 1999 (Commonwealth). According to the Minerals Council of Australia, the removal of four words—"a nuclear power plant"—in the act would allow nuclear energy to be considered for development in the country.

The financial gift to UNSW was provided by the Sir William Tyree Foundation, which was founded in Australia in the early 1970s as a philanthropic organization. Tyree, known as "an engineering dynamo," was an electrical engineer who established a company that would go on to become Australia's largest manufacturer of electrical transformers. In 1969, he sold the business to Westinghouse Electric Company. Throughout his life, Tyree was an advocate of nuclear energy. He died at age 92 in 2013.

Robyn Fennell, Tyree's daughter and chair of the Tyree Foundation board, commented, "This gift builds on the foundations laid down to develop a high-tech nuclear industry in Australia, which will be essential if we choose to adopt nuclear energy as one of the options available to our country as it deals with climate change. To make this a reality, nuclear engineering programs like UNSW's are critical in ensuring Australia has the homegrown skills to support that choice."


Fennell

Fennell added, "My father believed strongly in the benefits of nuclear energy as a safe, clean power source for Australia, and our gift continues to support that vision."

UNSW's nuclear engineering program was one of just 20 universities globally invited to be a founding member of the Nuclear Energy Agency Global Forum on Nuclear Education, Science, Technology, and Policy, which was established within the Organization for Economic Co-operation and Development in January 2021. The forum allows for policy dialogues with stakeholders that are not necessarily Nuclear Energy Agency member country governmental bodies. It aims to identify good practices, facilitate shared activities, and coordinate joint programs of investigation to advance nuclear science and technology education and policy in NEA member countries.

The forum also will conduct periodic symposia to serve as venues for experts from academic institutions and representatives of NEA member countries, as well as other stakeholders worldwide, to exchange good practices and identify emerging issues and solutions to challenges the nuclear energy sector faces today.

"The need for nuclear technologists is growing globally as both nuclear-generating countries and those that don't have commercial nuclear power recognize the need for new generations of engineers with the expertise to apply nuclear science and technology to meet medical, industrial, energy, and environmental challenges," said William D. Magwood, director general of the OECD NEA.

"After visiting UNSW in 2019, I was impressed with the education programs provided by the School of Mechanical and Manufacturing Engineering," Magwood added. "The passion of UNSW students for engaging with cutting-edge energy technologies was very compelling. We need their energy and expertise to address the complex issues facing the global community."

Although nuclear power is banned there, Australia has industries in nuclear medicine, nuclear science research, and uranium mining and resources.

Note: Nuclear News *publishes news about nuclear industry contracts—but only about contract awards. We generally do not publish announcements that the work is underway or announcements that the work has been completed. Email your new contract award announcements to nucnews@ans.org.*

ADVANCED REACTOR MARKETPLACE

Ukraine's Energoatom signs deals for nuclear power exploration and deployment

Energoatom, the state-owned nuclear utility of Ukraine, and **Westinghouse Electric Company** have signed an agreement to bring Westinghouse AP1000 reactors to multiple sites in Ukraine. The signing took place at the U.S. Department of Energy headquarters in Washington, D.C., and was witnessed by Ukrainian president Volodymyr Zelensky, U.S. energy secretary Jennifer Granholm, and Ukraine's energy minister, German Galushchenko.

In addition, Energoatom signed a memorandum of understanding with **NuScale Power** to explore small modular reactor deployment in Ukraine. Under the MOU, NuScale will support Energoatom's examination of NuScale's SMR technology, including a feasibility study for proposed project sites and the development of a project timeline and deliverables, cost studies, technical reviews, licensing and permitting activities, and project-specific engineering studies and design work.

BUSINESS DEVELOPMENTS

Poland signs on with advisor on the road to nuclear power

IP3 Corporation announced an agreement with Zespół Elektrowni Pątnów-Adamów-Konin SA (**ZE PAK**) electric power company for the development of a plan for the introduction of commercialized nuclear power to Poland. IP3 will be ZE PAK's main advisor in the process. ZE PAK is currently involved in various initiatives associated with nuclear technologies for Poland, including a plan to use nuclear power for the production of hydrogen.

■ **Framatome** has launched **FoxGuard EU**, which leverages the cybersecurity expertise of U.S.-based FoxGuard Solutions, a wholly owned subsidiary of Framatome. FoxGuard designs, manufactures, and integrates industrial computing, cybersecurity, and regulatory compliance solutions used in critical infrastructure markets.

Framatome also has completed the acquisition of **VirtualPiE Limited**, a company that produces fluid engineering–based products and services for the nuclear energy and chemical industries.

■ **Laurentis Energy Partners** announced a new program to produce helium-3, an isotope used in quantum computing, neutron research, border security, and medical imaging. Laurentis will obtain the He-3 from tritium stored at the Darlington CANDU plant in Canada, which is owned and operated by Laurentis's parent company, **Ontario Power Generation**. Production of the isotope will occur before the year's end.

■ **NuScale Power** has opened of the second of three planned NuScale Energy Exploration (E2) Centers in collaboration with the **University of Idaho** at the Center for Advanced Energy Studies (CAES) in Idaho Falls, Idaho. To be known as the SMR Simulator Laboratory, the E2 Center at CAES will assist the research of CAES entities—Idaho National Laboratory, Boise State University, Idaho State University, and the University of Idaho—and will allow users to assume the role of control room operator to learn about the features and functionality of NuScale's small modular reactor technology.

■ **Savannah River National Laboratory** opened its Critical Infrastructure, Industrial Control System Cybersecurity Laboratory at the Georgia Cyber Center in downtown Augusta, Ga. The new lab will allow SRNL to interact with key partners such as Army Cyber Command, the Defense Digital Service of the Department of Defense, the Georgia Bureau of Investigation Cyber Crime Center, the Augusta University School of Computer and Cyber Sciences, Augusta Technical College, and numerous cybersecurity industry leaders.

CONTRACTS

DOE inks cleanup deals with UCOR, Fluor-BWXT Portsmouth

The Department of Energy's Office of Environmental Management (EM) awarded $10.9 million to **UCOR** for its performance as Oak Ridge cleanup contractor from October 2020 through March 2021, amounting to 98 percent of the available fee for the period. UCOR's significant accomplishments noted by EM during the period included completing work ahead of schedule and under budget, addressing environmental liabilities by ramping up cleanup at the Oak Ridge National Laboratory and the Y-12 National Security Complex that included demolition at the East Tennessee Technology Park, and responding effectively to rapidly changing conditions associated with COVID-19.

In addition, EM awarded nearly $30.1 million to the DOE's Portsmouth Site decontamination and decommissioning contractor, **Fluor-BWXT Portsmouth**, for the period October 2019 through March 2021. The award amount was about 85 percent of the total fee available. Fluor-BWXT Portsmouth managed the cleanup contract at the former Portsmouth Gaseous Diffusion Plant site in southern Ohio. The company also coordinated the On-Site Waste Disposal Facility's construction and was involved with the demolition of the X-326 uranium enrichment process building, deactivation of the X-333 process building, and installation of liner and water detention treatment systems leading to startup of the On-Site Waste Disposal Facility.

■ **Westinghouse** and **ČEZ** have signed a nine-year project agreement to upgrade the instrumentation and control systems at the Temelin nuclear power plant in the Czech Republic. The project will replace an integrated set of several fully redundant I&C systems that have been operating at Temelin since their original installation in 2000.

■ **Curtiss-Wright**'s Nuclear Division has signed a teaming agreement with **Camfil USA, Inc.** Under the agreement, Curtiss-Wright will market Camfil's line of containment air filtration products and engineering services for U.S. commercial nuclear power plants.

Westinghouse and ČEZ officials at an agreement signing in the Czech Republic. Left to right: Patrik Foral, Westinghouse Czech Republic country manager; Tarik Choho, Westinghouse president, EMEA Operating Plant Services; and Bohdan Zronek, ČEZ chief nuclear officer.

NEW PRODUCTS

The GammaView handheld scintillation detector

S.E. International, of Summertown, Tenn., has made available the GammaView, a handheld scintillation detector that, when paired with a 1x1 NaI scintillation detector, measures gamma contamination and exposure during environmental monitoring or health physics activities or while measuring for radioactivity of scrap metals. The GammaView's features include multiple modes for units of measure, selectable alarm settings, and data logging. It includes a graphic LCD and membrane switch, and it can also function as a single-channel analyzer.

ANS initiating new standard on civilian nuclear export controls (ANS-60.1)

The American Nuclear Society Standards Committee has just initiated new standard ANS-60.1, *Civilian Nuclear Export Controls*. A Project Initiation Notification System form was submitted to the American National Standards Institute on August 5, 2021, to register the project. This standard addresses the requirements for compliance with U.S. export control regulations for civilian nuclear technology, equipment, and materials, as governed by 10 CFR Part 110, "Export and Import of Nuclear Equipment and Material," and 10 CFR Part 810, "Assistance to Foreign Atomic Energy Activities." This includes various types of export information required by the Nuclear Regulatory Commission and the Department of Energy and reporting requirements that exist before and after an export has occurred. The standard also provides guidance for establishing and maintaining internal compliance programs, including as related to classification and jurisdictional determinations, personnel, security, information technology, records management, contractual provisions and certifications, and training.

ANS initiated this new standard with the recognition that U.S. nuclear companies and other entities are subject to two different civilian nuclear-specific export control regulations. Companies are responsible for establishing their own organizational processes and procedures to ensure compliance and avoid unauthorized transfers and retransfers including deemed exports. Good practices for complying with these regulations are captured in informal agency guidance documents and the collective expertise of individuals. This new standard will provide a unified framework for establishing a compliance program that satisfies the requirements of NRC 10 CFR Part 110 regulation and DOE 10 CFR Part 810. Individuals interested in supporting this working group should contact standards@ans.org.

Volunteer support needed

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

- ANS-2.17, *Evaluation of Subsurface Radionuclide Transport at Commercial Nuclear Power Plants* (revision of ANSI/ANS-2.17-2010 [R2021]).
- ANS-2.18, *Standards for Evaluating Radionuclide Transport in Surface Water for Nuclear Power Sites* (proposed new standard).
- ANS-3.2, *Managerial, Administrative, and Quality Assurance Controls for the Operational Phase of Nuclear Power Plants* (revision of ANSI/ANS-3.2-2012 [R2017]).
- ANS-8.14, *Use of Soluble Neutron Absorbers in Nuclear Facilities Outside Reactors* (revision of ANSI/ANS-8.14-2004 [R2021]).
- ANS-3.13, *Nuclear Facility Reliability Assurance Program (RAP) Development* (proposed new standard).
- ANS-53.1, *Nuclear Safety Design Process for Modular Helium-Cooled Reactor Plants* (revision of ANSI/ANS-53.1-2011 [R2016]).
- ANS-56.2, *Containment Isolation Provisions for Fluid Systems After a LOCA* (new standard, historical revision of ANS-56.2-1989 [W1999]).

Does plant decommissioning need a final nuclear waste disposal site to be complete?

By James Conca

Not really, according to existing rules. Of course, it would be best as far as the public is concerned, as the lack of final disposition is stuck in their craw.

Decommissioning is the process by which nuclear power plants are retired from service and the operating licenses granted by the Nuclear Regulatory Commission are terminated. The process involves decontaminating the facility to reduce residual radioactivity, dismantling the structures, removing contaminated materials to appropriate disposal facilities, storing spent nuclear fuel until it can be removed from the site for disposal or consolidated storage, and releasing the property for other uses. The owner remains accountable to the NRC until decommissioning has been completed and the agency has terminated its license.

The above phrase "storing spent nuclear fuel until it can be removed" is key. For decommissioning to be complete, final removal of the spent fuel is not required. Since most of the material removed during decontamination and demolition is neither spent fuel nor high-level waste (the latter being only from weapons production), almost all of it can be disposed of at existing radioactive waste disposal sites, including EnergySolutions' Barnwell facility in South Carolina, the U.S. Ecology site in Washington, the Waste Control Specialists (WCS) site in Texas, and EnergySolutions' Clive facility in Utah.

So, the sites can be decommissioned and the spent fuel kept on-site. However, keeping spent fuel on-site is costing us about $2 million a day.

Since the dawn of nuclear power, 119 plants have operated in the United States. Of those, today there are 55 sites with operating reactors in the U.S. Thirty-eight nuclear reactors in the United States have been shut down, starting in 1964, 11 of which were prototypes or experimental reactors. The latest one was Indian Point-3, just this year.

Ten commercial nuclear reactors have been decommissioned either to the point of license termination or to the point where the remaining activities are limited to the management of an independent spent fuel storage installation, where the spent fuel is in dry cask storage, like at Maine Yankee.

Another 20 are currently in different stages of the decommissioning process, and several more will transition to this process over the next few years. What is strange is that we have an option to fix this and get the spent fuel off these decommissioned sites once and for all.

The Nuclear Regulatory Commission issued a license on September 13 to Interim Storage Partners LLC, a joint venture of WCS and Orano USA, to construct and operate a consolidated interim storage facility for spent nuclear fuel in Andrews County, Texas, on property adjacent to the WCS low-level radioactive waste disposal site already operating under a Texas license.

The license authorizes the company to receive, possess, transfer, and store up to 5,000 metric tons of spent fuel and 231.3 metric tons of Greater-Than-Class C low-level radioactive waste for 40 years. The company has said that it plans to expand the facility in seven phases, up to a total capacity of 40,000 metric tons of spent fuel. Each expansion would require a license amendment with additional NRC

Opinion continues

Texas already has a combined 2,610 metric tons of spent fuel at its Comanche Peak and South Texas nuclear power plants, much of it stored in casks similar to those shown here.

safety and environmental reviews. It could be expanded even further to include all spent fuel.

Seems perfect. Just what we've been waiting for over the past few decades—the best, safest, least expensive solution to our present nuclear waste problem.

Unfortunately, the Texas legislature banned the storage of high-level radioactive waste in the state, including spent nuclear fuel, just a week before the NRC issued the license. The legislation also directs the Texas Commission on Environmental Quality to deny any state permits for the project.

If you remember, the federal government licenses nuclear facilities and the state permits them. In other words, the feds control radioactive materials, but under the Resource Conservation and Recovery Act, the states control hazardous materials such as lead, mercury, and toxic chemicals. Since it's rare to have no toxic chemicals mixed in with the radioactive waste, this is where the state exerts its power.

The Texas Senate approved H.B. 7 unanimously, and the bill cleared the House by a 119–3 margin on September 2—a rare bipartisan agreement in the Texas legislature. But when Republicans and Democrats join religious groups, and environmental groups like Public Citizen and the Sierra Club join with oil and gas companies, you know something's strange.

They don't seem to understand that Texas already has lots of nuclear waste in storage—over 2,600 metric tons—at its two nuclear power plants, Comanche Peak and South Texas Generating Station.

Texas also has nuclear weapons waste from its Pantex Plant near Amarillo. Putting all its nuclear waste in one spot is the safest thing the state could do. It's also one of the most patriotic things it could do, helping the country take care of an important issue.

Besides, just because it would have more nuclear waste than any individual site, this centralized facility is no different, or more dangerous, than any of the others in Texas or around the country. The risk of this storage facility would actually be less than the two storage facilities at their nuclear power stations, and much less than the 30-plus storage sites around America, because the number of sites trumps the size of a site with respect to risk.

Having a centralized storage facility that takes all waste of this type from Texas would halve the risk of any event in Texas. If it took all the waste from America, since there's not much of it anyway, it would reduce the risk of any event by about 30 times. And the proposed location in Andrews County,

Texas, is physiographically ideal for this facility, better than the facilities that already exist in Texas or most anywhere else in America, and the design is much higher technologically.

It's always been puzzling to those of us who handle nuclear waste how nuclear waste got such a bad rep. It's not coincidental that no one has been killed by nuclear power or nuclear waste. It's just too easy to shield and store. It's not like coal, oil, or gas waste that does kill people every year, as does chemical waste.

A storage facility would store spent nuclear fuel, which is better referred to as slightly used nuclear fuel, until a final disposal facility is built, or until we build new fast reactors that will burn it, or we recycle it into new fuel.

Nuclear fuel usually spends five years in the reactor, after which about 5 percent of the energy in the fuel is used, but fission products of the reactions have built up to the point where the fuel must be replaced. After being removed from the reactor, the spent fuel is usually stored for about five years in pools of water, until heat and radiation have decreased sufficiently to allow the fuel to be passively cooled in a dry cask.

At this point, the dry casks can stay where they are for over a century or be moved to a centralized storage facility like what is being proposed. This would make the logistics of storage easier and the costs lower than having dozens of sites around the country, especially at those sites where the reactors themselves are gone.

A study by Oak Ridge National Laboratory showed that an interim storage site would save the U.S. Treasury $15 billion by 2040, $30 billion by 2050, and $54 billion by 2060.

The NRC has concluded that spent fuel storage in pools and casks is safe and secure. This and other nuclear developments follow directly from the recommendations of President Obama's Blue Ribbon Commission on America's Nuclear Future and were followed up in the 2015 "President's Memorandum on Disposal of Defense High-Level Waste in a Separate Repository" and the 2013 *Strategy for the Management and Disposal of Used Nuclear Fuel and High-Level Radioactive Waste*.

Conca and Wright (xcdsystem.com/wmsym/archives//2012/papers/12469.pdf) provide background on nuclear waste and interpretation of the three Blue Ribbon Commission recommendations pertaining to nuclear waste disposal that has led to some of these changes.

Interim storage of spent nuclear fuel is nothing new. It's been going on in the United States for decades at existing nuclear plant sites. Much of our spent fuel, over 70,000 tons, is in interim storage throughout the country, in pools and dry casks at operating nuclear power plants, and at several plants that have been shut down and decommissioned.

Dry casks are typically constructed of one or more shells of steel, cast iron, and reinforced concrete to provide leak containment and radiation shielding. Casks typically hold 10 tons of spent fuel. At present, dry cask storage is licensed at 35 nuclear plant sites in 24 states.

The real problem with this issue is intentional institutionalized ignorance. This waste poses little actual danger because it's a solid, there's so little of it, and it's so easily shielded. Again, no one has ever been killed by this type of waste. Storing it is the safest job in human history.

The other problem is that there is no constituency for nuclear. No Texas like there is for oil and gas. No West Virginia like for coal. No environmental movement like for renewables. Nuclear was always a national thing, and it seems we can't really think like a nation anymore.

So as Texas shoots down the best thing it could do with its own waste, as well as the nation's waste, plant decommissioning will not be truly complete.

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. Conca also writes about nuclear, the environment, and energy for Forbes*; you can view his stories online at forbes.com/sites/jamesconca.*

People

Pamela Cowan has been appointed president of Westinghouse Electric Company's Americas operating plant services unit, succeeding **David Howell**, who retired in September. Cowan has been in the commercial nuclear industry for more than 30 years, most recently as senior vice president of Holtec International and chief operating officer of Holtec Decommissioning International. She began her professional career at Westinghouse as a nuclear engineer specializing in transient analysis of pressured water reactors and is a licensed senior reactor operator.


Cowan

Ken Grumski has been named president of NAC LPT, an NAC International subsidiary focused on logistics, packaging, and technical services. Since NAC formed NAC LPT in September 2020, Grumski has served as vice president and managing director.


Grumski

The first female executive director for operations at the Nuclear Regulatory Commission, **Margaret Doane**, is departing the agency to take the position of deputy director general for management at the International Atomic Energy Agency. Doane has been the NRC's executive director for operations since July 2018. She began her career at the agency in 1991 and more recently served as NRC general counsel from 2012 to 2018. Doane has international experience, as well, having served in the Office of International Programs both as deputy director and director. The NRC said in September it had begun the process of identifying potential candidates for the EDO position.


Doane

Georgia Power's board of directors has elected **Aaron Abramovitz**, Southern Nuclear's vice president of business operations for the Vogtle-3 and -4 nuclear power plants, as executive vice president, chief financial officer, and treasurer of Georgia Power. In his new role, Abramovitz will be responsible for overseeing the company's accounting and financial functions. The move came after the announcement that **Dan Tucker**, the company's then executive vice president, CFO, and treasurer, was succeeding


Abramovitz


Tucker

Andrew Evans as executive vice president and CFO of Southern Company. Evans stepped down as executive vice president and CFO on September 1 but is serving as a senior advisor to the chief executive officer of Southern Company until his retirement on December 31, 2021. Upon his retirement, Evans will be joining the board of directors of Georgia Power.


Evans

Conval, a company that produces service valves, has named **Glenn Heglund** as Midwest regional sales manager. Heglund is a valve professional who has spent more than 35 years in a variety of operational, sales, and marketing roles at Forum Energy Technologies and MRC Global.


Heglund

Kudos

Texas A&M University nuclear engineering professor **Marvin L. Adams** was named by President Biden to the President's Council of Advisors on Science and Technology (PCAST). Adams, an ANS member since 1986,


Adams

is the HTRI (Heat Transfer Research Incorporated) professor of nuclear engineering, a Regents Fellow, and the director of National Laboratories Mission Support for the Texas A&M University System. PCAST is a direct descendant of the scientific advisory committee established by President Eisenhower in 1957 in the weeks after the launch of Sputnik. It is a group of external advisors charged with making science, technology, and innovation policy recommendations to the president and the White House. The 30 members of the council include leading experts in astrophysics and agriculture, biochemistry, computer engineering, ecology, immunology, nanotechnology, neuroscience, national security, social science, and cybersecurity. Adams is considered the nation's foremost academic expert on stewardship of the nuclear stockpile. He has served on many review and advisory bodies related to national security and has years of experience working with the military and U.S. scientists at Lawrence Livermore, Sandia, and Los Alamos national laboratories. Adams is the only academic on the Stockpile Assessment Team of U.S. Strategic Command, which annually assesses the nation's nuclear capabilities for the president and Congress. As a researcher, Adams has advanced the nation's ability to use complex computational algorithms that help gauge the reliability of weapons systems in an era when explosive nuclear testing is banned.

People continues

Obituaries

Zoltan R. Rosztoczy, 87, ANS member since 1964; born in Hungary on September 28, 1933, he left the country during the Hungarian Revolution in 1956 and came to the United States; received a master's degree in mechanical engineering from the University of California–Berkeley and a Ph.D. in nuclear engineering from the University of Arizona; went to work for Walter Zinn at General Nuclear in Florida; when it was bought by Combustion Engineering, continued his career there, where he managed the Safety and Licensing Department and was responsible for designing nuclear reactor safety systems; in 1973 his career in safety analysis led him to the Atomic Energy Commission and the Nuclear Regulatory Commission, where he worked for the next 26 years; charter member of the NRC's Senior Executive Service, managing various units of the NRC, including its technical evaluation of the Three Mile Island accident; served on various committees of the International Atomic Energy Agency and the Nuclear Energy Agency of OECD; as the U.S. representative on an IAEA committee, was charged with updating the agency's codes that established international standards for nuclear power plant siting, design, and operation; chaired PSA-99, an international topical meeting addressing probabilistic safety analysis of nuclear power plants; after retirement settled in Tucson, Ariz., and for the next 21 years continued to consult on reactors in Europe and the Middle East; a lifetime ANS member, was chair of the Connecticut chapter and Washington, D.C., chapter; for the 60-year anniversary of *Nuclear News* wrote the feature article "Root causes of the Three Mile Island accident"; died July 3.


Rosztoczy

Bernard W. Wehring, 84, ANS Fellow and member since 1969; earned a bachelor's degree in physics/mathematics from the University of Michigan–Ann Arbor and a master's in physics and Ph.D. in nuclear engineering from the University of Illinois–Urbana-Champaign (UIUC); was an international expert in the fields of experimental neutron physics and radiation detection; spent nearly 20 years at UIUC as a professor of nuclear engineering; his work, with his students, on the measurement of fission product yields stood for a while as the standard in the field and earned him the ANS Mark Mills award; in 1984, moved to North Carolina State University (NCSU), where he was appointed professor of nuclear engineering and director of the nuclear reactor program (NRP); during this time, managed various research and training activities at the NRP and the PULSTAR reactor and was awarded the rank of ANS Fellow; in 1989, moved to the University of Texas–Austin (UT), where he supervised the establishment of the new TRIGA reactor and the Nuclear Engineering Teaching Laboratory and served as director of the nuclear engineering program; retired from UT in 2000 and returned to NCSU as a research professor, spending much of his time contributing to NRP projects such as the ultracold neutron source, as well as teaching and student mentoring; died September 3.


Wehring circa 1985

Index to Advertisers

Since the magazine accepted its first advertisement in 1960, Nuclear News has proudly partnered with hundreds of vendors and organizations to help keep the worldwide nuclear field informed about the latest products and services, conferences and events, employment opportunities, and academic/training courses. If you are performing or seeking nuclear-related work, make sure advertising in our magazine is part of your business development strategy and annual budget.

View ads and request product/service information from this and past issues at: ans.org/advertising/nn/da.

If your company has a new innovation or recent project success story to convey to the nuclear industry, Sponsored Content in *Nuclear News* is an effective new way of communicating your message to the nuclear field in a greater level of detail than an ad alone. By integrating your brand into ours, you'll position yourself as an industry expert and increase the likelihood of a prospect becoming a client. Take control of your messaging and deliver your news directly to the nearly 10,000 nuclear science and technology professionals that rely on our magazine to stay informed.

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Calendar

● First time listed or significant change made
✖ Meeting canceled or postponed; see listing for details

●■✖ ANS event
●■✖ Non-ANS event cosponsored by ANS

November

● Nov. 7–12—**2021 International Topical Meeting on Probabilistic Safety Assessment and Analysis (PSA 2021)**, virtual meeting. psa.ans.org/2021

Nov. 8–12—**International Conference on a Decade of Progress after Fukushima-Daiichi: Building on the Lessons Learned to Further Strengthen Nuclear Safety**, Vienna, Austria. iaea.org/events/international-conference-on-a-decade-of-progress-after-fukushima-daiichi-building-on-the-lessons-learned-to-further-strengthen-nuclear-safety-2021

Nov. 12, 15–17—**G4SR-3 Virtual Summit**, virtual meeting. g4sr.org/

✖ Nov. 14–21—**FUSION20**, Shizuoka City, Japan. asrc.jaea.go.jp/soshiki/gr/HENS-gr/fusion20/index.html
Meeting has been postponed; dates TBA.

Nov. 15–17—**NESTet 2021—Nuclear Education & Training Conference**, Brussels, Belgium. ens.eventsair.com/nuclear-education-and-training/

Nov. 30–Dec. 2—**Enlit Europe**, Milan, Italy. enlit-europe.com/live

✖ Nov. 30–Dec. 2—**Perma-Fix 18th Annual Nuclear Waste Management Forum**, Nashville, Tenn. ir.perma-fix.com/upcoming-events/detail/824/perma-fixs-18th-annual-nuclear-waste-management-forum
Meeting has been canceled.

Nov. 30–Dec. 2—**World Nuclear Exhibition**, Paris, France. world-nuclear-exhibition.com/

■ Nov. 30–Dec. 3—**2021 ANS Winter Meeting and Technology Expo**, Washington, D.C. ans.org/meetings/wm2021/

December

Dec. 6–10—**15th International Symposium on Radiation Physics (ISRP-15)**, Kuala Lumpur, Malaysia. isrp15.com

● Dec. 12–16—**23rd IEEE Pulsed Power Conference (PPC) and the 29th IEEE Symposium on Fusion Engineering (SOFE)**, virtual meeting. uta.engineering/ppcsofe2021/

Meetings listed in the calendar that are not sponsored by ANS do not have the endorsement of ANS, nor does ANS have financial or legal responsibility for these meetings.

January 2022

Jan. 11–13—**IGD-TP Symposium and Webinar: The Role of Optimisation in Radioactive Waste Geological Disposal Programmes**, Zurich, Switzerland. igdtp.eu/event/igd-tp-symposium/

Jan. 25–27—**19th Annual USA Supply Chain Winter Conference**, Rancho Mirage, Calif. usainc.org/winter-conference/

Jan. 26–28—**PowerGen International**, Dallas, Texas. powergen.com/welcome

February

Feb. 7–8—**International Conference on Clean Energy Technologies and Power Issues (ICCETPI 2022)**, Lisbon, Portugal. waset.org/clean-energy-technologies-and-power-issues-conference-in-february-2022-in-lisbon

Feb. 7–11—**First International Conference on Nuclear Law: The Global Debate**, Vienna, Austria. iaea.org/events/icnl-2022

Feb. 20–24—**IRPA North American Regional Congress**, St. Louis, Mo. burkclients.com/hps/2022IRPA/site/

Feb. 23–24—**8th Nuclear Decommissioning and Waste Management Summit**, London, U.K. wplgroup.com/aci/event/nuclear-decommissioning-waste-management-summit/

Feb. 27–Mar. 3—**TMS 2022 Annual Meeting & Exhibition**, Anaheim, Calif. tms.org/AnnualMeeting/TMS2022

March

Mar. 6–10—**WM Symposia 2022**, Phoenix, Ariz. wmsym.org/

■ Mar. 6–11—**19th International Topical Meeting on Nuclear Reactor Thermal Hydraulics (NURETH-19)**, Brussels, Belgium. showsbee.com/fairs/NURETH.html

Mar. 16–17—**Enlit Australia**, Melbourne, Australia. enlit-australia.com/

April

■ April 3–8—**12th International Conference on Methods and Applications of Radioanalytical Chemistry (MARC XII)**, Kona, Hawaii. ans.org/meetings/view-366/

April 4–8—**Sixth International Conference on Geological Repositories (ICGR): Advancing Geological Repositories from Concept to Operation**, Helsinki, Finland. oecd-nea.org/jcms/pl_31984/sixth-international-conference-on-geological-repositories-icgr-advancing-geological-repositories-from-concept-to-operation

- April 5–7—**Global 2022**, Reims, France. new.sfen.org/evenement/global-2022

April 5–7—**ITER Business Forum IBF/22**, Marseille, France. iterbusinessforum.com/

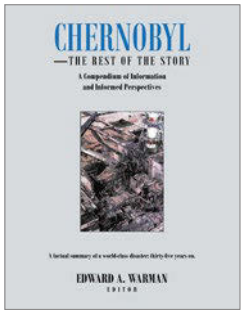
- April 14–16—**2022 Student Conference**, Urbana, Ill. ans.org/meetings/student2022/

May

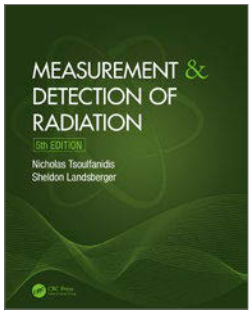
- May 9–13—**Tenth International Symposium on Naturally Occurring Radioactive Material**, Utrecht, Netherlands. iaea.org/events/evt2100681
- May 15–20—**International Conference on Physics of Reactors 2022 (PHYSOR 2022)**, Pittsburgh, PA. ans.org/meetings/physor2022/
- May 16–19—**Fifth International Conference on Nuclear Power Plant Life Management**, Osaka, Japan. iaea.org/events/plim-5
- May 22–25—**7th International Conference on Nuclear and Renewable Energy Resources (NURER2020)**, Ankara, Turkey. nurer2020.org/
- May 23–27—**International Conference on Accelerators for Research and Sustainable Development: From Good Practices Towards Socioeconomic Impact**, Vienna, Austria. iaea.org/events/accconf22
- May 29–Jun 3—**ICG-EAC Annual Meeting 2022**, Tampere, Finland. icg-eac.org/event/icg-eac-annual-meeting-2022/

Publications

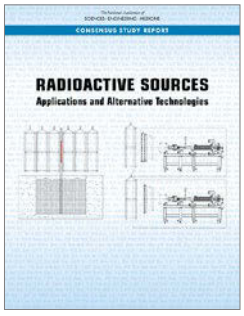
Recently Published



Chernobyl—The Rest of the Story: A Compendium of Information and Informed Perspectives, edited by Edward A. Warman. In his new, fact-based sourcebook, ANS Fellow Ed Warman has compiled excerpts from authoritative published reports and journal articles, as well as brief summaries of the development and implementation of the Shelter Implementation Plan that led to the New Safe Confinement in the aftermath of the Chernobyl disaster. The book also addresses the role of ANS in the early years after the accident—particularly the parts played by former ANS presidents Gail de Planque (1988–1989), Walter Loewenstein (1989–1990), and David Rossin (1992–1993). Intended for both specialists and laypersons, this book aims to tell "the rest of the story" beyond what appears in popular media, covering many aspects of the accident and its impact, response and cleanup, and effects on the population. (122 pages, paperback, $21.95, ISBN 978-1-64952-014-2, Fulton Books; for information, visit https://fultonbooks.com/books/?book=chernobyl-the-rest-of-the-story)



Measurement and Detection of Radiation, 5th ed., by Nicholas Tsoulfanidis and Sheldon Landsberger. The latest edition of this best-selling resource provides the most up-to-date and accessible introduction to radiation detector materials, systems, and applications available. By incorporating important recent advances in the field of radiation detection—especially in practical applications—this book will continue to be useful and popular among students and professionals alike. New to the fifth edition are expanded chapters on semiconductor detectors, data analysis methods, health physics fundamentals, and nuclear forensics; updated references and bibliographies; and new and expanded problems, including step-by-step derivations and numerous examples to illustrate key concepts. (642 pages, hardcover, $130, ISBN 978-0367-43401-4, CRC Press; order at routledge.com)



Radioactive Sources: Applications and Alternative Technologies, by the National Academies of Sciences, Engineering, and Medicine. Treating blood before a transfusion, exploring geological formations, sterilizing medical devices: radioactive materials are used commercially in a wide range of applications, and the responsibility of securing these materials falls to those industries that use them. The U.S. government and larger international community have taken steps to strengthen security and accountability, particularly for high-risk sources. This report, produced at the request of Sandia National Laboratories, assesses the status of medical, research, sterilization, and other commercial applications of radioactive sources, as well as nonradioisotopic technologies. It supports existing and future activities under the National Nuclear Security Administration Office of Radiological Security program to reduce the use of high-risk radiological materials in commercial applications. (194 pages, PDF, ISBN 978-0-309-44791-1, National Academies Press; free download at nap.edu/catalog)

The following are listings of the most recent issues of ANS's three technical journals. ANS members, access your free electronic subscription by visiting ans.org/pubs/journals and signing in to your ANS account.

ANS Technical Journals

FUSION SCIENCE AND TECHNOLOGY • OCTOBER–NOVEMBER 2021

This special combined issue contains 45 selected papers from research presented at the 24th Topical Meeting on the Technology of Fusion Energy (TOFE 2020). Included are eight student paper competition selections.

NUCLEAR SCIENCE AND ENGINEERING • NOVEMBER 2021

Cross Sections for Neutron Production from 6- and 10-MeV Neutrons Incident on ^{10}B and ^{11}B *P. W. Lisowski, M. Drosg, D. M. Drake, B. Hoop*

Experimental Analyses of ^{243}Am and ^{235}U Fission Reaction Rates at Kyoto University Critical Assembly *C. H. Pyeon, A. Oizumi, M. Fukushima*

Experimental and Computational Dose Rate Evaluation Using S_N and Monte Carlo Method for a Packaged ^{241}AmBe Neutron Source *M.-J. Wang, G. E. Sjoden*

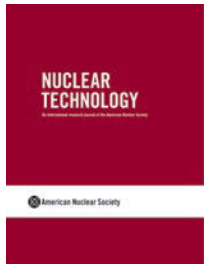
A Robust, Relaxation-Free Multiphysics Iteration Scheme for CMFD-Accelerated Neutron Transport *k*-Eigenvalue Calculations—I: Theory *Q. Shen, B. Kochunas*

A Robust, Relaxation-Free Multiphysics Iteration Scheme for CMFD-Accelerated Neutron Transport *k*-eigenvalue Calculations—II: Numerical Results *Q. Shen, S. Choi, B. Kochunas*

Calculation of Transient Parameters of the Integral Kinetic Model with Delayed Neutrons for Space-Dependent Kinetic Analysis of Coupled Reactors *H. Takezawa, D. Tuya, T. Obara*

Also coming soon: a fully open access online supplemental issue featuring five papers on the National Criticality Experiments Research Center: The first 10 years of operation.

NUCLEAR TECHNOLOGY • NOVEMBER 2021



In this issue, the first four papers form a special section on seismic analysis and risk assessment of nuclear facilities.

Effect of Soil Properties and Input Motion on Site Amplification Using Validated Nonlinear Soil Model *S. Shrestha, E. G. Kurt, K. Kim, A. Prakash, A. Irfanoglu*

Seismic Performance of Deeply Embedded Conceptual Advanced Reactors: Three-Dimensional Nonlinear Soil-Structure Interaction Analyses *E. G. Kurt, R. Spears*

Cost- and Risk-Based Seismic Design Optimization of Nuclear Power Plant Safety Systems *C. Bolisetti, J. Coleman, W. Hoffman, A. Whittaker*

Seismic Risk Assessment of Safety-Critical Nuclear Facilities for the Purpose of Risk-Informed Periodic Reevaluation *S. L. N. Dhulipala, C. Bolisetti, R. Yorg, P. Hashimoto, J. L. Coleman, M. Cox*

Evaluating the Improvement of Cross-Correlation–Based Flow Measurement by Periodic Fluid Injection *X. Gao, J. B. Coble, A. C. Hines, B. R. Upadhyaya, J. W. Hines*

Enhancements to the New TREAT Automatic Reactor Control System (ARCS) *B. A. Baker, K. D. Fielding, J. E. Hansen, T. Ellsworth*

Electroencephalography-Based Intention Monitoring to Support Nuclear Operators' Communications for Safety-Relevant Tasks *J. H. Kim, C. M. Kim, Y. H. Lee, M.-S. Yim*

Skyshine Calculations for a Large Spent Nuclear Fuel Storage Facility with SCALE 6.2.3 *G. Radulescu, K. Banerjee, T. M. Miller, D. E. Peplow*

Passive Reactivity Control Device with Thermal Expansion of Liquid In-Gd Alloy *R. Kimura, S. Kanamura, Y. Takahashi, K. Asano*

How is technology changing the field of environmental remediation?

For U.S. nuclear plants now undergoing decommissioning and those about to begin the process, environmental remediation has remained relatively consistent on the nuclear side with respect to contaminated soil and groundwater cleanup. However, non-radiological chemical remediation has been shifting as new and emerging compounds are getting attention from the public and from the Environmental Protection Agency and state agencies.

In the past few years, technological advances in laboratory methods have led to an understanding of the health effects and prevalence of per- and polyfluoroalkyl substances (PFAS), which have been dubbed the "forever chemicals." PFAS are an anthropogenic class of more than 3,000 chemicals that have been manufactured globally for use in products such as nonstick cookware; water-, grease-, and stain-resistant materials; food packaging; and—most relevant to nuclear plants—fire suppression foams.

These chemicals have gained regulatory and public attention due to their persistence in the environment (much like radiological contamination), and we now have the ability to detect them at low, part-per-trillion levels. This technology has led to health-based cleanup standards set at levels hundreds or thousands of times lower than those for more classic contaminants such as polychlorinated biphenyls (PCBs).

At nuclear plants, PFAS are typically associated with aqueous film forming foam used for fire suppression or in fire training operations. Because they do not degrade or decay over time and migrate quickly in groundwater, PFAS are commonly found in soils and groundwater. They are also found in septage due to their ongoing presence in food packaging products and other common household items. As a result, PFAS are an issue for plants that are permitted to dispose of their septic sludge by treating and then "landfarming" the biosolids.

PFAS are emerging as a complicating factor in nuclear power plant decommissioning because state environmental regulations govern the chemical (non-radiological) aspects of decommissioning, outside of and in addition to the Nuclear Regulatory Commission's regulatory authority, which has opened up new areas for states to regulate site remediation and closure.

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